PROPOSAL PACKAGE

LAKEWOOD WATER TREATMENT PLANT HEATING, VENTILATION, AND COOLING SYSTEM IMPROVEMENTS

City of Duluth, Minnesota
411 West 1st Street
Duluth, MN 55802

City Project # 1340

Bid # 2016-0274

Opening Date: March 31, 2016

Time: 2:00 PM

Place (Submit Bids): Room 100

PROPOSAL PACKAGE
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CITY OF DULUTH
INVITATION TO BID

PROJECT NAME/DESCRIPTION: LAKEWOOD WATER TREATMENT PLANT HEATING, VENTILATION, AND COOLING SYSTEM IMPROVEMENTS

BID NUMBER: 2016-0274 **BID OPENING: THURSDAY, MARCH 31, 2016 AT 2:00 PM**

PROJECT DESCRIPTION: Improvements and reconstruction of the Heating Ventilation and Cooling (HVAC) system of the main Water Treatment Plant building at the City of Duluth Lakewood Water Treatment Plant (WTP) located at 8130 Congdon Boulevard, Duluth, MN, 55804. Improvements to the facilities HVAC system will include replacement of existing Make-Up air Units, dehumidifiers, unit heaters, motor damper, hot water circulation pumps, and other appurtenances within the existing WTP building. The project work includes project management and coordination, temporary control and operation, building and equipment demolition, process mechanical piping/valve and equipment, painting, high performance coatings, HVAC, plumbing, electrical, HVAC DDC system and hardware integration, concrete work, carpentry, metal fabrication, restoration, startup services, testing, etc.

PRE-BID/WALK-THROUGH: A pre-bid meeting and walk-through will be conducted on Friday March 18, 2016 at the Lakewood Water Treatment Plant, 8130 Congdon Boulevard, Duluth, MN. The meeting will begin the conference room. All interested bidders are strongly encouraged to attend.

QUESTIONS: Please submit any questions regarding this project via e-mail to Howard Smith, City of Duluth Project Engineer at hsmith@duluthmn.gov. Responses will be provided to all interested bidders as an addendum to this solicitation.

Each bidder must review the 2016 Edition of the City of Duluth Public Works & Utilities Department/Engineering Division "Construction Standards" available on the city website (www.duluthmn.gov) as these Specifications are incorporated by reference and are deemed to be a part hereof this project as if fully incorporated and set forth herein.

The selected contractor will be issued a construction contract (draft attached). Notice to Proceed will be issued once the agreement is fully executed.

Plans and specifications may be obtained at no cost from the City's Purchasing Division website at http://www.duluthmn.gov/purchasing/bids-request-for-proposals/ Hard copies of the plans and specifications may be obtained from the City Engineering Office, Room 211 City Hall, 411 West 1st Street, Duluth, MN 55820 for a nominal fee, payable by check or money order.

Plans and specifications are on file for inspection at the City Engineering Office, Duluth Builders Exchange, Minnesota Builder's Exchange, Wisconsin Builder's Exchange, Blue Book Construction Network, and Meda Construction Connection.

INSTRUCTIONS TO BIDDERS

All bids must be complete, signed, and transmitted in a sealed envelope plainly marked with the bid number, subject matter, and opening date. The City of Duluth reserves the right to split the award where there is a substantial savings to the City, to waive informalities and to reject any and all bids. Bidder must state in their proposal if bid price is based on acceptance of the total order. Do not include sales tax in the unit price. Price may not be the only consideration for bid award. Bids must be firm for a minimum of 60 days.

Sealed bids must be received in Purchasing, Room 100 City Hall, 411 West 1st Street, Duluth, MN 55802 before 2:00 PM local time on the bid opening date specified on the Invitation for Bids. The City Purchasing Agent or her designee will conduct a public bid opening in Room 100 immediately following receipt of the bids. Bid results will be posted online at http://www.duluthmn.gov/purchasing/bids-request-for-proposals/ once all bids have been reviewed.

No alternatives to the specification will be considered unless specifically requested. Erasures or other changes to the bid must be initialed and dated.

The following documents must be submitted with your bid:

1. **Bid Bond** - A certified check or bank draft, payable to the order of the City of Duluth, negotiable U.S. Government Bonds (at par value), or a satisfactory bid bond executed by the bidder and acceptable surety, in an amount equal to five per cent (5%) of the total bid. Bids may be withdrawn without forfeiture of surety if the request is submitted by the Bidder and received at the Purchasing Office in writing or by telephone prior to the scheduled bid opening.

2. **Acknowledgment of Addendum** (if applicable) – any changes to this solicitation will be announced via Addendum. All such Addenda shall become part of the resulting purchase order and/or contract and all bidders shall be bound by such Addenda, whether or not received by the bidders Acknowledgement of Addenda should be indicated on your bid form by initialing and dating where indicated.

3. **Responsible Contractor** - No construction contract in excess of $50,000 will be awarded unless the Bidder is a "responsible contractor" as defined in Minnesota Statute §16C.285, subdivision 3. All Bidders submitting a proposal for this project must verify that they meet the minimum criteria specified in the statute by submitting a Responsible Contractor Verification and Certification of Compliance form (attached). The owner or officer of the company must sign the form under oath verifying compliance with each of the minimum criteria. Making a false statement under oath will render the Bidder or subcontractor that makes the false statement ineligible to be awarded a construction project and may result in termination of a contract awarded to a Bidder or subcontractor that submits a false statement. Bidders must obtain verification of compliance from all subcontractors. Bidders must submit signed copies of verifications and certifications of compliance from subcontractors at the City's request.

Please note that the following requirements also apply to this project, and any additional required documents must be submitted prior to award/contract execution. Submitting these documents with your bid will assist in expediting the process.

1. **Insurance** – Contractor must provide proof of Public Liability and Automobile Liability Insurance with limits not less than $1,500,000 Single Limit prior to the commencement of work. The City of Duluth must be named as an additional insured. Please refer to the draft Contract, Section 7.

2. **Affidavit of Non-Collusion** – The successful bidder shall be required to execute the attached affidavit stating that he/she has not entered into a collusive agreement with any other person, firm, or corporation in regard to any bid submitted.

3. **Performance & Payment Bonds** – The successful bidder will be required to submit performance and payments bonds in the full amount of the project cost prior to award.

4. **Affirmative Action/EEO** - The contractor must take affirmative action to ensure that the employees and applicants for employment are not discriminated against because of their race, color, creed, sex or national origin, and must meet the affirmative action goals. Contractors are encouraged to subcontract

with Disadvantaged Business Enterprises (DBEs) when possible. A current list of certified DBEs is available on the Minnesota Unified Certification website at http://mnucp.metc.state.mn.us . Contractor will comply with all applicable Equal Employment Opportunity laws and regulations. Awarded contractor will submit the attached Equal Employment Opportunity (EEO) Affirmative Action Policy Statement & Compliance Certificate.

5. **Project Labor Agreement (PLA)** - A PLA will be required for any bid that is over or could virtually go over $150,000. A copy of the City standard PLA is included in this package.

6. **Out of State Contractor** - Unless a State of Minnesota Certificate of Exemption is provided, any out-of-state bidder receiving a bid award will have 8% retained from invoice payments on any contracts over $50,000. Contractors must submit a signed copy of the exemption form when submitting Payment and Performance Bonds. This form may be found at the following web address: http://www.revenue.state.mn.us/Forms_and_Instructions/sde.pdf

7. **Prevailing Wage** - Not less than the minimum salaries and prevailing wages as set forth in the contract documents must be paid on this project.

The City of Duluth is an Equal Opportunity Employer. Contractor shall comply with all applicable Equal Employment Opportunity laws and regulations.

CITY OF DULUTH

Amanda Ashbach
Purchasing Agent

BID FORM

ITEM (all bid items are one lump sum quantity)	PRICE
1. Bonding	$
2. Lakewood Water Treatment Plant Heating, Ventilation, and Cooling System Improvements (Complete)	$
3. Roof Hand Rail (Complete)	$
4. Boiler Room Door and Stairs (Complete)	$
5. Washwater Building Equipment (Complete)	$
6. Utility Allowance	$
TOTAL:	$

_____
TOTAL PRICE IN WRITING

ACKNOWLEDGMENT OF ADDENDA

ADDENDUM # _____ DATE _____
ADDENDUM # _____ DATE _____
ADDENDUM # _____ DATE _____
ADDENDUM # _____ DATE _____

Signature _____ Date _____

Name/Title _____

Company Name _____

Address _____

City, State, Zip _____

Tel. _____

If your organization is certified as a disadvantaged business enterprise, please check here - ☐

ATTACHMENT A
PRIME CONTRACTOR RESPONSE

RESPONSIBLE CONTRACTOR VERIFICATION AND CERTIFICATION OF COMPLIANCE

CITY PROJECT NUMBER: 1340 – Lakewood Water Treatment Plant H.V.A.C. System Improvements

This form includes changes by statutory references from the Laws of Minnesota 2015, chapter 64, sections 1-9. This form must be submitted with the response to this solicitation. A response received without this form, will be rejected.

Minn. Stat. § 16C.285, Subd. 7. **IMPLEMENTATION.** … any prime contractor or subcontractor or motor carrier that does not meet the minimum criteria in subdivision 3 or fails to verify that it meets those criteria is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project…	
Minn. Stat. § 16C.285, Subd. 3. **RESPONSIBLE CONTRACTOR, MINIMUM CRITERIA**. "Responsible contractor" means a contractor that conforms to the responsibility requirements in the solicitation document for its portion of the work on the project and verifies that it meets the following minimum criteria:	
(1)	The Contractor: (i) is in compliance with workers' compensation and unemployment insurance requirements; (ii) is in compliance with Department of Revenue and Department of Employment and Economic Development registration requirements if it has employees; (iii) has a valid federal tax identification number or a valid Social Security number if an individual; and (iv) has filed a certificate of authority to transact business in Minnesota with the Secretary of State if a foreign corporation or cooperative.
(2)	The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 177.24, 177.25, 177.41 to 177.44, 181.13, 181.14, or 181.722, and has not violated United States Code, title 29, sections 201 to 219, or United States Code, title 40, sections 3141 to 3148. For purposes of this clause, a violation occurs when a contractor or related entity: (i) repeatedly fails to pay statutorily required wages or penalties on one or more separate projects for a total underpayment of $25,000 or more within the three-year period, provided that a failure to pay is “repeated” only if it involves two or more separate and distinct occurrences of underpayment during the three-year period; (ii) has been issued an order to comply by the commissioner of Labor and Industry that has become final; (iii) has been issued at least two determination letters within the three-year period by the Department of Transportation finding an underpayment by the contractor or related entity to its own employees; (iv) has been found by the commissioner of Labor and Industry to have repeatedly or willfully violated any of the sections referenced in this clause pursuant to section 177.27; (v) has been issued a ruling or findings of underpayment by the administrator of the Wage and Hour Division of the United States Department of Labor that have become final or have been upheld by an administrative law judge or the Administrative Review Board; or (vi) has been found liable for underpayment of wages or penalties or misrepresenting a construction worker as an independent contractor in an action brought in a court having jurisdiction. Provided that, if the contractor or related entity contests a determination of underpayment by the Department of Transportation in a contested case proceeding, a violation does not occur until the contested case proceeding has concluded with a determination that the contractor or related entity underpaid wages or penalties;*

(3)	The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 181.723 or chapter 326B. For purposes of this clause, a violation occurs when a contractor or related entity has been issued a final administrative or licensing order;*
(4)	The contractor or related entity has not, more than twice during the three-year period before submitting the verification, had a certificate of compliance under section 363A.36 revoked or suspended based on the provisions of section 363A.36, with the revocation or suspension becoming final because it was upheld by the Office of Administrative Hearings or was not appealed to the office;*
(5)	The contractor or related entity has not received a final determination assessing a monetary sanction from the Department of Administration or Transportation for failure to meet targeted group business, disadvantaged business enterprise, or veteran-owned business goals, due to a lack of good faith effort, more than once during the three-year period before submitting the verification;*
	* Any violations, suspensions, revocations, or sanctions, as defined in clauses (2) to (5), occurring prior to July 1, 2014, shall not be considered in determining whether a contractor or related entity meets the minimum criteria.
(6)	The contractor or related entity is not currently suspended or debarred by the federal government or the state of Minnesota or any of its departments, commissions, agencies, or political subdivisions that have authority to debar a contractor; and
(7)	All subcontractors and motor carriers that the contractor intends to use to perform project work have verified to the contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in clauses (1) to (6).

Minn. Stat. § 16C.285, Subd. 5. **SUBCONTRACTOR VERIFICATION**.

A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project. Prior to execution of a construction contract, and as a condition precedent to the execution of a construction contract, the apparent successful prime contractor shall submit to the contracting authority a supplemental verification under oath confirming compliance with subdivision 3, clause (7). Each contractor or subcontractor shall obtain from all subcontractors with which it will have a direct contractual relationship a signed statement under oath by an owner or officer verifying that they meet all of the minimum criteria in subdivision 3 prior to execution of a construction contract with each subcontractor.

If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors.

A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier pursuant to subdivision 3, clause (7). A prime contractor and subcontractors shall not be responsible for the false statements of any subcontractor with which they do not have a direct contractual relationship. A prime contractor and subcontractors shall be responsible for false statements by their first-tier subcontractors with which they have a direct contractual relationship only if they accept the verification of compliance with actual knowledge that it contains a false statement.

Subd. 5a. **Motor carrier verification.** A prime contractor or subcontractor shall obtain annually from all motor carriers with which it will have a direct contractual relationship a signed statement under oath by an owner or officer verifying that they meet all of the minimum criteria in subdivision 3 prior to execution of a construction contract with each motor carrier. A prime contractor or subcontractor shall require each such motor carrier to provide it with immediate written notification in the event that the motor carrier no longer meets one or more of the minimum criteria in subdivision 3 after submitting its annual verification. A motor carrier shall be ineligible to perform work on a project covered by this section if it does not meet all the minimum criteria in subdivision 3. Upon request, a prime contractor or subcontractor shall submit to the contracting authority the signed verifications of compliance from all motor carriers providing for-hire transportation of materials, equipment, or supplies for a project.

Minn. Stat. § 16C.285, Subd. 4. **VERIFICATION OF COMPLIANCE.**
A contractor responding to a solicitation document of a contracting authority shall submit to the contracting authority a signed statement under oath by an owner or officer verifying compliance with each of the minimum criteria in subdivision 3, with the exception of clause (7), at the time that it responds to the solicitation document. A contracting authority may accept a signed statement under oath as sufficient to demonstrate that a contractor is a responsible contractor and shall not be held liable for awarding a contract in reasonable reliance on that statement. A prime contractor, subcontractor, or motor carrier that fails to verify compliance with any one of the required minimum criteria or makes a false statement under oath in a verification of compliance shall be ineligible to be awarded a construction contract on the project for which the verification was submitted. A false statement under oath verifying compliance with any of the minimum criteria may result in termination of a construction contract that has already been awarded to a prime contractor or subcontractor or motor carrier that submits a false statement. A contracting authority shall not be liable for declining to award a contract or terminating a contract based on a reasonable determination that the contractor failed to verify compliance with the minimum criteria or falsely stated that it meets the minimum criteria. A verification of compliance need not be notarized. An electronic verification of compliance made and submitted as part of an electronic bid shall be an acceptable verification of compliance under this section provided that it contains an electronic signature as defined in section 325L.02, paragraph (h).

CERTIFICATION	
By signing this document I certify that I am an owner or officer of the company, and I swear under oath that: **1) My company meets each of the Minimum Criteria to be a responsible contractor as defined herein and is in compliance with Minn. Stat. § 16C.285, and** **2) if my company is awarded a contract, I will submit Attachment A-1 prior to contract execution, and** **3) if my company is awarded a contract, I will also submit Attachment A-2 as required.**	
Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

NOTE: Minn. Stat. § 16C.285, Subd. 2, (c) If only one prime contractor responds to a solicitation document, a contracting authority may award a construction contract to the responding prime contractor even if the minimum criteria in subdivision 3 are not met.

ATTACHMENT A-1

FIRST-TIER SUBCONTRACTORS LIST

SUBMIT PRIOR TO EXECUTION OF A CONSTRUCTION CONTRACT

CITY PROJECT NUMBER: 1524 – 2016 MICHIGAN STREET UTILITY REPLACEMENTS

Minn. Stat. § 16C.285, Subd. 5. A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project. Prior to execution of a construction contract, and as a condition precedent to the execution of a construction contract, the apparent successful prime contractor shall submit to the contracting authority a supplemental verification under oath confirming compliance with subdivision 3, clause (7). Each contractor or subcontractor shall obtain from all subcontractors with which it will have a direct contractual relationship a signed statement under oath by an owner or officer verifying that they meet all of the minimum criteria in subdivision 3 prior to execution of a construction contract with each subcontractor.

FIRST TIER SUBCONTRACTOR NAMES* (Legal name of company as registered with the Secretary of State)	**Name of city where company home office is located**

*Attach additional sheets as needed for submission of all first-tier subcontractors.

SUPPLEMENTAL CERTIFICATION FOR ATTACHMENT A-1	
By signing this document I certify that I am an owner or officer of the company, and I swear under oath that: **All first-tier subcontractors listed on attachment A-1 have verified through a signed statement under oath by an owner or officer that they meet the minimum criteria to be a responsible contractor as defined in Minn. Stat. § 16C.285.**	
Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

ATTACHMENT A-2

ADDITIONAL SUBCONTRACTORS LIST

PRIME CONTRACTOR TO SUBMIT AS SUBCONTRACTORS ARE ADDED TO THE PROJECT

CITY PROJECT NUMBER: 1524 – 2016 MICHIGAN STREET UTILITY REPLACEMENTS

This form must be submitted to the Project Manager or individual as identified in the solicitation document.

Minn. Stat. § 16C.285, Subd. 5. … If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors. …

ADDITIONAL SUBCONTRACTOR NAMES* (Legal name of company as registered with the Secretary of State)	**Name of city where company home office is located**

*Attach additional sheets as needed for submission of all additional subcontractors.

SUPPLEMENTAL CERTIFICATION FOR ATTACHMENT A-2	
By signing this document I certify that I am an owner or officer of the company, and I swear under oath that: **All additional subcontractors listed on Attachment A-2 have verified through a signed statement under oath by an owner or officer that they meet the minimum criteria to be a responsible contractor as defined in Minn. Stat. § 16C.285.**	
Authorized Signature of Owner or Officer:	**Printed Name:**
Title:	**Date:**
Company Name:	

DEPARTMENT OF TRANSPORTATION

NOTICE OF SUSPENSION

NOTICE IS HEREBY GIVEN that MnDOT has ordered that the following vendors be suspended for a period of six (6) months, effective January 14, 2016 until July 14, 2016:

- Jeffrey and Laurie Plzak doing business as Fibertech Incorporated[1], and its affiliates, Loretto, MN

NOTICE OF DEBARMENT

NOTICE IS HEREBY GIVEN that MnDOT has ordered that the following vendors be debarred for a period of three (3) years, effective May 6, 2013 until May 6, 2016:

- Gary Francis Bauerly and his affiliates, Rice, MN
- Gary Bauerly, LLC and its affiliates, Rice, MN
- Watab Hauling Co. and its affiliates, Rice, MN

NOTICE IS HEREBY GIVEN that MnDOT has ordered that the following vendors be debarred for a period of three (3) years, effective September 17, 2014 until September 17, 2017:

- Jeffrey Plzak and his affiliates, Loretto, MN
- Laurie Plzak and her affiliates, Loretto, MN
- Honda Electric Incorporated and its affiliates, Loretto, MN
- Jeffrey and Laurie Plzak doing business as Honda Electric Logistics, and its affiliates, Loretto, MN

NOTICE IS HEREBY GIVEN that MnDOT has ordered that the following vendors be debarred for a period of three (3) years, effective January 12, 2015 until January 12, 2018:

- Marlin Dahl, Granada, MN
- Dahl Trucking, Elmore, MN
- Elmore Truck and Trailer, Inc., Elmore, MN

Minnesota Statute section 161.315 prohibits the Commissioner, counties, towns, or home rule or statutory cities from awarding or approving the award of a contract for goods or services to a person who is suspended or debarred, including:

1) any contract under which a debarred or suspended person will serve as a subcontractor or material supplier,
2) any business or affiliate which the debarred or suspended person exercises substantial influence or control, and
3) 3) any business or entity, which is sold or transferred by a debarred person to a relative or any other party over whose actions the debarred person exercises substantial influence or control, remains ineligible during the duration of the seller's or transfer's debarment.

[1] This notice refers only to Fibertech Incorporated of Loretto, Minnesota and is not to be confused with any other businesses not controlled by Jeffrey and Laurie Plzak, including: FiberTech of Parkers Prairie, Minnesota; Fiber Tech Productions of Nisswa, Minnesota; Fiber Technologies Solutions of Georgia; or Fiber-Tech Industries of Cadillac, Michigan.

DEPARTMENT OF ADMINISTRATION

As of the date of this notice and in accordance with Minnesota Rules 1230.1150, the Minnesota Department of Administration has debarred and disqualified the following persons and businesses from entering into or receiving a State of Minnesota contract:

NAME	**DATE OF SUSPENSION**
Devos, Ltd. d/b/a Guaranteed Returns Dean Volkes, Donna Fallon & Ronald Carlino 100 Colin Drive Holbrook, NY	December 5, 2014 through December 31, 2099
NAME	**DATE OF DEBARMENT**
Best Electric Thomas Clifton and Earl Standafer 9909 S. Shore Drive #155 Plymouth, MN 55441	May 22, 2015 through May 21, 2018 (eligible for reinstatement on May 21, 2019)
Best Used Trucks of Minnesota, Inc. Jason W. Leas 635 Marin Avenue Crookston, MN 56716	Nov. 20, 2012 through Nov. 20, 2015 (eligible for reinstatement on Nov. 20, 2016)
C & S Electric, Inc. Thomas Clifton and Earl Standafer 9909 S. Shore Drive #155 Plymouth, MN 55441	May 22, 2015 through May 21, 2018 (eligible for reinstatement on May 21, 2019)
Dahl Trucking Marlin Dahl 305 Highway 169 South Elmore, MN 56027	Aug.19, 2014 through January 12, 2018
Elmore Truck and Trailer Repair, Inc. Marlin Dahl 305 Highway 169 South Elmore, MN 56027	Aug.19, 2014 through Jan. 12, 2018 (eligible for reinstatement on Jan. 12, 2019)
Groundscape Maintenance, Inc. Rob Sievers 1160 County Road 83 Maple Plain, MN 55359	February 19, 2015 through February 19, 2016 (eligible for reinstatement February 19, 2017)
Honda Electric, Inc. Jeffrey and Laurie Plzak 5075 Nielsen Circle, P.O. Box 236 Loretto, MN 55357	July 24, 2014 through July 23, 2017 (eligible for reinstatement on July 23, 2018)
McCaa, Webster & Associates, Inc. Sammie McCaa 2751 Hennepin Avenue South, #301 Minneapolis, MN 55408-1002	May 1, 2014 through April 30, 2015 (eligible for reinstatement on April 30, 2016)
MG Carlson Construction Company, Inc. Martin Gerald Carlson 701 East First Street Fort Worth, TX 76102-3276	Sept. 5, 2014 through October 5, 2015 (eligible for reinstatement on April 5, 2016)
Ocuture, LLC 11930 Camby Park Drive Houston, TX 77047	Dec. 15, 2014 through Dec. 15, 2015 (eligible for reinstatement Dec. 15, 2016)
Ramco Heating and Air Conditioning Mark and Cheryl Ramquist 605 Ash Street Downing, WI 54734	March 11, 2015 through March 11, 201 (eligible for reinstatement March 11, 2017)

St. Cloud Lawn & Landscaping, Inc. Pat Murphy 10602 County Road 2 Brainerd, MN 56401	February 20, 2015 through February 20, 2016 (eligible for reinstatement on Feb. 20, 2017)
TAC Construction Solutions, Inc. Christina Woods 31767 Deacons Way Pequot Lakes, MN 56472	August 19, 2014 through August 19, 2016 (eligible for reinstatement on August 19, 2017)
Watab Hauling Co. Gary Francis Bauerly 9695 Deerwood Rd. NE Rice, MN 56367	Jan. 14, 2013 through Jan. 14, 2016 (eligible for reinstatement on Jan. 14, 2017)

Minnesota Administrative Rule part 1230.1150, subpart 6 requires the Materials Management Division to maintain a master list of all suspensions and debarments. The master list must retain all information concerning suspensions and debarments as a public record for at least three (3) years following the end of a suspension or debarment. Refer to the following website for the master list: http://www.mmd.admin.state.mn.us/debarredreport.asp.

If the project is financed in whole or in part with federal funds, refer to the following website for vendors debarred by federal government agencies: http://sam.gov.

This list does not include preclusion actions taken by cities, counties or local authorities. Consult local authorities to ensure that contractors, subcontractors and materials suppliers are not currently suspended or debarred.

DATA FOR LABOR COST BIDDING

NOTE:
Wage Decisions are subject to change due to lock-in rules and revisions near the bid opening.

Project No.: 1340

Name: Lakewood Water Treatment Plant Heating, Ventilation, and Cooling System Improvements

City Project Manager: Howard Smith, P.E.

Bid Opening Date: March 31, 2016

This **project is funded** by:

City of Duluth

The **base workweek** may be:

Five 8-hour days OR four 10-hour days with OT after each
AND
OT after 40 hours per week

The project DOES contain a *project labor agreement (PLA).*

Should a project contain a project labor agreement:

1) Union scale may **not** be reflected in the prevailing wage schedule(s)
2) Note Article II Section 10 for trucking labor costs

City of Duluth funding only:
Each certified payroll must indicate the base workweek on the accompanying MnDOT Statement of Compliance form and beside each employee's name when his/her hours differ from the normal base workweek, if applicable.

OVERTIME REQUIREMENTS:
For projects funded by the City of Duluth: overtime must be paid on daily hours worked in excess of the base daily hours. Contractors (including sub-contractors) are not allowed to pay overtime solely on hours in excess of forty per week.

The overtime rate must be paid at NO LESS than the rate of pay as established in the project's wage decision multiplied by one and one-half OR the base rate the employee is being paid if it is higher than the wage decision base rate.

Project Prevailing Wage Decision: U S DOL Building General Decision MN160041 Dated 3/04/2016

General Decision Number: MN160041 03/04/2016 MN41

Superseded General Decision Number: MN20150041

State: Minnesota

Construction Type: Building

County: St Louis County in Minnesota.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016
1	03/04/2016

ASBE0049-007 06/01/2014

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes the application of all insulating materials, protective coverings, coatings & finishes to all types of mechanical systems)	$ 26.82	23.80

BOIL0647-007 01/01/2013

	Rates	Fringes
BOILERMAKER	$ 32.40	25.37

BRMN0001-050 05/01/2015

ST LOUIS (Remaining Northern part)

	Rates	Fringes
TILE SETTER	$ 24.59	20.98

BRMN0003-008 05/01/2014

ST. LOUIS COUNTY (City of Duluth and South of a line between Townships #54 & #55, 2 miles north of Cotton)

	Rates	Fringes
BRICKLAYER	$ 32.20	20.10

BRMN0003-011 05/01/2008

ST. LOUIS (City of Duluth and south of Township Line 55)

	Rates	Fringes
TILE SETTER	$ 24.13	17.38

BRMN0016-002 05/01/2014

ST. LOUIS COUNTY (North of a line between Townships #54 & #55, 2 miles north of Cotton)

	Rates	Fringes
BRICKLAYER	$ 31.75	20.55

CARP0068-005 07/01/2012

	Rates	Fringes
SOFT FLOOR LAYER	$ 30.94	11.75

CARP0361-012 05/01/2015

DULUTH AREA including Alborn, Arnold, Bartlett, Birch, Brookstone, Canyon, Clinton, Culver, Floodwood, Gowan, Island, Kelsey, Lakewood, Meadowlands, Munger, Palmers, Payne, Prasit, Shaw, Taft)

	Rates	Fringes
CARPENTER (Including Acoustical Installation, Drywall Hanging, Form Work & Overhead Door Installation)	$ 29.55	16.08

CARP0606-001 05/01/2015

EXCLUDING DULUTH AREA

	Rates	Fringes
CARPENTER (Including Acoustical Installation, Drywall Hanging, Form Work & Overhead Door Installation)	$ 29.45	14.37

* ELEC0242-012 05/31/2015

ST. LOUIS (South part bounded on the north by the north line of Kelsey Township extended east & west)

	Rates	Fringes
ELECTRICIAN	$ 33.90	24.47

ELEC0294-006 05/31/2015

ST. LOUIS (North part bounded on the south by the south line of Ellsburg Township, extended east & west)

	Rates	Fringes
ELECTRICIAN	$ 34.68	61.54%

ENGI0049-045 05/01/2015

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 37.74	17.15
GROUP 2	$ 37.40	17.15
GROUP 3	$ 35.99	17.15
GROUP 4	$ 35.65	17.15
GROUP 5	$ 35.48	17.15
GROUP 6	$ 33.97	17.15
GROUP 7	$ 32.85	17.15
GROUP 8	$ 30.84	17.15

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Truck & Crawler Crane with 200' of Boom & Over, including Jib ($.50 premium with 300' of Boom & over, including jib); & Tower Crane 250' & Over.

GROUP 2: Truck & Crawler Crane with 150' of Boom, up to but not including 200' of Boom, including Jib; & Tower Crane 200' & Over.

GROUP 3: Traveling Tower Crane; Truck & Crawler Crane, up to but not including 150' of Boom, including Jib; Tower Crane (Stationary) up to 200'; All-Terrain Vehicle Crane, Boom Truck over 100 ft.

GROUP 4: Backhoe/Track/Trackhoe, Hoist (3 drums or more); Overhead Crane (inside building perimeter), Excavator.

GROUP 5: Asphalt Spreader, Bulldozer, Curb Machine, Drill, Forklift, Compressor 450 CFM or over (2 or more machines); Boom Truck up to 100 ft, Loader over 1 cu yd, Hoist (1 or 2 drums); Mechanic; Milling Machine, Roller, Scraper, Tractor over D2.

GROUP 6: Bobcat/Skid Loader, Loader up to 1 cu. yd., Tractor D2 or similar size.

GROUP 7: Compressor 600 CFM or over, Crane Oiler.

GROUP 8: Oiler.

IRON0512-018 05/01/2015

	Rates	Fringes
IRONWORKER, ORNAMENTAL, REINFORCING, AND STRUCTURAL	$ 31.04	23.45

LABO1091-011 01/01/2014

	Rates	Fringes
LABORER (ASBESTOS ABATEMENT)		
Removal from Floors, Walls & Ceilings	$ 27.89	16.31

LABO1091-013 05/01/2012

ST. LOUIS (South of T 55 N)

	Rates	Fringes
Laborers:		
GROUP 1	$ 21.95	14.93
GROUP 2	$ 22.10	14.93
GROUP 3	$ 22.35	14.93
GROUP 4	$ 22.65	14.93

LABORER CLASSIFICATIONS

GROUP 1: Common or General, Asphalt Shoveler, Carpenter Tender, Form Stripping

GROUP 2: Vibrating Plate

GROUP 3: Pipelayer

GROUP 4: Mason Tender (Brick, Cement/Concrete)

LABO1097-008 05/01/2012

ST.LOUIS (North of T 55N)

	Rates	Fringes
LABORER		
GROUP 1	$ 20.62	16.25
GROUP 2	$ 21.02	16.25

LABORERS CLASSIFICATIONS

GROUP 1 - Common or General, Asphalt Shoveler, Carpenter Tender, Form Stripping, Mason Tender (Brick, Cement/Concrete)

GROUP 2 - Pipelayer, Vibrating Plate

PAIN0106-001 05/01/2013

	Rates	Fringes
GLAZIER	$ 26.28	15.47

FOOTNOTE:
1 to 4 years service - 1 week paid vacation; 5 to 11 years - 2 weeks paid vacation; 11 years or more - 3 weeks paid vacation

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PAIN0106-013 05/01/2014

	Rates	Fringes
Painters:		
New:		
Brush, Roller	$ 28.81	15.27
Spray, Drywall Finisher/Taper	$ 29.41	15.27
Repaint:		
Brush, Roller	$ 27.31	15.27
Spray, Drywall Finisher/Taper	$ 27.91	15.27

PLAS0633-024 05/01/2012

ST. LOUIS (North of White Face River) COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 26.71	14.64

PLAS0633-059 05/01/2012

CARLTON & ST. LOUIS (South of T 55N) COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 29.69	16.30

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* PLUM0011-019 05/04/2015

ST. LOUIS (South of an east-west line drawn through Cotton)

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 38.17	18.13

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* PLUM0589-007 05/01/2015

ST. LOUIS (North of an East- West line drawn through Cotton)

	Rates	Fringes
PLUMBER/PIPEFITTER		
Contracts $90,000.00 and under	$ 38.65	17.71
Contracts over $90,000.00	$ 38.65	17.71

ROOF0096-024 07/01/2015

ST. LOUIS (South of Hwy 16, excluding City of Forbes)

	Rates	Fringes
ROOFER	$ 32.15	14.67

ROOF0096-025 05/01/2015

ST. LOUIS (Remaining Northern two-thirds)

	Rates	Fringes
ROOFER	$ 28.89	11.13

SHEE0010-045 05/01/2009

ST. LOUIS (Southern one-third)

	Rates	Fringes

SHEET METAL WORKER (Including
HVAC Duct Installation).....$ 31.61 16.52

SHEE0010-056 05/01/2008

ST. LOUIS (Northern two-thirds)

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation)	$ 29.99	16.08

SUMN2009-050 07/27/2009

	Rates	Fringes
LABORER: Landscape	$ 12.88	4.61
TRUCK DRIVER: Dump Truck	$ 19.15	5.70

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion

date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

AFFIDAVIT AND INFORMATION REQUIRED OF BIDDERS

Affidavit of Non-Collusion:

I hereby swear (or affirm) under penalty of perjury:

1) That I am the bidder (if the bidder is an individual), a partner in the bidder (if the bidder is a partnership), or an officer or employee of the bidding corporation having authority to sign on its behalf (if the bidder is a corporation);

2) That the attached bid or bids have been arrived at by the bidder independently and have been submitted without collusion with and without agreement, understanding, or planned common course of action with any other vendor or materials, supplied, equipment or services described in the invitation to bid, designed to limit independent bidding or competition;

3) That the contents of the bid or bids have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder or its surety on any bond furnished with the bid or bids and will not be communicated to any such person prior to the official opening of the bid or bids; and

4) That I have fully informed myself regarding the accuracy of the statements made in this affidavit.

Signed:_____

Firm Name:_____

Subscribed and sworn to me before this____ day of _____, _____

NOTARY PUBLIC_____

My commission expires:_____

Bidder's E.I. Number_____
(Number used on employer's quarterly Federal Tax return)

EQUAL EMPLOYMENT OPPORTUNITY (EEO) AFFIRMATIVE ACTION POLICY STATEMENT & COMPLIANCE CERTIFICATE

TO: City of Duluth, Minnesota for (PROJECT NUMBER & DESCRIPTION) 1340 – Lakewood Water Treatment Plant Heating, Ventilation, and Cooling System Improvements

FROM: _____

_____

(FIRM's name, address, telephone number)

A) Employment: It is the policy of the above named FIRM to afford equal opportunity for employment to all individuals regardless of race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance and/or disability. The FIRM will take affirmative action to ensure that we will: (1) recruit, hire, and promote all job classifications without regard to race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability, except where sex is a bona fide occupational qualification; (2) base decisions on employment so as to further the principle of equal employment opportunity; (3) ensure that promotion decisions are in accord with the principles of equal employment opportunity by imposing only valid requirements for promotional opportunities; (4) ensure that all personnel actions such as compensation, benefits, transfers, layoffs, return from layoff, FIRM sponsored training, education tuition assistance, social and recreational programs will be administered without regard to race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability. The FIRM also intends full compliance with Veteran affirmative action requirements. Additionally, minority and female employees shall be encouraged to participate in all FIRM activities and refer applicants.

I have designated (name) _____to direct the establishment of and to monitor the implementation of personnel procedures to guide the FIRM's affirmative action program. Where PROJECTS exceed $500,000, this official shall also serve as the liaison officer that administers the FIRM's "Minority Business Enterprise Program." This official is charged with designing and implementing audit and reporting systems that will keep management informed on a monthly basis of the status of the equal opportunity area.

Supervisors have been made to understand that their work performance is being evaluated on the basis of their equal opportunity efforts and results, as well as other criteria. It shall be the responsibility of the FIRM and its supervisors to take actions to prevent harassment of employees placed through affirmative action efforts.

B) Reports: Unless exempted by law and regulation, the FIRM shall make available and file those reports related to equal opportunity as may be required by the City of Duluth and State and Federal compliance agencies. Requirements and Reports are defined in 41CFR60 "Compliance Responsibility for Equal Opportunity" published by the U. S. Department of Labor which is incorporated herein by reference. Additional requirements are defined in various State and Federal Civil Rights Legislation and Rules promulgated thereunder.

C) Nonsegregated Facilities: The FIRM certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The FIRM certifies that it will not maintain or provide for its employees any segregated facilities at any of its establishments and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The FIRM agrees that a breach of this

certification is a violation of the Equal Opportunity Clause in this certificate. As used in this Certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation for entertainment area, transportation, and housing facilities provided for employees which are segregated by explicit directive or are, in fact, segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise.

D) Affirmative Action Compliance Program: Unless exempted by regulation and law, the FIRM–if the FIRM has 50 or more employees and if the value of current contracts with the City of Duluth exceeds $50,000–shall prepare and maintain a written affirmative action compliance program that meets the requirement as set forth in 41CFR60.

E) Non-Compliance: The FIRM certifies that it is not currently in receipt of any outstanding letters of deficiencies, show cause, probable cause, or other such notification of non-compliance with EEO Laws and Regulations.

F) Employment Goals - "Construction" Projects: It shall be the goal of the FIRM if the PROJECT is of a construction nature that in all on-site employment generated that no less than 3% of the on-site workforce will be minority employees and that no less than 7% of the on-site workforce will be female employees. Further, it is the goal of the FIRM if the PROJECT is of a construction nature that in all on-site employment generated that no less than 3% of the work hours generated shall be worked by minority employees and that no less than 7% of the work hours generated shall be worked by female employees.

G) Subcontractors: The FIRM will for all its PROJECT subcontractors regardless of tier (unless exempted by law and regulation) that received in excess of $2,500 require that: (1) the subcontractor shall execute an "EEO Statement and Certification" similar in nature to this "Statement and Certification", (2) said documentation to be maintained on file with the FIRM or subcontractor as may be appropriate.

Executed this _____ day of _____, 20__ by:

_____
Printed name and title

_____
Signature

NOTE: In addition to the various remedies prescribed for violation of Equal Opportunity Laws, the penalty for false statements is prescribed in 18 U.S.C. 1001.

CITY OF DULUTH

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we:

_____

(contractor's name)

(hereinafter called the "Contractor") located at:_____

_____

(contractor's address)

and _____

(surety's name)

(a corporation holding a certificate of the Insurance Commissioner of the State of Minnesota showing that it is authorized to contract as a surety, hereinafter called the "Surety") located at:

_____

(surety's address)

are held and firmly bound unto the City of Duluth (hereinafter called the "Owner"), in the penal sum of _____ Dollars ($_____) for the payment of which we bind ourselves, our heirs, executors and administrators, successors and assigns, for the faithful performance of a written contract for the purpose of:

_____

_____

_____

according to plans, profiles, and specifications thereto annexed. A copy of that contract is incorporated herein by reference and is made a part hereof as if fully copied herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH That,

A) If the Contractor shall in all respects comply with the terms and conditions of the Contract (which includes the contract documents) and such alterations as may be made in said contract as documents therein provide for, and shall complete the contract in accordance with its terms,

B) If the Contractor shall indemnify, defend and save harmless the owner from all costs, expenses, damages, injury or conduct, want or care or skill, negligence or default, including patent infringement on the part of the Contractor, agents or employees, in the execution or performance of the contract,

C) If the Contractor shall indemnify the owner for all costs that may accrue on account of the

enforcing of the terms of the bond, if action is brought on the bond, including reasonable attorney's fees, in any case where such action is successfully maintained,

D) If the Contractor shall comply with all laws pertaining to doing the work under the contract,

Then, this obligation shall be void; the Contractor and Surety jointly and severally agree to pay to the Owner any difference between the sum to which the Contractor will be entitled on the completion of the contract and that which the Owner may be obliged to pay for the completion of the work by contract or otherwise, and any damages, direct or indirect, or consequential, which the Owner may sustain on account of the work, or on account of the failure of the Contractor to properly and in all things, keep and execute all of the provisions of the Contract, provided however that Surety's liability to pay damages is limited to the amount of the Performance Bond as set forth above.

And, the said Contractor and Surety hereby further bind themselves, their successors, executors, administrators and assigns, jointly and severally, that they will employ and fully protect the said Owner against and will pay any and all amounts, damages, costs and judgements which may be recovered against or which the Owner may be called upon to pay to any person or corporation by reason of any damage arising from the performance of said work, repair or maintenance thereof, or the manner of doing the same, or the neglect of the said Contractor or his agents or servants, or the improper performance of the said work by the Contractor or his agents or servants, or the infringements of any patent rights by reason of the use of any material furnished or work done, as aforesaid, or otherwise. For the purpose of this paragraph, a subcontractor shall be deemed to be the agent or employee of the Contractor to the extent of his subcontract.

The Contractor and the Sureties do hereby expressly waive any objection that might be interposed as to the right of the Owner to require a bond containing the foregoing provisions, and they do hereby further expressly waive any defense which they or either and any of them might interpose to an action brought hereon by any person, firm, or corporation, including subcontractors, materialmen and third persons, for work, labor, services, supplies or material performed, rendered or furnished as aforesaid, upon the ground that there is no law authorizing the Owner to require the foregoing provisions to be placed in this bond.

And the Surety, for value received, hereby stipulates and agrees that the obligations of the Surety and this bond shall in no way be impaired or affected by any extension of time, modification, omission, addition or change in or to the contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provision thereof, or by any assignment, subletting or other transfer thereof, or of any part thereof, or of any work to be performed, or of any moneys due or to become due thereunder; and

the said Surety does hereby waive notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to executors, administrators, successors, assignees, subcontractors and other transferees, shall have the same effect as to said Surety as though done or omitted to be done by and in relation to the Contractor.

Signed this _____ day of _____, 20___.

_____
Name of Principal

_____
By

_____
Name of Surety

By _____
Attorney-in-Fact

ACKNOWLEDGEMENTS

State of Minnesota)
) ss. Principal – Individual

County of St. Louis)

This instrument was acknowledged before me on _____

by _____.

Notary Seal

_____
Notary Public

State of Minnesota)
) ss. Principal – Corporate or Partnership
County of St. Louis)

This instrument was acknowledged before me on _____

by _____ as _____

of _____.

Notary Seal

_____
Notary Public

State of Minnesota)
) ss. Surety
County of St. Louis)

Be It Known, That on this _____ day of _____ A. D., 20___, came before me personally _____, to me personally known, who being by me duly sworn, did say that he/she is the _____(title) of _____ the above named corporation which executed the foregoing bond as surety; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was executed in behalf of said corporation, by authority of its Board of Directors; that said corporation hold a certificate of the Insurance Commissioner of the State of Minnesota showing that it is authorized to contract as a surety; and said _____ acknowledged said instrument to be the free act and deed of said corporation.

Notary Seal

_____
Notary Public

APPROVED AS TO FORM, CORRECTNESS AND VALIDTY HEREOF

Dated this _____ day of _____, 20 ___

_____
Assistant City Attorney Duluth MN

Dated this _____ day of _____, 20 ___

_____
Finance Director Duluth MN

CITY OF DULUTH

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we:

_____
(contractor's name)

(hereinafter called the "Contractor") located at: _____

_____
(contractor's address)

and _____
(surety's name)

(a corporation holding a certificate of the Insurance Commissioner of the State of Minnesota showing that it is authorized to contract as a surety, hereinafter called the "Surety") located at:

_____
(surety's address)

are held and firmly bound unto the City of Duluth (hereinafter called the "Owner"), for the benefit of persons furnishing labor and materials for the contract set forth below, in the penal sum of

_____

Dollars ($_____) for the payment of which we bind ourselves, our heirs, executors and administrators, successors and assigns, for the payment of all labor and materials supplied by any person in the performance of a written contract for the purpose of:

_____

_____

according to plans, profiles, and specifications thereto annexed. A copy of that contract is incorporated herein by reference and is made a part hereof as if fully copied herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH That,

A) If the Contractor shall make payments, as they may become due, to all persons supplying "labor and materials," as defined in Minnesota Statutes Section 574.26, used directly or indirectly by the Contractor, or his Subcontractor, in the prosecution of the work provided for in the contract,

B) If the Contractor shall indemnify the owner or other claimant for all costs that may accrue on account of the enforcing of the terms of the bond, if action is brought on the bond, including reasonable attorney's fees, in any case where such action is successfully maintained,

Then, this obligation shall be void; otherwise it shall remain in full force and effect.

And, the said Contractor and Surety agree that in accordance with Minnesota Statutes Section 574.26 not only said City, but any person furnishing “labor and materials,” as defined in Minnesota Statutes 574.26, may sue on this bond for their use on account of any sums due them for anything so furnished.

The Contractor and the Sureties do hereby expressly waive any objection that might be interposed as to the right of the Owner to require a bond containing the foregoing provisions, and they do hereby further expressly waive any defense which they or either and any of them might interpose to an action brought hereon by any person, firm, or corporation, including subcontractors, materialmen and third persons, for work, labor, services, supplies or material performed, rendered or furnished as aforesaid, upon the ground that there is no law authorizing the Owner to require the foregoing provisions to be placed in this bond.

And the Surety, for value received, hereby stipulates and agrees that the obligations of the Surety and this bond shall in no way be impaired or affected by any extension of time, modification, omission, addition or change in or to the contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provision thereof, or by any assignment, subletting or other transfer thereof, or of any part thereof, or of any work to be performed, or of any moneys due or to become due thereunder; and the said Surety does hereby waive notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to executors, administrators, successors, assignees, subcontractors and other transferees, shall have the same effect as to said Surety as though done or omitted to be done by and in relation to the Contractor.

Signed this _____ day of _____, 20___.

_____
Name of Principal

_____
By

_____
Name of Surety

By _____
Attorney-in-Fact

ACKNOWLEDGEMENTS

State of Minnesota)
) ss. Principal – Individual
County of St. Louis)

This instrument was acknowledged before me on _____
by _____.

Notary Seal _____
Notary Public

State of Minnesota)
) ss. Principal – Corporate or Partnership
County of St. Louis)

This instrument was acknowledged before me on _____
by _____ as _____
of _____.

Notary Seal _____
Notary Public

State of Minnesota)
) ss. Surety
County of St. Louis)

Be It Known, That on this _____ day of _____ A. D., 20___, came before me personally _____, to me personally known, who being by me duly sworn, did say that he/she is the _____ (title) of

_____

the above named corporation which executed the foregoing bond as surety; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was executed in behalf of said corporation, by authority of its Board of Directors; that said corporation hold a certificate of the Insurance Commissioner of the State of Minnesota showing that it is authorized to contract as a surety; and said _____ acknowledged said instrument to be the free act and deed of said corporation.

Notary Seal _____
Notary Public

APPROVED AS TO FORM, CORRECTNESS AND VALIDTY HEREOF

Dated this _____ day of _____, 20 ___

_____
Assistant City Attorney Duluth MN

Dated this _____ day of _____, 20 ___

_____
Finance Director Duluth MN

City of Duluth
Indemnification & Insurance Requirements

INDEMNIFICATION CLAUSE

To the extent allowed by law, Consultant shall defend, indemnify and hold City and its employees, officers, and agents harmless from and against any and all cost or expenses, claims or liabilities, including but not limited to, reasonable attorneys' fees and expenses in connection with any claims resulting from the Consultant's a) breach of this agreement or b) its negligence or misconduct or that of its agents or contractors in performing the Services hereunder or c) any claims arising in connection with Consultant's employees or contractors, or d) the use of any materials supplied by the Consultant to the City unless such material was modified by City and such modification is the cause of such claim. This Section shall survive the termination of this Agreement for any reason.

INSURANCE

a. Contractor shall provide the following minimum amounts of insurance from insurance companies authorized to do business in the state of Minnesota, which insurance shall indemnify Contractor and City from all liability described in the paragraph above, subject to provisions of subparagraph below.

(1) Worker's compensation in accordance with the laws of the state of Minnesota.

(2) Public Liability and Automobile Liability Insurance with limits not less than **$1,500,000** Single Limit, and twice the limits provided when a claim arises out of the release or threatened release of a hazardous substance; shall be in a company approved by the city of Duluth; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability.

(3) City of Duluth shall be named as **Additional Insured** under the Public Liability, Excess/Umbrella Liability* and Automobile Liability, or as an alternate, Contractor may provide Owners-Contractors Protective policy, naming itself and the City of Duluth. Contractor shall also provide evidence of Statutory Minnesota Worker's Compensation Insurance. Contractor to provide Certificate of Insurance evidencing such coverage with 30-days' notice of cancellation, non-renewal or material change provisions included. The City of Duluth does not represent or guarantee that these types or limits of coverage are adequate to protect the Contractor's interests and liabilities.

(4) *An umbrella policy with a "following form" provision is acceptable if written verification is provided that the underlying policy names the City of Duluth as an additional insured*.

(4) If a certificate of insurance is provided, the form of the certificate shall contain an unconditional requirement that the insurer notify the City without fail not less than 30 days' prior to any cancellation, non-renewal or modification of the policy or coverages evidenced by said certificate and shall further provide that failure to give such notice to City will render any such change or changes in said policy or coverages ineffective as against the City.

(5) **The use of an "Acord" form as a certificate of insurance shall be accompanied by two forms – 1) ISO Additional Insured Endorsement (CG-2010 pre-2004) and 2) Notice of Cancellation Endorsement (IL 7002) or equivalent, as approved by the Duluth City Attorney's Office**.

b. The insurance required herein shall be maintained in full force and effect during the life of this Agreement and shall protect Contractor, its employees, agents and representatives from claims and damages including but not limited to personal injury and death and any act or failure to act by Contractor, its employees, agents and representatives in the negligent performance of work covered by this Agreement.

c. Certificates showing that Contractor is carrying the above described insurance in the specified amounts shall be furnished to the City prior to the execution of this Contract and a certificate showing continued maintenance of such insurance shall be on file with the City during the term of this Contract.

d. The City shall be named as an additional insured on each liability policy other than the workers' compensation policies of the Contractor.

e. The certificates shall provide that the policies shall not be changed or canceled during the life of this Contract without at least 30 days advanced notice being given to the City.

f. Contractor shall be required to provide insurance meeting the requirements of this Paragraph unless Contractor successfully demonstrates to the satisfaction of the City Attorney, in the exercise of his or her discretion, that such insurance is not reasonably available in the market. If Contractor demonstrates to the satisfaction of the City Attorney that such insurance is not reasonably available, the City attorney may approve an alternative form of insurance which is reasonably available in the market which he or she deems to provide the highest level of insurance protection to the City which is reasonably available.

PRE-2004 CG 2010

A. **Section II - Who Is an Insured** is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of your ongoing operations performed for that insured.

****

NOTICE OF CANCELLATIONS ENDORSEMENT IL-7002 (10-90)

All Coverage Parts included in this policy are subject to the following condition: If we cancel this policy for any reason other than non-payment of premium, we will mail advance notice to the person(s) or organization(s) as shown in the Schedule.

Schedule

Person or Organization (Name and Address)	Advance Notice (Days)
City of Duluth Purchasing Division Room 100 City Hall 411 West First Street Duluth MN 55802	30

CONTRACTOR
&
CITY OF DULUTH

THIS AGREEMENT, effective as of the date of attestation by the City Clerk, is made by and between the **CITY OF DULUTH**, a municipal corporation, hereinafter referred to as the "CITY," party of the first part, and **Contractor, address,** hereinafter referred to as the "Contractor," party of the second part;

WITNESSETH: That the Contractor and the City agree as follows:

1. The following shall be deemed to be part of this contract:
   a. The annexed resolution and legal advertisement of the City Council.
   b. The bid request and specifications, as modified by irreconcilable language in this written contract.
   c. The bid by Contractor, as modified by irreconcilable language in this written contract.
   d. The performance bond and payment bond certification.
   e. All provisions of law applicable to a contract of this nature.

2. The Contractor agrees to furnish and deliver to the Department all labor, supervision, material, equipment, supplies, insurance, performance bond, payment bond and everything else necessary for general construction of Project at location, all in strict accordance with plans and specifications prepared by design co. or city architect, your bid of $ and resolution no. passed on date. Contractor shall not commence performance of any work under this contract until Contractor receives authorization from the City's Purchasing Agent in writing and dated.

3. The City agrees to pay progress payments and make final payments to the Contractor as stated in the contract specifications. The total amount payable under this contract shall not exceed **dollar amount spelled out ($)** unless the contract is modified by formal amendment or change order. Payments under this Agreement shall be made from the following funding and RQ no. Due to the dollar amount of this contract, a Project Labor Agreement is or is not included as part of this contract (City Code Section 2-29).

4. The Contractor shall furnish and maintain in full force and effect until this contract is completely performed by the Contractor, a performance bond and payment bond if and when required by law, or if and when required by the City.

5. Inasmuch as this contract concerns work, materials and equipment needed for the public benefit, the provisions of this contract relating to the time of performance and completion of work and delivery of materials or equipment are of the essence of this contract.

6. The Contractor will defend, indemnify and save the City harmless from all costs, charges, damages, and loss of any kind that may grow out of the matters covered by this contract.

Said obligation does not include indemnification of the City for claims of liability arising out of the sole negligent or intentional acts or omissions of City but shall include but not be limited to the obligation to defend, indemnify and save harmless the City in all cases where claims of liability against the City arise out of acts or omissions of City which are derivative of the negligence or intentional acts or omissions of Contractor such as, and including but not limited to, the failure to supervise, the failure to warn, the failure to prevent such act or omission by Contractor and any other such source of liability. In addition Contractor will comply with all local, state and federal laws, rules and regulations applicable to this contract and to the work to be done and things to be supplied hereunder.

7. Insurance

a. Contractor shall provide the following minimum amounts of insurance from insurance companies authorized to do business in the state of Minnesota, which insurance shall indemnify Contractor and City from all liability described in Paragraph 6 above, subject to provisions below.

(1) Workers' compensation insurance in accordance with the laws of the State of Minnesota.

(2) Public Liability and Automobile Liability Insurance with limits not less than **$1,500,000** Single Limit, and twice the limits provided when a claim arises out of the release or threatened release of a hazardous substance; shall be in a company approved by the city of Duluth; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability.

(3) City of Duluth shall be named as **Additional Insured** under the Public Liability, Excess/Umbrella Liability* and Automobile Liability, or as an alternate, Contractor may provide Owners-Contractors Protective policy, naming itself and the City of Duluth. Contractor shall also provide evidence of Statutory Minnesota Workers Compensation Insurance. Contractor to provide Certificate of Insurance evidencing such coverage with 30-days' notice of cancellation, non-renewal or material change provisions included. The City of Duluth does not represent or guarantee that these types or limits of coverage are adequate to protect the Contractor's interests and liabilities.

**An umbrella policy with a "following form" provision is acceptable if written verification is provided that the underlying policy names the City of Duluth as an additional insured.*

(4) If a certificate of insurance is provided, the form of the certificate shall contain an unconditional requirement that the insurer notify the City without fail not less than 30 days' prior to any cancellation, non-renewal or modification of the policy or coverages evidenced by said certificate and shall further provide that failure to give such notice to City will render any such change or changes in said policy or coverages ineffective as against the City.

(5) The use of an "ACORD" form as a certificate of insurance shall be accompanied by two forms – 1) ISO Additional Insured Endorsement (CG-2010 pre-2004) and 2) Notice of Cancellation Endorsement (IL 7002) or equivalent, as approved by the Duluth City Attorney's Office.

b. The insurance required herein shall be maintained in full force and effect during the life of this Agreement and shall protect Contractor, its employees, agents and representatives from claims and damages including but not limited to personal injury and death and any act or failure to act by Contractor, its employees, agents and representatives in the negligent performance of work covered by this Agreement.

c. Certificates showing that Contractor is carrying the above described insurance in the specified amounts shall be furnished to the City prior to the execution of this Contract and a certificate showing continued maintenance of such insurance shall be on file with the City during the term of this Contract.

d. Contractor shall be required to provide insurance meeting the requirements of this Paragraph 7 unless Contractor successfully demonstrates to the satisfaction of the City Attorney, in the exercise of his or her discretion, that such insurance is not reasonably available in the market. If Contractor demonstrates to the satisfaction of the City Attorney that such insurance is not reasonably available, the City Attorney may approve an alternative form of insurance which is reasonably available in the market which he or she deems to provide the highest level of insurance protection to the City which is reasonably available.

8. No claim whatsoever shall be made by the Contractor against any officer, agent or employee of the City for, or on account of, anything done, or omitted to be done, in connection with this contract. If this contract is not made in conformity with mandatory provisions of any statute or of the ordinances and charter of the City of Duluth, the Contractor agrees to raise no defense and make no claim against the City on the basis of ratification, laches, estoppel, or implied contract.

9. The Contractor shall not assign, transfer, convey or otherwise dispose of this contract, or his right to execute it, or his right, title or interest in or to it, or any part thereof, without the consent of the City, evidenced by a resolution duly adopted by the City Council. The prohibition contained in this paragraph shall not be deemed to prevent the contractor from subcontracting. Contractor shall remain primarily responsible for all work performed by any subcontractor.

10. The Contractor agrees that in the hiring of common or skilled labor for the performance of any work under this contract, Contractor will not discriminate by reason of race, creed or color, religion, national origin, sex, marital status, status with regard to public assistance, disability or age.

11. The Contractor agrees that Contractor shall not in any manner discriminate against or intimidate or prevent the employment of any person or persons, or on being hired, prevent or conspire to prevent any person or persons from the performance or work under this contract on account of race, creed or color, religion, national origin, sex, marital status, status with regard to public assistance, disability or age.

12. The contractor agrees that, as provided in Minnesota Statutes 16C.05, Subd. 5, contractor's books, records, documents, and accounting procedures and practices are subject to examination by the City or the state auditor for six years from the date of final payment under this contract.

13. This contract may be cancelled or terminated by the City and all moneys due or to become due hereunder may be forfeited for any failure to perform any terms or conditions of this contract including but not limited to any violation of the terms or conditions of Section 10 or 11 of this contract.

14. Any waiver by any party of any provision of this contract shall not imply a subsequent waiver of that or any other provision.

15. This contract is made in the state of Minnesota and shall be construed and interpreted in accordance with the laws of the State of Minnesota. The appropriate venue and jurisdiction for any litigation hereunder shall be in a court located in St. Louis, County, Minnesota, and the parties to this Agreement waive objection to the jurisdiction of this court, whether based on convenience or otherwise.

16. This Agreement constitutes the entire agreement between the City and the Contractor on the subject matter hereof. It may not be changed, modified, discharged or extended except by written instrument duly executed on behalf of the City and the Contractor. The Contractor agrees that no representations or warranties made by the City shall be binding upon the City unless expressed in writing herein.

17. This Agreement shall not be in force and effect, or in any way binding upon the City until the same shall have been approved by the Department Head, signed by the Mayor, attested by the Clerk, and countersigned by the City Auditor.

18. The Contractor unconditionally guarantees to perform all work pursuant to this contract in a good and workmanlike manner, in strict compliance with the specifications and instructions hereto attached, and to the satisfaction of the City of Duluth.

19. This Agreement may be executed in counterparts, each of which shall be deemed to be original and all of which together shall constitute the binding and enforceable agreement of the parties hereto. This Agreement may be executed and delivered by a party by facsimile or PDF transmission, which transmission copy shall be considered an original and shall be binding and enforceable against such party.

Countersigned:

_____
City Auditor
Approved this_____day of _____

_____
Department Director
Approved this_____day of _____

_____
Purchasing Agent
Approved this_____day of _____

_____
Assistant City Attorney
Approved this_____day of _____

CITY OF DULUTH-Client

By

_____
Mayor

Attest:

_____
City Clerk
Attested this_____day of _____

CONTRACTOR/COMPANY
Contractor

By

_____
Company Representative

Its

_____
Title of Representative
Approved this_____day of _____

CITY OF DULUTH - PART II -

SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY, STATE OF MINNESOTA, AND/OR CITY ASSISTED ACTIVITIES

(revised 4/15/11)

The following conditions take precedence over any conflicting conditions in this Contract.

E-Mail Addresses

For ease in communication, the e-mail address of the person(s) responsible for preparing certified payroll reports (CPRs) is required from the prime contractor and all subcontractors (regardless of tier). This information will be provided to the project engineer prior to the pre-construction meeting OR with materials required in the Letter of Intent.

Section I

Restrictions on Disbursements

No money under this Contract shall be disbursed by the City to any Contractor except pursuant to a written contract which incorporates the applicable PART II, Supplementary General Conditions for Federally, State of Minnesota, and/or City Assisted Activities, and unless the Contractor is in compliance with the Federal Agency requirements with regard to accounting and fiscal matters to the extent they are applicable.

Subcontractors

(A) The Contractor shall include in any subcontract the clauses set forth in the PART II, Supplementary General Conditions for Federally, State of Minnesota and/or City Assisted Activities in their entirety and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

(B) The Contractor shall not subcontract any part of the work covered by this Contract or permit subcontracted work to be further subcontracted without the City's prior written approval of the subcontractors. The City will not approve any subcontractor for work covered by this Contract who is at the time ineligible under the provisions of any applicable regulations issued by a Federal Agency or the Secretary of Labor, United States Department of Labor, to receive an award of such subcontract.

Federal Agency Requirements

Unearned payments under this Contract may be suspended or terminated upon refusal to accept any additional conditions that may be imposed by the Federal Agency at any time; or if the grant, if applicable, to the City under which this Contract is made is suspended or terminated.

Separability

If any provisions of this Contract is held invalid, the remainder of this Contract shall not be affected thereby if such remainder would then continue to conform to the terms and requirements of applicable law.

Property

Acquisition, use, and disposal of all property, materials and goods acquired as a result of activities made possible by this Contract shall be accomplished in accordance with the applicable provisions of Federal Management Circular (FMC)-74-7, as amended.

Section 2

Miscellaneous Provisions

(A) **Copyrights.** In the event this Contract results in a book or other copyrightable material, the author is free to copyright the work, but Federal Agency and the City reserve a royalty-free, nonexclusive, and irrevocable license to reproduce, publish or otherwise use, all copyrighted material and all material which can be copyrighted.

(B) **Patents.** Any discovery or invention arising out of or developed in the course of work aided by this Contract shall be promptly and fully reported to the Federal Agency and the City for determination by the Federal Agency as to whether patent protection on such invention or discovery shall be sought and how the rights in the invention or discovery, including rights under any patent issued thereon, shall be disposed of and administered in order to protect the public interests.

(C) **Political Activity Prohibited.** None of the funds, materials, property or services provided directly or indirectly under this Contract shall be used in the performance of this Contract on any partisan political activity, or to further the election or defeat of any candidate for public office.

(D) **Lobbying Prohibited.** None of the funds under this Contract shall be used for publicity or propaganda purposes designed to support or defeat legislation pending before the Congress or the City.

(E) **Prohibition of and Elimination of Lead-Based Paint Hazard.** Notwithstanding any other provision, the Agency and Contractor agree to comply with the regulation issued by the Secretary of Housing and Urban Development set forth in 37 F. R. 22732-3 and all applicable rules and orders issued thereunder which prohibit the use of lead-based paint in residential structures undergoing Federally assisted construction or rehabilitation and require the elimination of lead-based paint hazards. Every contract or subcontract, including paint, pursuant to which such Federally assisted construction or rehabilitation is performed shall include appropriate provisions prohibiting the use of lead-based paint.

(F) **Architectural Barriers Act.** The design for and construction of any facility funded in whole or in part by this Contract shall be in conformance with the American Standard Specification for Making Buildings and Facilities Accessible and Usable by the Physically Handicapped, Number A-117.1-1971, as modified.

(G) **Relocation and Acquisition.** Any relocation or acquisition resulting from activities funded in whole or in part by this Contract shall be in conformance with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (40 U.S.C. 4601) and the implementing regulations 24CFR Part 42.

(H) **Prohibition Against Payments of Bonus or Commission.** The assistance provided under this Contract shall not be used in the payment of any bonus or commission for the purpose of obtaining Federal Agency approval for such assistance, or Federal Agency approval of applications for additional assistance, or any other approval or concurrence of a Federal Agency required under this Contract, Federal Law or Federal Regulations thereto; provided, however, that reasonable fees or bonafide technical, consultant, managerial or other such services, other than actual solicitation, are not hereby prohibited if otherwise eligible as project costs.

(I) **Hatch Act.** Where applicable, the Contractor will comply with the provisions of the Hatch Act which limits the political activity of the Contractor's employees.

Section 3

Definitions

(A) City means the City of Duluth, Contracting Officer, or other persons authorized to act on behalf of the City of Duluth.

(B) Contracting Officer is the delegated representative of the City who has the responsibility for administering the Project.

(C) Contractor means an entity, whether public or private, which furnishes (other than standard commercial supplies, office space or printing services) to the City, products, services or supplies as described in this project Contract.

(D) Federal Agency means the United States, the District of Columbia, and any executive department, independent establishment, administrative agency, or instrumentality of the United States or of the District of Columbia, including any corporation, all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or by any of the foregoing departments, establishments, agencies, and instrumentalities. The term Federal Agency shall also include the person or persons authorized to act on behalf of said Federal Agency.

(E) Project means the activities to be undertaken by the Contractor as described in this Contract, which from time to time may be amended by mutual consent of the City and Contractor.

(F) Subcontractor means an entity, regardless of tier, which has entered into an agreement with the Contractor or another Subcontractor, to undertake certain Project activities as described in that agreement.

(G) The term labor standards, as used in the Contract, means the requirements of the Davis-Bacon Act, the Contract Work Hours and Safety Standards Act (other than those relating to safety and health), the Copeland Act, and the prevailing wage provisions of the other statutes listed in 20 CFR 5.1.

(H) Work means all labor necessary to produce the construction required by the Contract Documents, all materials and equipment incorporated or to be incorporated in such construction, products, services, or supplies required by the Contract Documents, or any other requirements set forth in the Contract.

(I) Additional Definitions, that are applicable to the Labor Standards provisions - Section 8 - of this Contract can be found in 29CFR5.2 as published by the U.S. Department of Labor and said definitions are hereby incorporated by reference into the provisions of this Contract.

Section 4

Environmental Provisions

(A) The Contractor agrees to follow the regulations, requirements, policies, goals and procedures set forth by the Council on Environmental Quality (CEQ) under provisions of the National Environmental Policy Act (NEPA) (Pub. L 91-190, 42 U.S.C. 4321 et seq.), Executive Order 11514, and 40 CFR Part 1500.

(B) **Historic Properties.** The Contractor agrees to follow the regulations, requirements, policies, goals, and procedures set forth under provisions of the National Historic Preservation Act of 1966 (Pub. L. 89-665); Preservation of Historic and Archeological Data Act of 1974 (Pub. L. 93-291); Executive Order 11593; 36 CFR , Part 800 and applicable State legislation or regulations.

(C) **Coastal Zones and Wetlands.** The Contractor agrees to follow the regulations, requirements, policies, goals and procedures set forth under provisions of the Coastal Zone Management Act of 1972 (Pub. L. 92-583) and applicable State legislation or regulations.

(D) **Noise.** The Contractor agrees to comply with provisions set forth in the U.S. Department of Housing and Urban Development Handbook 1390.2, Noise Abatement and Control, Department Policy, Responsibility and Standards, 1971.

(E) **Flood Plain.** The Contractor agrees to comply with the provisions set forth in the Flood Disaster Protection Act of 1973 (Pub. L. 93-234) and implementing regulations; Title 24, Chapter X, Subchapter B, National Flood Insurance Program, Executive Order 11296, and Executive Order 11988 relating to the evaluation of flood hazards.

(F) **Air Quality.** The Contractor agrees to comply with provisions set forth in the Clean Air Act (Pub. L. 90-148) and Clean Air Act Amendments of 1970 (Pub. L. 91-604); and applicable U.S. Environmental Protection Agency implementing regulations.

(G) **Water Quality.** The Contractor agrees to comply with the provisions set forth in the Federal Water Pollution Control Act (Pub. L. 92-500) and applicable U.S. Environmental Protection Agency implementing regulations, and Executive Order 11288 relating to the prevention, control, and abatement of water pollution.

(H) **Wildlife.** The Contractor agrees to comply with the provisions of the Fish and Wildlife Coordination Act (Pub. L. 85-264).

Section 5

Contract Compliance

(A) In the event of the Contractor's noncompliance with the provisions of this Contract or with any of the said regulations, the City may withhold payment(s) until evidence of compliance by the Contractor has been demonstrated, or the Contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further City contracts.

(B) In the event the Contract is terminated or canceled as a result of noncompliance with any of the provisions of this Contract, the City may subject to bids the remainder of the Project for which this Contract was made. The City shall have the right upon termination or suspension to withhold all further payments under this

Contract to the Contractor. Upon the award of a new contract for the remainder of the Project, the City shall pay to the Contractor an amount no more than the balance remaining due to the Contractor less the sum of the costs incurred by the City which are necessary in preparing the new bid specifications. In the event the amount paid the Contractor prior to the date of termination or cancellation exceeds the full amount of this Contract less the cost of the new contract and the additional costs mentioned above, the Contractor agrees to reimburse the City for such excess amount within ninety days after the new contract is awarded by the above procedures.

(C) Provisions contained in subparagraph (A) and (B) above shall not be interpreted as precluding any authorized Federal, State, or County governmental unit from exercising their legal administrative or other responsibilities in respect to the enforcement by said governmental units of laws or regulations concerning activities of the Contractor.

Section 6

Records

(A) **Establishment and Maintenance of Records.** Records shall be maintained in accordance with requirements prescribed by the Federal Agency or the City with respect to all matters covered by this Contract. Except as otherwise authorized by the Federal Agency, such records shall be maintained for a period of three years after receipt of final payment under this Contract.

(B) **Documentation of Costs.** All costs shall be supported by properly executed payrolls, time records, invoices, contracts, or vouchers, or other official documentation evidencing in proper detail the nature and propriety of the charges. All checks, payrolls, invoices, contracts, vouchers, orders, or other accounting documents pertaining in whole or in part to this Contract shall be clearly identified and readily accessible.

Reports and Information

At such times and in such forms as the Federal Agency or the City may require, there shall be furnished to the Federal Agency or the City such statements, records, data and information as the Federal Agency or the City may request pertaining to matters covered by this Contract.

Audits and Inspection

At any time during normal business hours and as often as the City, the Federal Agency and/or the Comptroller General of the United States may deem necessary, there shall be made available to the City, the Federal Agency and/or representatives of the Comptroller General for examination of all its records with respect to all matters covered by this Contract and will permit the City, the Federal Agency and/or representative of the Comptroller General to audit, examine and make excerpts or transcripts from such records, and to make audits of all contracts, invoices, materials, payrolls, records of personnel, conditions of employment, and other data relating to all matters covered by this Contract.

Section 7

Conflict of Interest and Lobbying

(A) **Interest of Members, Officers, or Employees of the City, Members of Local Governing Body, or Other Public Officials.** No member, officer, or employee of the City, or its designees or agents, or member of the governing body of the City, during his/her tenure of for one year thereafter, shall have any interest, direct or indirect in any contract or subcontract, or the proceeds thereof, for work to be performed in connection with the Project assisted under this Contract. Any contract in which any of the above indicated individuals becomes directly or indirectly, interested, personally or as a member of a firm, or as an officer, director, or stockholder of a corporation, shall be and become absolutely void; and any money which shall have been paid on such contract by the City may be recovered back from any or all persons interested therein, by a joint action or several actions.

(B) The Contractor agrees that he will incorporate into every contract required to be in writing the following provisions: **Interest of Contractors and Employees** - The Contractor covenants that he presently has no interest and shall not acquire any interest, direct or indirect, in the Project which would conflict in any manner or degree with the performance of this Contract, and no person having any conflicting interest shall be employed. Any interest on the part of the Contractor or his employees must be disclosed to the Federal Agency and the City. Provided, however, that this paragraph shall be interpreted in such a manner so as not to unreasonably impede any statutory requirements that opportunity be provided for employment of and participation by certain residents of a designated geographical are, if applicable.

(C) **Interest of Member or of Delegate to Congress.** No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

(D) The Contractor by signing this document certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Contractor, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the Contractor shall complete and submit Standard Form -LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

The above certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1332, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

(E) The parties to this Contract certify and agree that they are under no contractual or other disability which would prevent them from complying with the terms of this Contract.

Section 8

Labor Standards - Physical Improvement Projects

Where applicable, there shall be included in all construction, rehabilitation, alteration or repair contracts with private entities made possible by or resulting from this Contract, the following Labor Standards provisions;

(A) **General Requirements.**

(1) **Subcontracts.** The Contractor shall include in any subcontract the clauses set forth in Section 8, **Labor Standards**, in their entirety and also a clause requiring the subcontractors to include these clauses in any Tower tier subcontract which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

(2) The transporting of materials and supplies to or from the site of the Project or Program to which this Contract pertains by the Employees of the Contractor or of any subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the Project or Program to which this Contract pertains by persons employed by the Contractor or by any subcontractor, shall for the purpose of this Contract, and without limiting the generality of the foregoing provisions of this Contract, be deemed to be work to which these **Labor Standards** provisions are applicable.

(3) No person under the age of eighteen years shall be employed on work covered by this Contract.

(4) In connection with the performance of work under this Contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, September 10, 1955 (18 U.S.C. 4082 (c) (2)) and Executive Order 11755, December 29, 1973.

(5) The Contractor will permit authorized representatives of the Federal Agency and the City to interview employees during working hours on the job.

(6) No employee to whom the wage, salary, or other **Labor Standards** provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the Labor Standards applicable under this Contract to his employer.

(B) **Safety Standards.** No Contractor or subcontractor contracting for any part of a construction contract shall require any laborer or mechanic, including apprentices and trainees, employed in the performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous to his health or safety, as determined under construction safety and health standards promulgated by the Secretary of Labor. The Contractor or subcontractor comply with all the rules, regulations, and relevant orders, promulgated by the Secretary of Labor pursuant to Public Law 91-54.

(C) **Davis-Bacon Act - 29 CFR 5.5**

web site: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title29/29cfr5_main_02.tpl

Refer to Section 10, Page 10 Housing and Urban Development (HUD) form-4010 (06/2009) Ref Handbook 1344.1

City of Duluth "Mini Davis-Bacon"

(D) **City of Duluth - Minimum Wage Ordinance 8940, as Amended.**

(1) On a project (as defined below) funded in whole or in part by federal and/or state funds and/or city of Duluth funds, these local provisions shall prevail in those instances where the requirements of the local provisions are equal to or greater than similar minimum labor standards provisions as set forth in applicable federal and/or state laws and regulations.

(2) In all contracts in excess of $2,000 for projects (as defined below), the Contractor's particular attention is called to Ordinance 8940, effective June 8, 1989, respectively coded as Article IV of Chapter 2 of the Duluth City Code, and entitled "An Ordinance Pertaining to Wages and Working Hours of Persons on Public Works in the City of Duluth", as set forth below:

(3) **Definitions.**

For the purposes of this section the following words and phrases shall have the meanings respectively ascribed to them in this section:

(a) **Basic hourly rate** - The hourly wage paid to any employee.

(b) **Prevailing wage rate** - The basic hourly rate plus fringe benefits prevailing in the city of Duluth as determined by the United States secretary of labor pursuant to the Davis-Bacon act, as amended; provided that whenever employer and employee organizations employing and representing a majority of a class of workers in a particular industry within the city jointly certify that the prevailing basic hourly rate plus fringe benefits of such workers differs from the amount determined by the secretary of labor, the certified rate shall be considered to be the prevailing wage rate for such class of workers in that industry.

(c) **Fringe benefits** - Employer contribution for health and welfare benefits, vacation benefits, pension benefits, and all other economic benefits other than the basic hourly rate.

(d) **Apprentice** - An employee who is working under a training program which is approved either by the U.S. Department of Labor Bureau of Apprenticeship & Training or the Minnesota Director of Voluntary Apprenticeship; see apprentice ratios on pages 6-7 and HUD 4010 in Section 10.

(e) **Trainee** - An employee registered with the U. S. Department of Labor Employment & Training Administration; see HUD 4010 in Section 10.

(e) **Project** - Erection, construction, demolition, painting, remodeling or repairing of any public building, highway, sidewalk, bridge, water or gas line, sewer and sewage treatment facility or other public work performed under contract with the city.

(f) **Labor, mechanic** - All persons utilized, employed or working on a project who are doing work usually done by mechanics and laborers, including proprietors, partners, and members of cooperatives.

(4) **Wage Rates and Hours for City of Duluth Projects.**

(a) Any contract which provides for a project of estimated total cost of over $2,000.00 shall contain a stipulation that no laborer, mechanic or apprentice-trainee employed directly upon the project work site by the contractor or any subcontractor shall be permitted or required to work at a rate of pay less than the prevailing wage rate; nor shall any such employee be permitted or required to work more than 8 hours in any work day **OR** 40 hours in any work week unless he is paid at a rate of at least 1½ times the basic hourly rate for all hours in excess of 8 per day **OR** 40 per week [in other words: all hours in excess of eight per day and all hours after 40 per week] and unless he receives fringe benefits that are at least equal to those in the prevailing wage rate; provided that whenever employer and employee organizations employing and representing a majority of a class of workers in a particular industry within the city jointly certify that the maximum number of hours that such persons may work under existing labor agreements before overtime wages must be paid differs from the hours specified in this paragraph, the maximum number of hours specified in such labor agreements shall be substituted for those specified above in applying the provisions of this paragraph to such workers.

(b) The word "or" in the state statute and the city of Duluth Code refers to the number of hours worked in any one week or, in the alternative, the number of hours worked in any one day in the week (the days in one week being totaled for reporting purposes); the law requires use of the alternative which results in the higher number of overtime hours for each employee whose time is being reported.

EXCEPTIONS: Federal government funding only and HUD (Housing and Urban Development) funding - see point "e'

In summary, if a project is solely funded with city of Duluth monies, city ordinance 8940 as amended allows the employees to work four ten-hour days and be paid at the regular hourly rate for those ten hours; exceeding hours must be paid at the overtime rate. An employer may not withhold overtime payment exclusively until 40 hours per week have been worked. Daily overtime must be paid as it is earned.

- **The base workweek hours must be clearly indicated on each payroll. Employees may be assigned a different workweek; however, that must be clearly marked beside the employees' names.**

The following are examples of how these rules apply to different situations.

TT refers to the total time worked on the day or in the week
RT refers to the hours worked at the regular rate of pay (straight time)
OT refers to the hours worked for which overtime must be paid

State Funded with or without federal funding Projects

	Mon	Tues	Wed	Thurs	Fri	Sat	Total
TT	10	10	10	10	0	6	46
RT	8	8	8	8	0	6	38
OT	2	2	2	2	0	0	8

City-only Funded Projects (4 ten-hour days)

	Mon	Tues	Wed	Thurs	Fri	Sat	Total
TT	10	10	10	10	0	6	46
RT	10	10	10	10	0	0	40
OT	0	0	0	0	0	6	6

State Funded with or without federal funding Projects

	Mon	Tues	Wed	Thurs	Fri	Sat	Total
TT	0	10	10	0	7	0	27
RT	0	8	8	0	7	0	23
OT	0	2	2	0	0	0	4

City-only Funded Projects (4 ten-hour days)

	Mon	Tues	Wed	Thurs	Fri	Sat	Total
TT	10	0	12	0	0	0	32
RT	10	0	10	10	0	0	30
OT	0	0	2	0	0	0	2

c) **Overtime Calculations**

Minnesota Statutes Chapter 177.42, subd 4 specifies that the prevailing hours of labor may not be more than eight hours per day or more than 40 hours per week (as stated above in (b), the City of Duluth does allow for ten hours per day/40 hours per week with City funding *only*. Example: hours exceeding eight per day are paid at 1.5 times the rate in the contract's wage decision OR the base rate the employee is being paid if it is higher than the required base rate; once 40-hours in any one week are attained, all hours exceeding that 40 are paid at 1.5 times the rate in the project contract's wage decision. See example (1) and (2) below.

Minnesota Statutes Chapter 177.42, subd 5 defines the hourly basic rate as the hourly wage paid to any employee. (subd 6): The prevailing wage rate means the hourly basic rate of pay plus the contribution for health and welfare benefits, vacation benefits, pension benefits, and any other economic benefit paid to the largest number of workers engaged in the same class of labor within the area...

Minnesota Statutes Chapter 177.43, subd 1 (1) ...employees are permitted to work more hours than the prevailing hours of labor [being] paid for all hours in excess of the prevailing hours at a rate of at least 1-½ times the hourly basic rate of pay. (2) A laborer or mechanic may not be paid a lesser rate of wages than the prevailing wage rate in the same or most similar trade or occupation in the area.

An employer may pay a lower **regular time/straight time** hourly rate and higher fringe benefit rate--to a bona fide plan--than stated in the contract's wage decision providing the total of the two rates is equal to or greater than the total in the wage decision; however, the **OVERTIME rate** must be paid on the higher rate in the contract's wage decision.

(1) Overtime Calculation with Fringe Benefits Paid to Bona Fide Plans

For overtime purposes, an employer paying higher fringe benefits to a bona fide plan and paying a lower hourly rate MUST calculate the overtime on the higher hourly rate as stated in the project contract's wage decision. The fringe benefit amount may be reduced to reflect any increase in the total prevailing wage package IF the plan administrator permits such a reduction. This acceptance must be verified in writing by the plan administrator and attached to the appropriate certified payroll report.

(2) Overtime Calculation with Cash Payment of Fringe Benefits

When the fringe benefit is paid directly to an employee, the prevailing base rate and the fringe benefit rate as established in the project contract's wage decision for a specific classification are totaled to arrive at the hourly rate. *Overtime is calculated at 1.5 x the base rate of the wage decision with the fringe benefit amount added to that rate: base rate of the wage decision x 1.5 + fringe benefit rate = overtime rate.*

Contract Work Hours and Safety Standards Act

[Refer to page two of this document.] All projects valued at $100,000 or greater are subject to this Act. As with Minnesota Statutes Chapter 177.43, the overtime rate is calculated as in items one and two above OR (e) below.

(d) A contractor shall not reduce a worker's private, regular rate of pay when the wage rate certified by the U. S. Department of Labor or the Minnesota Department of Labor & Industry is less than the worker's normal hourly wage [Minnesota Statute 181.03 subdivision 1(2)].

(e) **Regular Time & Overtime Definitions**

• **State of Minnesota** funded projects with or without federal funding *only allow for five eight-hour days per week at regular time.* Overtime is calculated at a rate not less than time and one-half (1.5) of the prevailing base rate as stated in the wage decision OR the base rate the employee is being paid if it is higher than the required base rate--plus the straight time fringe benefit amount. (see (1) above for example when a lower base rate and higher fringe are paid)

• **City of Duluth** funded projects do permit four ten-hour work days at regular time–see point 4-a, b for stipulations. Overtime is calculated at a rate not less than time and one-half (1.5) of the prevailing base rate as stated in the wage decision--OR the base rate the employee is being paid if it is higher than the required base rate--plus the straight time fringe benefit amount. (see (1) above for example when a lower base rate and higher fringe are paid)

• **Federal** funded only projects allow overtime pay for hours worked in excess of 40 in a workweek at a rate not less than time and one-half (1.5) of the prevailing base rate as stated in the wage decision OR the base rate the employee is being paid if it is higher than the required base rate--plus the straight time fringe benefit amount.

• **HUD** funded projects allow overtime pay for hours worked in excess of 40 in a workweek at a rate not less than time and one-half (1.5) of the prevailing base rate as stated in the wage decision OR the base rate the employee is being paid if it is higher than the required base rate--plus the straight time fringe benefit amount.

** When a combination of funding sources are included in any one project, the most strict requirements will apply.

(f) The minimum hourly prevailing wages are contained in each project specification. When both federal (general decision rates from the U. S. Department of Labor) and State of Minnesota prevailing wages for state funded construction projects from the Minnesota Department of Labor and Industry are used, the prime contractor and all subcontractors including trucking operations, are required to **pay the higher of the two wages** for all laborers and mechanics [MnDOT Contract Administration Manual, Section 5-591.320].

(g) The prime contractor and any lower-tier subcontractor shall review all wage decisions and compensate a worker according to the type of work performed and at the rate that is the greatest.

(h) State of Minnesota prevailing wages typically list two rates for each classification with two effective dates. Should any City of Duluth contract continue to and past the second effective date, that rate and fringe benefit will be in effect through the remainder of the project.

(i) **Mn/DOT Statement of Compliance is required on all city of Duluth construction projects (regardless of the project funding source) with each weekly certified payroll report.** web site: http://dot.state.mn.us/const/labor/forms.html

(j) All contracts for city projects shall have applicable schedules of prevailing wage rates set forth in the contract. Schedules of applicable prevailing wage rates shall be posted on all project job sites for public review and shall be protected from the weather.

(k) Employees on projects shall be paid at least **weekly**. Fringe benefits shall be paid either in cash or to an employee benefit plan that has been approved by the U.S. Department of Labor. ■ **The fringe benefit package is an integral portion of the prevailing wage. Should the prime contractor or any subcontractor (regardless of tier) become delinquent with any fringe benefit plan administrator's requirements for monthly payment, the monthly estimate(s) may be withheld until the plan payments are made current.** (city ordinance 8940 6-18-89 plus amendments)
See MnDOT Specification 1906 on page nine and Section 5 of this document: Contract Compliance.
See Statement of Compliance and Certified Payroll Report requirements in Section 10, HUD 4010 and web sites in Section 14, Forms.

(l) Any contractor or subcontractor working on a project shall furnish the City with **original** certified payroll reports with **original signatures** relating to the project. Such certified payroll reports shall be **submitted weekly** on U.S. Department of Labor standard forms (WH-347) or their equivalent–using the same format--to the City of Duluth Labor Standards representative. All City of Duluth funded projects must have the base workweek hours indicated on the certified payroll form and/or beside each employee's name (should some employees be working different base workweeks).

(m) No contractor or subcontractor working on a project shall evade or attempt to evade the provisions of this section through the use of non-recognized training programs. The only employees involved in training programs that shall be allowed to work on projects covered by this section shall be apprentice-trainees as defined by this article.

(n) Any person violating the provisions of this section shall be guilty of a misdemeanor with each day of violation constituting a separate offense. In addition, if the prevailing wage rate and accompanying fringe benefit rate is not paid to employees working on a project, the City of Duluth may withhold contract payments to the prime contractor until such deficiencies are corrected. Should fringe benefits be paid to authorized Plans, the payments must be made within the demands of those Plans. Delinquencies may result in withholding of project funds to the prime contractor.

(o) This section shall not apply to contracts for projects where the total cost of the project is less than $2,000.00; nor to materialmen who do no more than deliver materials to the work site, **except** that this section shall apply to employees who deliver asphalt, concrete or mineral aggregate such as sand, gravel or stone where such material is incorporated into the project by depositing the material substantially in place, either directly or through spreaders, from the transporting vehicle.

(5) **Helpers**

A helper may perform work *only* if the helper classification is specified and defined in the federal wage decision and/or State of Minnesota wage decision incorporated into the project contract. Without such a helper classification, the contractor must assign a job classification that is the "same or most similar" [Minnesota Statute 177.44, subdivision 1] and compensate the helper for the actual work performed regardless of the helper's skill level.

(6) **Apprentice Ratios**

Journeyworkers must be on site with the apprentices and their hours must match.

FUNDING SOURCE:

City of Duluth and State of Minnesota with or without Federal funding

- Apprentices are not permitted to work alone under any circumstances.
- Working foremen are acceptable as a journeyworker PROVIDING he/she is in the same classification.
  - » Example: carpenter foreman and carpenter apprentice
- Ratios are determined by the trade's labor agreement.
- In the absence of ratio language, the following State of Minnesota apprenticeship ratios will be applied:
  (apprentice : journeyworker) 1:1 2:4 3:7 4:10, etc.

- Employees working in excess of the allowable ratio must be paid the full journeyworker compensation.
- Out-of-ratio apprentices will be calculated beginning with the **apprentice at the highest level of training** and, then, to less senior apprentices in their rank order.
- Should two or more out-of-ratio apprentices have the same level of training, whomever was on the work site first will receive journeyworker pay; if the apprentices at the same level of training began work on the project site at the same time, hours worked out-of-ratio for which restitution is due will be divided among those apprentices.

Examples:

Four apprentices working unsupervised are on site. [4:0]
Ratio calls for four apprentices and ten journeyworkers [4:10]

Correction: all apprentices will receive the full journeyworker compensation as apprentices are not permitted to work alone.

Three apprentices and two journeyworkers are on site. [3:2]
Ratio calls for three apprentices and seven journeyworkers [3:7]

Two journeyworkers may accompany only one apprentice; therefore, the two highest level apprentices are paid the full journeyworker compensation.

Even though this particular job has three apprentices–the second journeyworker is a mute point; a third journeyworker would also be a mute point in this example.

Correction: the two highest level apprentices are paid the full journeyworker compensation and the third lower level apprentice is considered in ratio.

H U D (CDBG) and Federal funding only

- Apprentices are not permitted to work alone unless the U. S. Department of Labor-approved agreement allows that practice.
- Working foremen are acceptable as a journeyworker PROVIDING he/she is in the same classification.
  - » Example: electrician foreman and electrician apprentice
- Ratios are determined by the trade's U. S. Department of Labor-approved agreement.
- In the event of the absence of ratio language in the applicable agreement, the Minnesota Department of Labor ratio of one apprentice for the first journeyworker and one apprentice for each three journeyworkers thereafter will be applied, (i.e., 1:1, 2:4, 3:7, 4:10, etc.).

- The **legal apprentices are those who first came to work on the job site;** in the event that all apprentices begin work on the project site at the same time, hours worked out-of-ratio for which restitution is due will be divided among the apprentices.
- Time cards will be required to substantiate the start times.
- Employees working in excess of the allowable ratio--or for which U. S. Department of Labor-apprentice agreement/certificate is not provided–must be paid the full journeyworker compensation.

Examples:

Four apprentices and one journeyworker are on site. [4:1]
Ratio calls for four apprentices and ten journeyworkers. [4:10]

The first apprentice on site is considered in ratio as one journeyworker may only accompany one apprentice [1:1]; this particular job has four apprentices.

Correction: the second through the fourth apprentices coming on site are paid the full journeyworker compensation.

Six apprentices and two journeyworkers are on site [6:2]
Ratio calls for six apprentices and sixteen journeyworkers [6:16]

The first apprentice on site is considered in ratio as two journeyworkers may only accompany one apprentice; this particular job has six apprentices–the second journeyworker is a mute point.

Correction: the second through sixth apprentices coming on site are paid the full journeyworker compensation.

(7) **Poster Boards**

The prime contractor must construct and display a poster board, which contains all required posters, is legible and is accessible to all workers from the first day of work until the project is 100% complete. Posters must be protected from the weather. Prime contractors are not allowed to place a poster board at an off-site facility location.

(8) **Trucking Issues**

a) For the purpose of sections seven and eight, the term "owner" includes all persons having an ownership interest in the trucking entity or a partnership interest in the trucking entity and has a legal and rightful title to the vehicle(s) or has an approved lease on the vehicle(s). "Operate" means the owner either physically drives the vehicle or hires another to physically drive the vehicle; yet, maintains the right to direct the day-to-day operations of the vehicle.

b) Trucking Operations Definitions: See MN Rule 5200.1106 web site: https://www.revisor.mn.gov/rules/?id=5200.1106

Independent Trucking Operator: an individual or partnership who owns or holds a vehicle under lease and who contracts that vehicle and the owner's services to an entity which provides construction services to a public works project. The individual owns or leases and drives the equipment, is responsible for the maintenance of the equipment, bears all operating costs, determines the details and means of performing the services, and enters into a legally binding agreement that specifies the relationship to be that of an independent contractor and not that of an employee.

Multiple Truck Operations: any legal business entity that owns more than one vehicle and hires the vehicles out for services to brokers or contractors on public works projects. The owners of a trucking firm may either drive the vehicles or hire employees to drive the vehicles. Employee drivers are subject to the appropriate prevailing wage rate. The owner driving a vehicle is obligated to account for the value of his/her services as a driver at the appropriate prevailing wage.

Partnerships: a legal business entity where two or more individuals hold vehicles under lease and contract those vehicles and their services to an entity which provides construction services to a public works project. The partners own or lease the equipment, are responsible for maintenance and all operating costs, drive the equipment, determine the details and means of performing the services, and enter a legally binding agreement that specifies the

relationship to be that of a partner and not that of an employee. All partners are subject to the appropriate prevailing wage per city of Duluth ordinance 8940 as amended.

Corporation: any legal business entity that owns or leases vehicles to provide construction services to public works projects. All individuals are employees of the corporation and subject to the appropriate prevailing wage regardless of title or position.

Broker: an individual or firm who (activities include, but are not limited to):

- contracts to **provide** trucking services [equipment and driver] in the construction industry to users of such services, such as prime contractors and various subcontractors of the prime;
- contracts to **obtain** services from other trucking operations and dispatches them to various assignments;
- receives payment from the users (such as prime contractors and various subcontractors) in consideration for the trucking services provided; and
- makes payment to the providers (trucking operations so contracted with) for their services.

(9) **Specific documentation from trucking operations.**

Independent Trucking Operators

The owner/operator of a truck must submit a copy of his/her commercial driver's license (CDL), cab card, and insurance certificate for each truck the owner/operator drives on each construction project *before commencing work* on that project. These documents must be sent to the prime contractor who will then forward the material to Labor Standards, Engineering Division at the City of Duluth.

Multiple Truck Operators

Weekly certified payrolls and payment of corresponding prevailing wages plus the fringe benefit package will be required for each project where trucks are operating. This covers the owner plus all employees performing work on the project.

Partnerships

Weekly certified payrolls and payment of corresponding prevailing wages plus fringe benefit packages will be required for each project where trucks are operating. This covers all partners of the organization who perform work on the project.

Each partner performing work on a project must submit a copy of his/her commercial driver's license (CDL), cab card, and insurance certificate for the truck being operated with that weekly certified payroll. It is not necessary to repeat such supporting documentation until a different truck is used and/or certificates or licenses have expired.

Employees of the partnership are always reported on a weekly certified payroll and paid the appropriate prevailing wage plus fringe benefit package for the work being performed.

Corporations

All persons employed by the corporation are subject to receive payment of the prevailing wage plus the fringe benefit package for the work performed on a project regardless of title or position. Weekly certified payrolls must be submitted for all work performed on the project.

Brokers

Truck ownership and a **bonafide contract** between the broker and another trucking operation, a prime contractor, or a subcontractor must be identified. Paperwork must be submitted with the month end trucking report to the city of Duluth Labor Standards representative - Engineering. Certified payrolls are not required when the above documentation is provided and approved.

(10) **Month End Trucking Report - ONLY REQUIRED WITH STATE OF MINNESOTA FUNDING**

The Minnesota Department of Transportation Month End Trucking Report Form A and Form B plus Minnesota Department of Transportation Month End Trucking Report Statement of Compliance are *only required on state funded projects*.

A guide for completing the forms including definitions and the reports, themselves, may be downloaded from:

www.dot.state.mn.us/const/labor/forms.html

Payment to the prime contractor may be withheld until documentation is received and approved.

(11) **Truck Rental Rates - ONLY REQUIRED WITH STATE OF MINNESOTA FUNDING**

Truck rental rates are listed in the prevailing wage section of the project specifications.

(12) **Minnesota Rules 5200.1105 and 5200.1106**

These rules are incorporated into this supplementary general conditions part II by reference and are found on these web sites:
www.revisor.mn.gov/rules/?id=5200

(13) **Truck Axles** web site: https://www.revisor.mn.gov/rules/?id=5200.1100

Per Minnesota Rules 5200.1100 Master Job Classifications, a truck "unit" refers to all axles including the steering axle. A tag axle is also counted as one of the axles. Examples: four rear axles plus one steering axle = five axles total one rear axle plus one steering axle = two axles total

(14) **Non-Compliance and Enforcement**

a) The prime contractor shall be liable for any unpaid wages to its workers or those of its lower-tier subcontractors, trucking companies/Multiple Truck Owners (MTO's) and/or Independent Truck Owner/Operator (ITOs) [MnDOT Standard Specifications for Construction, Section 1801].

b) See Section 9, MnDOT Specification 1906 Partial Payments and Section 5, page two of this document.

c) City of Duluth ordinance 8940 as amended.

(15) **IC-134 form - Withholding Affidavit for Contractors**

The IC-134 form will be required from all Multiple Truck Operators, Partnerships, and Corporations performing trucking services on a project before the retainage or all remaining funds can be released. Web site for completing form online: www.mndor.state.mn.us

The form, itself, is found at: and www.taxes.state.mn.us/Forms_and_Instructions/ic134.pdf

(16) **Owners, Supervisors, Foremen listed on certified payrolls.**

All persons working on a City of Duluth project including owners, partners, supervisors, salaried persons, and working foremen who perform laborer and/or mechanic work shall be reported on the weekly certified payroll reports including all data required of any laborer or mechanic. (ordinance 8731, 6/24/85 and 8940 as amended).

(17) **Supporting documentation**.

At his/her discretion, the City of Duluth employee responsible for prevailing wage labor standards may demand proof of payment of the prevailing wage which may include copies of a payroll register, itemized time sheet and matching cancelled check, or any other supporting documents as stipulated. Payment to the prime contractor may be withheld until documentation is received and approved.

(18) **Kickbacks from Public Works employees prohibited**.

No contractor working on a project or other person shall, by force intimidation, or threat of termination of employment, cause any employee working on a project to give up any part of the compensation to which he is entitled under his contract of employment.

Section 9
Minnesota Department of Transportation Specification 1906 Partial Payments
Process For "Withholding Contract Monies" and "Default and Termination of a Contract" 11/5/04

Mn/DOT Specification 1906 Partial Payments describes the Commissioner's authority to withhold funds to protect the Department's interests. In addition, Specification 1808 Default and Termination of a Contract describes the Commissioner's authority to take the prosecution of the work out of the hands of the Contractor.
Additionally, on projects funded in whole or part with federal funds and in accordance with the Required Contract Provisions Federal-Aid Construction Contracts Form – 1273, Section IV, Subpart 6, "Withholding", incorporated into federal aid contracts, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance or guarantee of funds until such violations have ceased.

However, the Department must give the Contractor, and it's Sureties due notice prior to exercising these authorities. The withholding of contract funds, in accordance with Specification 1906 or the Required Contract Provisions Federal-Aid Construction Contracts Form – 1273, Section IV, Subpart 6, "Withholding", should be implemented as soon as a possible prevailing wage violation is recognized. However, Default and Termination of a Contract, in accordance with Specification 1808, should only be exercised as a "last resort" if the Contractor is not willing to comply.

Definitions

(Mn/DOT Standard Specifications for Construction 2000 Edition, Section 1103)
Commissioner: The Commissioner of the Minnesota Department of Transportation, or the chief executive of the department or agency constituted for administration of Contract work with its jurisdiction.
Contractor: The individual, firm or corporation Contracting for and undertaking prosecution of the prescribed work; the party of the second part to the Contract, acting directly or through a duly authorized representative.
Department: The Department of Transportation or the State of Minnesota, or the political subdivision, governmental body, board, commission, office, department, division, or agency constituted for administration of the Contract work within its jurisdiction.

(Form 1273 - 29 CFR, Part 5.1, Definitions)

Contracting Officer: The individual, a duly appointed successor or authorized representative who is designated and authorized to enter into Contracts on behalf of the Federal Agency and/or the City of Duluth.

Important Considerations

1. Upon completion of the work under a contract, the department should consider issuing the final voucher as soon as possible. Failure to finalize a contract expeditiously could result in subsequent claims that would prevent the department from finalizing the contract. However, before the issuance of the final voucher, the department must be able to ensure that the terms of the contract have been satisfied. Failure on the part of the department to ensure compliance could result in the Mn/DOT state aid division retaining funds from the department in accordance with *Minnesota Rules 8820.3000, subpart 5*.

2. On every contract, the department should withhold the final retainage in accordance with the following guidelines: (1) if the total amount of the contract is $1,000,000 or more, the department should retain funds not more than $50,000, (2) if the total amount of the contract is less than $1,000,000, the department should retain 5% of the total contract, (3) retainage should be withheld until the department can ensure that the contractor has met the terms of the contract or until the finalization of the contract.

3. This guide specifies that the department verbally notify the bonding company early in the process. Generally, as a "rule of thumb", notifying the bonding company is usually the "last resort". However, the justification for the early notification is related to the language found in *Minnesota statute 574.31, subdivision 2,* which summarizes that if an individual or the department does not submit a claim on the payment bond within 120 days after the completion of work under the contract, the claim can be denied.

The following are general guidelines that should be followed prior to placing a Contractor in default:

Step 1: Upon verbal or written notification that a possible prevailing wage violation exists, the Department should give written notice to the Contractor regarding the nature of the claim, along with the Department's intent to withhold monies until the claim is investigated and determined to be in compliance. Additionally, the Department should inform the Contractor that the bonding company has been verbally notified of the claim. Please be aware, the Department should ensure employee confidentiality at all times.

Step 2: Upon a preliminary determination surrounding the financial extent of the claim, the Department should consider retaining a "reasonable" portion of one or more partial estimates in accordance with Mn/DOT's 2000 Standard Specifications for Construction, Section 1906; or on federal aid contracts, in accordance with the Required Contract Provisions Federal-Aid Construction Contracts Form – 1273, Section IV, Subpart 6, "Withholding".

Step 3: If it is determined that the claim is valid, the Department should schedule a meeting with the Contractor and attempt to resolve the matter. If the claim is determined to be invalid, the Department should release any partial estimates that may have been held as a result of the claim. However, the Department should continue to withhold the final retainage in accordance with the above-mentioned: *Important Considerations, 2*.

Step 4: If resolution cannot be obtained through a meeting, the Department should order the Contractor, in writing, to complete their obligations under the contract. The letter should clearly state the circumstances under which the Department has deemed that the Contractor has not met the terms of the contract. Additionally, the Department should include a reasonable deadline for this obligation to be completed. A copy of this letter should be forwarded to the Surety, District State Aid Engineer (DSAE), Labor Compliance Unit and the Department's Attorney.

Step 5: In the event that the Contractor does not respond to the Department's written order, the Department should send a similar letter, requesting that the Contractor respond immediately, in writing, regarding the Contractor's intention to comply or not comply with the order. A copy of this letter should be forwarded to the Surety, District State Aid Engineer (DSAE), Labor Compliance Unit and the Department's Attorney.

Step 6: If the Department still does not get a proper response from the Contractor, the Department should write another letter, addressed to both the Contractor and the Surety, specifying all the facts of the alleged breach, demanding that the Contractor, or its Surety, respond satisfactorily within 10 days or the Department may exercise its authority to Default and Terminate the Contract in accordance within/DOT's 2000 Specifications for Construction, Section

1808. It's important to provide sufficient detail so that the Surety understands the situation. This notification should be sent by certified mail. A copy of this letter should be forwarded to the Surety, District State Aid Engineer (DSAE), Labor Compliance Unit and the Department's Attorney.

Step 7: If the Contractor or Surety is unresponsive after 10 days, the Department should consult with their attorney to consider proceeding with Default and Termination of the Contract.

Step 8: Upon termination of the contract, the Department provides a written order to the Surety, requiring the Surety to bring resolution to the prevailing wage violation.

Step 9: The Department places the Contractor on a Non-Responsible Bidder's List and rejects any future awards.

Section 10

Federal Labor Standards Provisions U.S. Department of Housing and Urban Development Office of Labor Relations

Previous editions are obsolete Page 1 of 5 form **HUD-4010 (06/2009**) ref. Handbook 1344.1

Applicability

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. (i) Minimum Wages. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section l(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part Previous editions are obsolete Page 2 of 5 form **HUD-4010** (06/2009) ref. Handbook 1344.1 of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work, all or part of the wages required by the contract, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for and on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section l(b)(2)(B) of the Davis-bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section l(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i) except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at *http://www.dol.gov./whd/wh347.pdf* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to HUD or its designee. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149.)

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;

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(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph A.3.(ii)(b).

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under subparagraph A.3.(i) available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant ',to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding

journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by
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the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in subparagraphs 1 through 11 in this paragraph A and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this paragraph.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.
(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.
(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1 01 0, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Administration..... makes, utters or publishes any statement knowing the same to be false..... shall be fined not more than $5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. <u>Contract Work Hours and Safety Standards Act.</u> The provisions of this paragraph B are applicable where the amount of the prime contract exceeds $100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in sub paragraph (1) of this paragraph.
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(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. <u>Health and Safety.</u> The provisions of this paragraph C are applicable where the amount of the prime contract exceeds $100,000.

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, (Public Law 91-54, 83 Stat 96). 40 USC 3701 et seq.

(3) The contractor shall include the provisions of this paragraph in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontractor as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

Section 11

Equal Opportunity Laws and Regulations

(A) In addition to Contract specifications set forth below, the Contractor shall conduct and administer this Contract in compliance with:

(1) Title VI of the Civil Rights Act of 1964 (Pub. L. 88-352) and implementing regulations issued at 24 CFR Part 1;
(2) Title VIII of the Civil Rights Act of 1968 (Pub. L. 90-284), as amended, and implementing regulations;
(3) Section 109 of the Housing and Community Development Act of 1974, as amended; and the regulations issued pursuant thereto (24 CFR Section 570.601);
(4) Section 3 of the Housing and Urban Development Act of 1968, as amended, and implementing regulations of 24 CFR Part 135;
(5) Executive Order 11246, as amended by Executive Order 11375 and 12086 and implementing regulations at 41 CFR Chapter 60;
(6) Executive Order 11063, as amended by Executive Order 12259 and implementing regulations at 24 CFR Part 107;
(7) Section 504 of the Rehabilitation Act of 1973 (Pub. L. 93-112), as amended, and implementing regulations when published for effect;
(8) The Age Discrimination Act of 1975, as amended, (Pub. L. 94-135) and implementing regulations when published for effect;
(9) The Minnesota Human Rights Act of 1974, as amended (Chapter 363).

Equal Opportunity and Affirmative Action

(A) Contractors and Subcontractors that have a work force in excess of fifty (50) employees and a contract in excess of $50,000.00 shall prepare and maintain an appropriate affirmative action plan in accordance with the provisions of 41 CFR 60 "Compliance Responsibility for Equal Opportunity".

(B) Non-segregated Facilities. The Contractor shall certify that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The Contractor covenants that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. As used in this paragraph the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, creed, religion, national origin, ancestry, age, marital status, status with respect to public assistance, and/or disability because of habit, local custom, or otherwise.

General Provisions Against Discrimination

(A) In all hiring or employment made possible by or resulting from this Contract, there:

(1) will not be any discrimination against any employee or applicant for employment because of race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability.

(2) affirmative action will be taken to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability. This requirement shall apply to, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; lay-off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. There shall be posted in conspicuous places available to employees and applicants for employment, notices setting forth the provisions of this clause. All solicitations or advertisements for employees shall state that all qualified applicants will receive consideration for employment without regard to race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability.

(B) No person in the United States shall, on the grounds of race, color, creed, religion, national origin, age, sex, marital status, status with respect to public assistance, and/or disability, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity made possible by or resulting from this Contract. The Contractor and each employer will comply with all requirements imposed by or pursuant to the regulations of the Federal Agency effectuating Title VI of the Civil Rights Act of 1966. The Contractor will note this requirement in all solicitations or advertisements for employees. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(C) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representative of the Contractor's commitments under these provisions, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(D) The Contractor hereby agrees that he will incorporate into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained pursuant to this Contract, the equal opportunity clause which is a part of these Contract Documents.

(E) The Contractor further agrees that he will be bound by the equal opportunity clause and other provisions of 41 CFR Chapter 60, with respect to his own employment practices when he participates in federally assisted construction work: **Provided:** That of the Contractor so participating is a State or Local Government, the above equal opportunity clause is not applicable to any agency, instrumentality, or subdivision of such government which does not participate in work on or under the Contract. Also, the Contractor will make his files available to inspection by appropriate government agencies and shall furnish those reports as may be required by said agencies.

(F) The Contractor agrees that he will assist and cooperate actively with the Federal Agency and the Secretary of Labor in obtaining the compliance of subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that he will furnish the Federal Agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that he will otherwise assist the Federal Agency in the discharge of its primary responsibility for securing compliance.

(G) The Contractor further agrees that he will refrain from entering into any contract or any contract modification subject to Executive Order 11246 of September 24, 1965, with a subcontractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order. In addition, the Contractor agrees that if he fails or refuses to comply with these undertakings, the City or the Federal Agency may take any or all of the following actions: Terminate or suspend in whole or in part this Contract; refrain from extending any further assistance to the Contractor under the Project with respect to which the failure or refusal occurred until satisfactory assurance of future compliance has been received from such Contractor and refer the case to the Department of Justice for appropriate legal proceedings.

Affirmative Action - "Construction Contracts" over $10,000

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity
(Executive Order 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation (percent)	Goals for female participation (percent)
From April 1, 1980 until revised	3.0	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3 (a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the City and to the Director of the Office of Federal Contract Compliance Programs; U.S. Department of Labor, ESA/OFCCP, 16th Floor, 230 South Dearborn Street, Chicago, Illinois, 60604, within 10 working days of award of any construction subcontract and/or subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the contractor and/or subcontractor; employer identification number; estimated dollar amount of the prime contract; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

4. As used in this Notice, and in the Contract, the "covered area" is all work under a contract currently held with the City of Duluth, Minnesota.

Standard Federal Equal Employment Opportunity
Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:
   a) "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor; or any person to whom the Director delegates authority;
   b) "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
   c) "Minority" includes:
      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notices of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitments and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of officers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, creed, religion, national origin, sex, ancestry, age, marital status, status with respect to public assistance and/or disability.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails

to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

Affirmative Action for Handicapped Workers

(applies to contracts in excess of $2,500)

(A) The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: Employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

(B) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(C) In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

(D) The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

(E) The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

(F) The Contractor will include the provisions of this clause in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era

(applies to contracts in excess of $10,000)

(A) The Contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans status in all employment practices such as the following: Employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

(B) The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract and including those occurring at an establishment of the Contractor other than the one wherein the contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to provide such reports to such local office regarding employment openings and hires as may be required.
State and local government agencies holding Federal contracts of $10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in paragraphs (D) and (E).

(C) Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and non-veterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Contractor from any requirements in Executive Orders of regulations regarding nondiscrimination in employment.

(D) The reports required by paragraph (B) of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the Contractor has more than hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of non-disabled veterans of the Vietnam era hired, (3) the number of disabled veterans of the Vietnam era hired, and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 U.S.C. 1787. The Contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one year after final payment under the contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the contracting officer of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment and placement.

(E) Whenever the Contractor becomes contractually bound to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions, and has so

advised the State system, there is no need to advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(F) This clause does not apply to the listing of employment openings which occur and are filled outside of the 50 States, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.

(G) The provisions of paragraphs (B), (C), (D), and (E) of this clause do not apply to openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement for that opening.

(H) As used in this clause:

(1) "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: Production and non-production; plant and office; laborers and mechanics; supervisory and non-supervisory; technical; and executive, administrative, and professional openings as are compensated on a salary basis of less than $25,000 per year. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

(2) "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

(3) "Openings which the Contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the Contractor proposes to fill from regularly established "recall" lists.

(4) "Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangement" means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of his employees.

(I) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(J) In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

(K) The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.

(L) The Contractor will notify each labor union representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative action to employ and advance qualified disabled veterans and veterans of the Vietnam era..

(M) The Contractor will include the provisions of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

Section 12

Employment Opportunities - "HUD Section 3"

General

These requirements apply to the City of Duluth contracts receiving assistance under the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program.

Type of Covered Projects

24CFR570.607 (b) of the HUD CDBG Program Regulations state in part "... that employment and other economic opportunities arising in connection with housing rehabilitation, housing construction, or other public construction projects shall to the greatest extent feasible, and consistent with existing Federal, State, and local laws and regulations be given to low- and very low-income persons.

Thresholds

In accordance with the provisions of 24CFR135.3(a) (3) (ii) (A), the requirements of this Section apply to those recipients as defined at 24CFR135.5 when the amount of this contract exceeds $200,000.

In addition, in accordance with the provisions of 24CFR135.3 (a) (3) (ii) (B), the requirements of this Section apply to any contractor or subcontractor whose contract exceeds $100,000 as a result of assistance provided under this contract.

Requirements (Section 3 Clause)

(A) The work to be performed under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

(B) The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.

(C) The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement, or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The

notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

(D) The Contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

(E) The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligation under 24 CFR part 135.

(F) Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD-assisted contracts.

Section 13

Federal Requirements for Minority/Women Business Enterprises Contract Guidance - MPFA

General

Municipalities that receive loan funding must comply with Federal requirements concerning utilization of Minority Business Enterprises (MBE) and Women's Business Enterprises (WBE). These requirements are designed to encourage the prime contractors to utilize MBEs and WBEs whenever procurement opportunities occur.

Regulation

40 C.F.R. Section 35.3145(d) Application of other Federal Authorities, M/WBE Requirements
Executive Orders No. 11625, 12138 and 12432 - Promoting the use of M/WBEs
Section 129 of Public Law 100-590 - Small Business Administration Reauthorization and Amendment Act of 1988
Regulations detailed in the EPA's *Cross-Cutting Federal Authorities - Clean Water Act State Revolving Fund Program and Safe Drinking Water Act State Revolving Fund Program*

Implementation

The "fair share" target percentage participation proposed for this project is 3.5 percent (3.5%) for MBE and 11.5 percent (11.5%) for WBE.

If the Contractor intends to let any subcontractors for a portion of the work, the Contractor shall take affirmative steps to assure that minority and women businesses are utilized when possible as sources of supplies, equipment, construction and services. Affirmative steps shall include the following:

a) Include qualified minority businesses on solicitation lists.
b) Assure that minority businesses are solicited whenever they are potential sources.
c) When economically feasible, divide total requirements into smaller tasks or quantities so as to permit maximum small and minority business participation.
d) Where the requirement permits, establish delivery schedules, which will encourage participation by minority businesses.
e) Use the services and assistance of the Office of Minority Business Enterprise of the Department of Commerce.

The low bidder will be required to submit to the City of Duluth documentation of his good faith efforts to meet the targeted goals of utilizing MBEs and WBEs.

Section 14 - Forms

Minnesota Department of Transportation and City of Duluth, Minnesota funded certified payroll forms

- MnDOT Prime Contractor's-Subcontractor's Statement of Compliance form (12/2010)
  www.dot.state.mn.us/const/labor/forms.html
- Certified Payroll Forms
  http://www.dol.gov/forms/whd/wh347.pdf
  use front side only

U. S. Department of Housing and Urban Development and federal government funded certified payroll forms

- Statement of Compliance Form & Certified Payroll Forms
  http://www.dol.gov/forms/whd/wh347.pdf
  (use reverse side for Statement of Compliance form)
- MnDOT Prime Contractor's-Subcontractor's Statement of Compliance form (12/2010)
  www.dot.state.mn.us/const/labor/forms.html

Minnesota Department of Transportation Trucking Requirements

- Month End Trucking Report Form A and Form B
- Month End Trucking Report Statement of Compliance
- Definitions, instructions, forms:
  www.dot.state.mn.us/const/labor/forms.html

PROJECT LABOR AGREEMENT

NO STRIKE, NO LOCKOUT

PUBLIC SECTOR

CITY OF DULUTH

&

Vendor

Project name

Project No.

INDEX	

AGREEMENT

This Project Labor Agreement (hereinafter, the "Agreement"), effective as of the date of attestation by the City Clerk, by and between the various contractors engaged in the construction of facilities to be known as the (Project). The parties to this Agreement are the Building and Construction Trades Council, on behalf of its affiliated Local Unions (hereinafter "Union" or "Unions"), the City of Duluth (hereinafter "Owner") and Contractor (hereinafter "Construction Manager/General Manager," "Contractor," and "Contractors").

It is understood by the parties to this Agreement that it is the policy of the Owner that the construction work covered by this Agreement shall be contracted to Contractors who agree to be bound by the terms of this Agreement. Therefore, the Union agrees that other Contractors may execute the Agreement for the purpose of covering that work. The Construction Manager/General Contractor shall monitor compliance with this Agreement by all Contractors who through their execution of this Agreement, together with their subcontractors, have become bound hereto.

The term "Contractor" shall include all Contractors and subcontractors of whatever tier engaged in on-site construction work within the scope of this Agreement.

The Union and all signatory Contractors agree to abide by the terms and conditions contained in this Agreement with respect to the administration of the Agreement by the Owner and the performance of the construction by the Contractor of the Project. This Agreement represents the complete understanding of the parties, and it is further understood that no Contractor party is required to sign any other agreement as a condition of performing work within the scope of this Agreement. No practice, understanding or agreement between a Contractor and a Union party which is not explicitly set forth in this Agreement shall be binding on any other party unless endorsed in writing by the Project Contractor.

ARTICLE I - PURPOSE

The (Project), an undertaking of the Owner, is a public project which will employ numbers of skilled and unskilled workers. Construction of the Project will entail utilization of the construction industry in an area having multiple labor contracts and employer associations. Consequently, conflicts within labor-management relations could cause delay or disruption of the efficient completion of the .project unless maximum cooperation of all segments of the construction industry is obtained. This Agreement is to establish as the minimum standards on the Project the hours and working conditions as those prevailing for the largest number of workers engaged in the same classes of work within the area.

It is in the public interest that the Project progress and be completed in an expeditious and efficient manner, free of disruption or delay of any kind. Therefore, it is essential to secure optimum productivity and to eliminate any delays in the work. In recognition of the special needs of this Project and to maintain a spirit of harmony, labor-management peace and stability during the term of this Project Labor Agreement, the parties agree to establish effective and binding methods for the settlement of all misunderstandings, disputes or grievances which may arise. Therefore, the Unions agree not to engage in any strike, slowdown or interruption of work and the Contractor agrees not to engage in any lockout.

ARTICLE II - SCOPE OF THE AGREEMENT

Section 1. This Agreement, hereinafter designated as the “Project Labor Agreement” or “Agreement,” shall apply and is limited to all construction work included in all Bid Categories for the (Project), under the direction of the signatory Contractors and performed by those Contractor(s) of whatever tier which have contracts awarded for such work on and after the effective date of this Agreement with regard to the Project.

Such Project is generally described as the construction of: Project

Section 2. It is agreed that all direct subcontractors of a Contractor, of whatever tier, who have been awarded contracts for work covered by this Agreement on or after the effective date of this Agreement shall be required to accept and be bound by the terms and conditions of the Project Labor Agreement.

Section 3. The provisions of this Project Labor Agreement shall apply to all craft employees represented by any Union listed in Schedule A hereto attached and shall not apply to other field personnel or managerial or supervisory employees as defined by the National Labor Relations Act.

Section 4. All employees covered by this Agreement shall be classified in accordance with work performed and paid the base hourly wage rates for those classifications as specified in the attached Schedule A.

Section 5. The Contractors agree to pay contributions to the established employee benefit funds in the amounts designated in the appropriate Schedule A.

Contractors that are not signatory to a collective bargaining agreement beyond the scope of this Agreement ("PLA contractor") may select to participate in the legally established industry health reimbursement arrangement ("HRA") plan, in lieu of contributing to the respective bona fide benefit funds as designated in Schedule A. The amount of the contribution is based on the difference between the contribution amount of the bona fide Schedule A benefit funds and the cost of the PLA contractor's bona fide non-discretionary plans. Contributions must be made on behalf of named employees. Participating contractors will submit to the Trustees of the HRA trust and plan a copy of their plan, summary plan description, and the premium structure for workers covered under the PLA contractor's bona fide, non-discretionary plans. The value of the PLA contractor's benefit plans are subject to confirmation by the Trustees of the HRA trust and plan. This may include an independent audit according to a policy as established by the Trustees. Contractors are required to submit certified payroll reports to the Trustees or authorized administrator in order to confirm compliance with the terms of the HRA trust and plan.

The Contractors adopt and agree to be bound by the written terms of the legally-established Trust Agreements (or in lieu thereof, the aforementioned HRA plan and trust including any policies) specifying the detailed basis on which payments are to be made into, and benefits paid out of, such Trust Funds. The Contractors authorize the parties to such Trust Agreements to appoint trustees and successor trustees to administer the Trust funds and hereby ratify and accept the Trustees so appointed as if made by the Contractors.

Section 6. In the event of any conflict between any provisions of this Agreement and in the Local Area Agreements, the terms of this Agreement will be applied. In other words, where a subject covered by the provisions of this Project Labor Agreement is also covered by the Local Area Agreement the provisions of this Project Labor Agreement shall prevail. Where a subject is covered by the Local Area Agreement and not covered by this Project Labor Agreement, the Local Area Agreement provisions shall prevail.

Section 7. This Agreement shall only be binding on the signatory parties hereto and shall not apply to the parents, affiliates, subsidiaries, or other ventures of any such party.

Section 8. This Agreement shall be limited to work historically recognized as construction work. Nothing contained herein shall be construed to prohibit, restrict, or interfere with the performance of any other operation, work or function which may occur in or around the Project site or be associated with the development of the Project, or with the ongoing operations of the Owner.

Section 9. It is understood that the liability of any Contractor and the liability of the separate Unions under this Agreement shall be several and not joint. The Union agrees that this Agreement does not have the effect of creating any joint employment status between or among Owner and any Contractor.

Section 10. All workers delivering fill, sand, gravel, crushed rock, transit/concrete mix, asphalt or other similar materials and all workers removing any materials from the construction site as required by the specifications are subject to the provisions of the Minnesota state

prevailing wage law and are entitled to the appropriate area standard wage. For purposes of this contract, such materials are for specified future use and per Minnesota state prevailing wage law delivery and pickup of the above-listed materials constitutes incorporation.

ARTICLE III - UNION RECOGNITION AND REPRESENTATION

Section 1. The Contractor recognizes the Union as the sole and exclusive bargaining representative of all craft employees working on facilities within the scope of this Agreement.

Section 2. Authorized representatives of the Union shall have access to the Project, provided they do not interfere with the work of employees and further provided that such representatives fully comply with the posted visitor and security and safety rules of the Project.

ARTICLE IV - LABOR HARMONY CLAUSE

The contractor shall furnish labor that can work in harmony with all other elements of labor employed on that (Project) and shall submit a labor harmony plan to demonstrate how this will be done. “Harmony” shall include the provision of labor that will not, either directly or indirectly, cause or give rise to any work disruptions, slow downs, picketing, stoppages, or any violence or harm to any person or property while performing any work, or activities incidental thereto at the (project). The labor harmony plan should include the company's labor management policies, collective bargaining agreements if any and their expiration dates, past labor relations history, a listing of activities anticipated under this contract that may potentially cause friction with on-site workers, and procedures the company will undertake to eliminate this friction.

The contractor agrees that it shall require every lower-tier subcontractor to provide labor that will work in harmony with all other elements of labor employed in the work, and will include the provisions contained in the paragraph above, in every lower-tier subcontract let for work under this contract.

The requirement to provide labor that can work in harmony with all other elements of labor employed in the work throughout the contract performance is a material element of this contract. Failure by the contractor or any of its lower tier subcontractors to comply with this requirement shall be deemed a material breach of the contract which will subject the contractor to all rights and remedies the city of Duluth may have, including without limitation the right to terminate the contract.

ARTICLE V - WORK STOPPAGES AND LOCKOUTS

Section 1. There shall be no strike, picketing, work stoppages, slowdowns or other disruptive, activity for any reason by the Union or employees against any Contractor covered under this Agreement, and there shall be no lockout by the Contractor. Failure of any Union or employee to cross any picket line established by any union, signatory or non-signatory, or any other organization, at or in proximity to the Project site is a violation of this Article.

Section 2. Any party alleging a breach of Section 1, of Article IV shall have the right to petition a court for temporary and permanent injunctive relief. The moving party need not show the existence of irreparable harm, and shall be required to post bond only to secure payment of court costs and attorney fees as may be awarded by the court.

ARTICLE VI - DISPUTES AND GRIEVANCES

Section 1. This Agreement is intended to provide close cooperation between management and labor. The Construction Manager/General Contractor and the Building and Construction Trades Council shall each assign a representative to this Project for the purpose of assisting the Local Unions, together with the Contractor, to complete the construction of the Project economically, efficiently, continuously and without interruption, delays or work stoppages.

Each Contractor shall hold a pre-job conference with the Union and Construction Manager/General Contractor to clear up any project question and work assignments in which there is thought to be a difference in opinion. Every effort will be made to hold such conference well in advance of actual work performance.

Section 2. The Contractor, Union, and employees collectively and individually, realize the importance to all parties to maintain continuous and uninterrupted performance of the work of the Project, and agree to resolve disputes over grievances in accordance with the arbitration provisions set forth in the Local Area Agreements in effect with the Unions listed in Schedule A attached hereto.

ARTICLE VII - JURISDICTIONAL DISPUTES

Section 1. There will be no strikes, work stoppages, slowdowns, or other disruptive activity arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted as assigned by the Contractor.

Section 2. Building construction work shall be assigned by the Contractor in accordance with the procedural rules of the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (hereinafter the “Plan”). Any jurisdictional dispute over the Contractor's assignment of work shall be settled in accordance with the provisions of the Plan.

Section 3. Where a jurisdictional dispute involves the International Brotherhood of Teamsters, it shall be referred for resolution to that International Union and the disputing International Union. The resolution of the dispute shall be reduced to writing, signed by the authorized representative of the International Unions and the Contractor. The assignments made by the Contractor shall be followed until such time as the dispute is resolved in accordance with this Section.

ARTICLE VIII - NO DISCRIMINATION

Section 1. The Contractor and Union agree that they will not discriminate against any employee or applicant for employment because of his or her membership or nonmembership in a Union or based upon race, color, religion, sex, national origin or age in any manner prohibited by law or regulation.

Section 2. Any complaints regarding application of the provisions of Section 1 should be brought to the immediate attention of the involved Contractor for consideration and resolution.

Section 3. The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

ARTICLE IX - SAVINGS AND SEPARABILITY

It is not the intention of the parties to violate any laws governing the subject matter of this Agreement. The parties hereto agree that in the event any provisions of the Agreement are finally held determined to be illegal or void as being in contravention of any applicable law, the remainder of the Agreement shall remain in full force and effect unless the part or parts so found to be void are wholly inseparable from the remaining portions of this Agreement. Further, the contractor and Union agree that if and when any and all provisions of this Agreement are finally held or determined to be illegal or void by Court of competent jurisdiction, the parties will promptly enter into negotiations concerning the substance affected by such decision for the purpose of achieving conformity with the requirements of an applicable law and the intent of the parties hereto.

ARTICLE X DURATION OF THE AGREEMENT

The Project Labor Agreement shall be effective as of the date of attestation by the City Clerk, and shall continue in effect for the duration of the Project construction work described in Article II hereof Construction of any phase, portion, section or segment of the project shall be deemed complete when such phase, portion, section or segment has been turned over to the Owner and has received the final acceptance from the Owner's representative.

Since there are provisions herein for no strikes or lockouts in the event any changes are negotiated and implemented under a Local Area Agreement during the term of this Agreement, the Contractor agrees that, except as specified herein, such changes shall be recognized and shall apply retroactively to the termination date in the particular Local Agreement involved. Each Contractor which has a Local Agreement with a Union at the time that its contract at the project

commences shall continue it in effect with each said Union so long as the Contractor remains on the project. In the event any such Local Area Agreement expires, the Contractor shall abide by all of the terms of the expired Local Agreement until agreement is reached on a new Local Agreement, with any changes being subject to the provisions of this Agreement.

The Union agrees that there will be no strikes, work stoppages, sympathy actions, picketing, slowdowns or other disruptive activity affecting the Project by any Union involved in the negotiation of a Local Area Agreement nor shall there be any lockout on this Project affecting the Union during the course of such negotiations.

IN WITNESS WHEREOF the parties have entered into this Agreement to be effective as of the day and year above written.

DULUTH BUILDING AND CONSTRUCTION TRADES COUNCIL

By: _____

Its _____
(Printed Name/Title)

Date: _____

VENDOR

By: _____

Its _____
(Printed Name/Title)

Date: _____

CITY OF DULUTH

By:_____
Mayor

Attest:

_____
City Clerk

Date: _____

_____
City Auditor

Date: _____

_____
Assistant City Attorney

Date: _____

SCHEDULE "A"

A1 Asbestos Workers Local 49
A-2 Boilermakers Local 647
A-3 BAC Local 1 Chapter 3 Duluth & Iron Range
A-4 Carpenters Local 361
A-5 Cements Masons/Plasterers Local 633
A-6 Elevator Constructors Local 9
A-7 IBEW Local 242
A-8 Iron Workers Local 512
A-9 Laborers Local 1091
A-10 Millwrights & Machinery Erectors Local 1348
A-11 Operating Engineers Local 49
A-12 Painters & Allied Trades Local 106
A-13 Plumbers & Fitters Local 11
A-14 Roofers Local 96
A-15 Sheet Metal Workers Local 10
A-16 Sprinkler Fitters Local 669
A-17 Teamsters Local 346

Building Trades Affiliates
Contract Expirations

Heat & Frost Insulators Local 49	May 31, 2017
Boilermakers Local 647	December 31, 2016
Bricklayers Local 1	April 30, 2016
Carpenters Local 361	May 30, 2017
Cement Masons Local 633	April 30, 2017
Elevator Constructors Local 9	July 8, 2017
Glaziers Local 106	April 30, 2017
IBEW Local 242	May 31, 2019
Iron Workers Local 512	April 30, 2016
Laborers Local 1091	April 30, 2017
Operator Engineers Local 49 (Bldrs)	April 30, 2016
(Hwy Heavy)	April 30, 2017
Painters Local 106	April 30, 2017
Plumbers & Steamfitters Local 11	April 30, 2017
Roofers Local 96	June 30, 2016
Sheet Metal Local 10	April 30, 2016
Sprinkler Fitters Local 669	March 31, 2016
Teamsters Local 346	April 30, 2017

Updated 9/4/2015

Affiliated AFL-CIO

DULUTH BUILDING AND CONSTRUCTION TRADES COUNCIL

2002 LONDON ROAD LABOR CENTER DULUTH, MINN. 55812

Officers
Craig Olson
President
Darrell Godbout
Vice President
Dan Olson
Secretary
Jeff Daveau
Treasurer

Boilermakers #647
Bricklayers #1
Carpenters #361
Cement Masons #633
Elevator #9
IBEW #242
Insulators #49
Ironworkers #512
Laborers #1091
Millrights #1348
Operators #49
Painters #106
Pipefitters #11
Roofers #96
Sheetmetal #10
Sprinklerfitters #669
Teamsters #346

ASBESTOS WORKERS LOCAL 49
Dave Cartwright
2002 London Road #210
Duluth, MN 55812
(218) 724-3223 / Fax# 724-1870
dave@insulatorslocal49.org

BOILERMAKERS LOCAL 647
Bill Polchow
1007 NW 4th Street, Ste C
Grand Rapids, MN 55744
(218) 326-2522 / Fax# SAME
bpolchow647@outlook.com

BAC LOCAL #1 CHAPTER 3 DULUTH & IRON RANGE
Stan (Ogie) Paczynski
2002 London Road #100
Duluth, MN 55812
(218) 724-8374 / Fax# 724-8341
spaczynski@bac1mn-nd.org

CARPENTERS LOCAL 361
Steve Risacher & Chris Hill
5238 Miller Trunk Hwy
Hermantown, MN 55811
(218) 724-3297 / Fax# 724-8536
srisacher@ncsrcc.org
chill@ncsrcc.org

CEMENT MASONS LOCAL 633
Michael Syversrud
2002 London Road #112
Duluth, MN 55812
(218) 724-2323 / Fax# 724-2472
mikes@local633.org

ELEVATOR CONSTRUCTORS LOCAL 9
Dave Aaserud
433 Little Canada Rd E
Little Canada, MN 55117
(651) 287-0817 / Fax# 287-0820
d.aaserud@local9.com

IBEW LOCAL 242
Don Smith
2002 London Road #111
Duluth, MN 55812
(218) 728-6895 / Fax# 728-1965
dsmithlcl242@unions-america.com

IRON WORKERS LOCAL 512
Darrell Godbout, ***Vice President***
3752 Midway Road
Hermantown, MN 55810
(218) 724-5073 / Fax# 724-1525
darrell@iron512.com

LABORERS LOCAL 1091
Dan Olson, ***Secretary***
2002 London Road #119
Duluth, MN 55812
(218) 728-5151 / Fax# 728-2431
laborers@local1091.com

MILLRIGHTS & MACHINERY ERECTORS LOCAL 1348
Wayne Nordin
307 N 1st Street
Virginia, MN 55792
(218) 741-6314 / Fax# 741-6017
wnordin@ncsrcc.org

OPERATING ENGINEERS LOCAL 49
Brent Pykkonen
2002 London Road #116
Duluth, MN 55812
(218) 724-3840 / Fax# 728-1441
pyke49@yahoo.com

PAINTERS LOCAL 106
Craig Olson, ***President***
2002 London Road #106
Duluth, MN 55812
(218) 724-6466 / Fax# 724-7359
president@duluthbuildingtrades.com

PLUMBERS & FITTERS LOCAL 11
Jeff Daveau, ***Treasurer***
4402 Airpark Boulevard
Duluth, MN 55811
(218) 727-2199 / Fax# 727-2298
jeff@ualocal11.com

ROOFERS LOCAL 96
Vance Anderson
1145 Villa Vista Circle
Cromwell MN 55726
(218) 644-1096 / Fax# SAME
valocal96@yahoo.com

SHEET METAL WORKERS LOCAL 10
Doug Christy
6279 Industrial Road
Saginaw, MN 55779
(218) 724-6873 / Fax# SAME
dchristy@smw10.org

SPRINKLER FITTERS LOCAL 669
James Westby
PO Box 398
Mabel, MN 55954
(507) 493-5671 / Fax# 493-5481
westby@mabeltel.coop

TEAMSTERS LOCAL 346
Rod Alstead
2802 West 1st Street
Duluth, MN 55806
(218) 628-1034 / Fax# 628-0246
teaml346@qwest.net

International Brotherhood of
BOILERMAKERS · IRON SHIP BUILDERS
9459 N.W. Highway 10, Suite 105
Ramsey, MN 55303-7280
S-[illegible]/3

Local Lodge No. 647
BLACKSMITHS · FORGERS & HELPERS
Luke A. Voigt
Business Manager/Secretary Treasurer
763-712-9930 . Fax: 763-712-9935

December 1, 2015

TO WHOM IT MAY CONCERN:

The following wage package changes listed below become effective 01/01/2016 thru 12/31/2016 for Boilermakers Local Lodge #647. Per the Great Lakes Articles of Agreement for the year of 2016, there is a $1.40 increase to be allocated by the membership. The $1.40 has been allocated as follows: $1.00 will go to a wage increase, $.40 will go to an Annuity increase. Per Article 24.4, the 647 Development and Training Fund (D&T) will increase $.05 for a total contribution of $.51.

CHANGES AS OF:	January 1, 2016
Increase General Foreman	$ 1.00
Increase Foreman	1.00
Increase Journeyman	1.00
Increase Annuity	.40
Increase 647 D&T	.05
Increase Vacation Fund Deduction	.95
Increase Subsistence	5.00

Effective:	01/01/2016
General Foreman Wage	$ 39.65
Foreman Wage	37.65
Journeyman Wage	35.15
Pension Trust	14.14
Annuity Trust	4.40
Health & Welfare Fund	7.07
Retiree Welfare Plan	.50
Apprenticeship Fund	.40
MOST	.34
647 D&T	.51

Deductions (after tax)	
Vacation Trust	2.00
647 Political Action Fund	.05

All other benefits and deductions remain the same for the Great Lakes Articles of Agreement as listed further in this letter.

Subsistence will be paid under the terms and conditions of the Great Lakes Articles of Agreement. For the provisions of the agreement on subsistence, Addendum A of the agreement states effective 01/01/2016 thru 12/31/2016 the daily rate of Subsistence is $65.00 per day if a Boilermaker's permanent address is 50 miles from the jobsite.

Boilermaker-Blacksmith National Pension Trust ($14.14), National Annuity ($4.40), National Health & Welfare Fund ($7.07), Boilermakers Great Lakes Region Retiree Welfare Plan ($.50), Boilermakers 647 D&T Fund ($.51), Boilermakers 647 Political Action Fund ($.05 deducted after taxes), to be paid on hours PAID, not hours worked.

Vacation Trust ($2.00 deducted after taxes), Apprenticeship Fund ($.40) and MOST ($.34) are to be paid on hours WORKED.

647 Political Action Fund and 647 D&T Fund monies will be submitted to Local 647 on separate forms and will require separate checks for each fund.

Boilermakers receive time and one-half over the established workday of eight hours and all time worked on Saturdays. All time worked on Sundays and holidays are double time.

Effective November 1, 2011, Field Dues increased to 4.25% of the gross pay, which is remitted to Local 647.

An Emergency Work Addendum has been added to the Great Lakes Articles of Agreement which provides for time and one half rate of pay for unscheduled emergency outages. If you would like a copy of this addendum please contact Local 647.

This is the third and final year of the agreement.

If you have any questions please call me at 763-712-9930.

Very truly yours,

Luke A. Voigt
Business Manager/Secretary Treasurer
Boilermakers Local Lodge #647

LAV/vm
opeiu #12

Bricklayers and Allied Craftworkers

Local Union 1 Minnesota / North Dakota

312 Central Avenue, Suite 328
Minneapolis, Minnesota 55414

"Building For the Future"

TELEPHONE: 612/379-2966
FAX: 612/379-8754

MICHAEL J COOK
President/Secretary-Treasurer

To: All Associated General Contractors
Minnesota Masonry Contractors
Independent Contractors
Chapter #3
Duluth Area

January 28, 2015

Scope of the Agreement
This agreement shall cover all of the part of St. Louis County, south of a line between townships 54 and 55 (two miles north of Cotton), also the eastern half of Aitkin County on a line with the northeast boundary line of Mille Lacs County, also Carlton, Lake, Cook, Pine and Kanabec.

BRICKLAYERS AND ALLIED CRAFTWORKERS
LOCAL UNION 1 MINNESOTA / NORTH DAKOTA
DULUTH AREA – BRICKLAYERS, BLOCKLAYERS AND P.C.C.'S

This is to advise you that the new working agreement calls for a $1.00 increase per hour on May 1, 2015. Please inform your bookkeeping department of the following rates.

The total wage rate effective May 1, 2015 for members of the Bricklayers and Allied Craftworkers will be as follows:

WAGES	HEALTH $BANK – RPP	HRA	IU & PPA PENSION	LOCAL PENSION	DUL ANN	DUL VAC	DUES	IMI	APPR	FCF	TOTAL
29.64	(5.65 + 1.10)	.88	(1.50 + .44)	6.70	3.85	2.00	1.23	.54	.30	.02	53.85

Base Rate:	$29.64
Vacation, Dues Check Off:	$3.23
Taxable Amount:	$32.87

FOREMAN RATE - The Foreman rate shall be an additional $3.00 above the scale.
REFRACTORY - The Refractory Base Wage rate shall be $31.14 with above fringe benefits.
VACATION PAY - Vacation Pay shall be pyramided in all overtime pay. Time and one-half = $3.00
Double-time =$4.00

Sincerely,
Michael J Cook

Michael J. Cook
President / Secretary - Treasurer
Bricklayers and Allied Craftworkers
Local Union 1Minnesota / North Dakota
8 – 2015

APPRENTICE WAGES

BASE WAGE	TAXABLE
1st 1000 hours 50% - $14.82	$18.05*
2nd 1000 hours 55% - $16.30	$19.53*
3rd 1000 hours 65% - $19.27	$22.50*
4th 1000 hours 75% - $22.23	$25.46*
5th 1000 hours 85% - $25.19	$28.42*
6th 1000 hours 95% - $28.16	$31.39*

* Taxable wage - Includes Vacation and Dues

Bricklayers and Allied Craftworkers

Local Union 1 Minnesota / North Dakota

312 Central Avenue, Suite 328
Minneapolis, Minnesota 55414

"Building For the Future"

TELEPHONE: 612/379-2966
FAX: 612/379-8754

MICHAEL J. COOK
President/Secretary-Treasurer

To: All Associated General Contractors
Minnesota Tile Contractors
Independent Contractors
Chapter #3
Duluth Area

Scope of the Agreement
This agreement shall cover the counties of St. Louis, Koochiching, Itasca, Aitkin, Carlton, Lake, and Cook. The agreement shall also cover all of the part of Pine County north of County Road 30 and include the city of Sandstone.

March 5, 2015

BRICKLAYERS AND ALLIED CRAFTWORKERS
LOCAL UNION 1 MINNESOTA / NORTH DAKOTA

DULUTH AREA –TILE LAYERS

This is to advise you that the new working agreement calls for a $1.06 increase per hour on May 1, 2015. Please inform your bookkeeping department of the following rates.

The total wage rate effective May 1, 2015 for members of the Bricklayers and Allied Craftworkers will be as follows:

WAGES	HEALTH $BANK – RPP	HRA	IU & PPA PENSION	LOCAL PENSION	LOCAL ANNUITY	VAC.	DUES	IMI	APPR	FCF	TOTAL
23.02	(5.65 + 1.10)	.71	(1.50 + .44)	6.70	4.68	.50	1.07	.46	.20	.02	46.05

Base Rate:	$23.02
Vacation, Dues Check Off:	$1.57
Taxable Amount:	$24.59

Foreman shall receive an additional $1.00 above the scale.

APPRENTICESHIP WAGES

BASE WAGE	TAXABLE
1st 2000 hours 91% - $20.95	$22.52 *
2nd 2000 hours 94% - $21.64	$23.21 *
3rd 2000 hours 97% - $22.33	$23.90 *

* Taxable wage = Includes Dues

Sincerely,

Michael J. Cook

Michael J. Cook
President / Secretary - Treasurer
Bricklayers and Allied Craftworkers
Local Union 1 Minnesota / North Dakota

46-2015

Bricklayers and Allied Craftworkers

Local Union 1 Minnesota / North Dakota

312 Central Avenue, Suite 328
Minneapolis, Minnesota 55414

"Building For the Future"

TELEPHONE: 612/379-2966
FAX: 612/379-8754

MICHAEL J. COOK
President/Secretary-Treasurer

To: All Associated General Contractors
Minnesota Tile Contractors
Independent Contractors
Chapter #3
Duluth Area

Scope of the Agreement
This agreement shall cover the counties of St. Louis, Koochiching, Itasca, Aitkin, Carlton, Lake, and Cook. The agreement shall also cover all of the part of Pine County north of County Road 30 and include the city of Sandstone.

March 5, 2015

BRICKLAYERS AND ALLIED CRAFTWORKERS
LOCAL UNION 1 MINNESOTA / NORTH DAKOTA
DULUTH AREA - TILE FINISHERS

This is to advise you that the new working agreement calls for a $.80 increase per hour on May 1, 2015. Please inform your bookkeeping department of the following rates.

The total wage rate effective May 1, 2015 for members of the Bricklayers and Allied Craftworkers will be as follows:

WAGES	HEALTH $BANK - RPP	HRA	IU & PPA PENSION	LOCAL PENSION	LOCAL ANNUITY	VAC.	DUES	IMI	APPR	FCF	TOTAL
16.24	(5.65 + 1.10)	.50	(1.50 + .44)	6.70	.50	.50	.85	.35	.20	.02	34.55

Base Rate:	$16.24
Vacation, Dues Check Off:	$1.35
Taxable Amount:	$17.59

APPRENTICESHIP WAGES

BASE WAGE	TAXABLE
1st 1000 hours 60% - $9.74	$11.09*
2nd 1000 hours 70% - $11.37	$12.72 *
3rd 1000 hours 80% - $12.99	$14.34 *
4th 1000 hours 90% - $14.62	$15.97 *

* Taxable wage = Includes Dues

Sincerely,

Michael J. Cook

Michael J. Cook
President / Secretary - Treasurer
Bricklayers and Allied Craftworkers
Local Union 1 Minnesota / North Dakota

47-2015

NORTH CENTRAL STATES
Regional Council of
CARPENTERS

Effective May 1, 2015

Northern Minnesota

Local 361

Commerical & Residential Carpenter Wage Rates

Classification		Percent (%)	Gross Wages	Deductions		Fringe Benefits					Total Package
				Savings	Dues	Health	DB Pension	DC Pension	Apprentice/ Education	Fair Contracting	
Commercial Foreman (+2.00 Above JP)		100%	$31.55	-$1.30	-$1.26	$6.33	$6.15	$3.00	$0.60	$0.02	$47.65
Commercial Journeyperson		100%	$29.55	-$1.30	-$1.18	$6.33	$6.15	$3.00	$0.60	$0.02	$45.65
Residential Foreman (+2.00 Above JP)		100%	$27.12	-$1.30	-$1.08	$6.33	$6.15	$3.00	$0.60	$0.02	$43.22
Residential Journeyperson		100%	$25.12	-$1.30	-$1.00	$6.33	$6.15	$3.00	$0.60	$0.02	$41.22
Apprentice	6125-7000	97%	$28.66	-$1.30	-$1.15	$6.33	$6.15	$3.00	$0.60	$0.02	$44.76
	5250-6125	93%	$27.48	-$1.30	-$1.10	$6.33	$6.15	$3.00	$0.60	$0.02	$43.58
	4375-5250	88%	$26.00	-$1.30	-$1.04	$6.33	$6.15	$3.00	$0.60	$0.02	$42.10
	3500-4375	83%	$24.53	-$1.30	-$0.98	$6.33	$6.15	$3.00	$0.60	$0.02	$40.63
	2625-3500	78%	$23.05	-$1.30	-$0.92	$6.33	$6.15	$3.00	$0.60	$0.02	$39.15
	1750-2625	73%	$21.57	-$1.30	-$0.86	$6.33	$6.15	$3.00	$0.60	$0.02	$37.67
	875-1750	68%	$20.09	-$1.30	-$0.80	$6.33	$6.15	$3.00	$0.60	$0.02	$36.19
	0-875	63%	$18.62	-$1.30	-$0.74	$6.33	$6.15	$3.00	$0.60	$0.02	$34.72

Consisting of Carlton, Cook, Pine, and portions of Lake and St. Louis Counties in Minnesota and Douglas and Western Bayfield Counties in Wisconsin.

Residential work is defined as single family/duplex or smaller. All other work is considered commercial and should be paid accordingly.

NORTH CENTRAL STATES
Regional Council of
CARPENTERS

Effective May 1, 2015

Minnesota Highway Heavy

All Districts *

Piledriver Wage Rates

Classification		Percent (%)	Gross Wages	Deductions: Savings	Deductions: Dues	Fringe Benefits: Health	Fringe Benefits: DB Pension	Fringe Benefits: DC Pension	Fringe Benefits: Apprentice/ Education	Fringe Benefits: Fair Contracting	Total Package
Foreman		100%	$37.85	-$1.15	-$1.51	$6.33	$9.45	$1.40	$0.60	$0.02	$55.65
Piledriver Journeyperson		100%	$35.85	-$1.15	-$1.43	$6.33	$9.45	$1.40	$0.60	$0.02	$53.65
Apprentice	42-48 Months	95%	$34.06	-$1.15	-$1.36	$6.33	$9.45	$1.40	$0.60	$0.02	$51.86
	36-42 Months	90%	$32.27	-$1.15	-$1.29	$6.33	$9.45	$1.40	$0.60	$0.02	$50.07
	30-36 Months	85%	$30.47	-$1.15	-$1.22	$6.33	$9.45	$1.40	$0.60	$0.02	$48.27
	24-30 Months	80%	$28.68	-$1.15	-$1.15	$6.33	$9.45	$1.40	$0.60	$0.02	$46.48
	18-24 Months	78%	$27.96	-$1.15	-$1.12	$6.33	$9.45	$1.40	$0.60	$0.02	$45.76
	12-18 Months	75%	$26.89	-$1.15	-$1.08	$6.33	$9.45	$1.40	$0.60	$0.02	$44.69
	6-12 Months	72%	$25.81	-$1.15	-$1.03	$6.33	$9.45	$1.40	$0.60	$0.02	$43.61
	0-6 Months	70%	$25.10	-$1.15	-$1.00	$6.33	$9.45	$1.40	$0.60	$0.02	$42.90

***NOTE: Gross wages for Piledriver Apprentices working in all districts are calculated using the respective percentages of a District 1 Piledriver Journeyperson. Fringe Benefit allocations are also the same as a District 1 Piledriver Journeyperson.**

The following rates are per hour above Journeyperson Piledriver scale.

Foreman: $2.00 Certified Welder: $1.00 Welder: $0.50 Diver: $6.50 Tender: $3.00 Creosote: $0.75 Tunnel Work: $0.30

The diving crew shall have a Designated Person In Charge (DPIC) in accordance with OSHA regulations. The contractor must always assign a crew that complies with OSHA regulations and may increase the crew to meet productivity and safety requirements.

Diver's Expenses: $100.00 per day for use of personal equipment and $50.00 per day for use of air compressor.

May 1, 2016 Increase: $1.61 to be allocated

NORTH CENTRAL STATES
Regional Council of
CARPENTERS

Effective May 1, 2015

Minnesota Highway Heavy

District 2

Highway Heavy Carpenter Wage Rates

Classification		Percent (%)	Gross Wages	Deductions: Savings	Deductions: Dues	Fringe Benefits: Health	Fringe Benefits: DB Pension	Fringe Benefits: DC Pension	Fringe Benefits: Apprentice/ Education	Fringe Benefits: Fair Contracting	Total Package
Foreman		100%	$36.11	-$1.40	-$1.44	$6.33	$7.35	$2.80	$0.60	$0.02	$53.21
Journeyperson		100%	$34.11	-$1.40	-$1.36	$6.33	$7.35	$2.80	$0.60	$0.02	$51.21
Apprentice	6125-7000	97%	$33.09	-$1.40	-$1.32	$6.33	$7.35	$2.60	$0.60	$0.02	$49.99
	5250-6125	93%	$31.72	-$1.40	-$1.27	$6.33	$7.35	$2.60	$0.60	$0.02	$48.62
	4375-5250	88%	$30.02	-$1.40	-$1.20	$6.33	$7.35	$2.60	$0.60	$0.02	$46.92
	3500-4375	83%	$28.31	-$1.40	-$1.13	$6.33	$7.35	$2.60	$0.60	$0.02	$45.21
	2625-3500	78%	$26.61	-$1.40	-$1.06	$6.33	$7.35	$2.60	$0.60	$0.02	$43.51
	1750-2625	73%	$24.90	-$1.40	-$1.00	$6.33	$7.35	$2.60	$0.60	$0.02	$41.80
	875-1750	68%	$23.19	-$1.40	-$0.93	$6.33	$7.35	$2.60	$0.60	$0.02	$40.09
	0-875	63%	$21.49	-$1.40	-$0.86	$6.33	$7.35	$2.60	$0.60	$0.02	$38.39

Consisting of Aitkin, Carlton, Cook, Itasca, Koochiching, Lake, Pine and St. Louis Counties in Minnesota and in Wisconsin, Douglas and Western Bayfield Counties.

IMPORTANT NOTE TO CONTRACTORS: Wage Percentages for **APPRENTICES ONLY** match rates in the jurisdiction in which they are indentured. Please check with local training centers to find correct jurisdictional indenture rates.

May 1, 2016 Increase: $1.54 to be allocated

CEMENT MASONS, PLASTERERS AND SHOPHANDS
Local No. 633

of Minnesota, North Dakota, and NW Wisconsin · AFL-CIO

312 Central Avenue · Room 376 · Minneapolis, Minnesota 55414

Phone (612)379-1558 · Fax (612)379-1559

GREG MASSEY *Financial Secretary Business Manager*

DAVE SCHUTTA *President*

JOSEPH DeRASMI *Business Agent*

BRIAN GULLICKSON *Business Agent*

GREG JOHNSON *Business Agent*

JEROME JOHNSON *Business Agent*

MICHAEL KRAHN *Business Agen*

DARRELL LENDE *Business Agent*

MICHAEL SYVERSRUD *Business Agent*

THOMAS REGER *Apprentice Coordinator*

TO: ALL NORTHERN MINNESOTA & NORTHWESTERN WISCONSIN **PLASTERING** CONTRACTORS

ATTN: PAYROLL DEPT, 2015 WAGE RATES

This Agreement shall govern work done in the areas defined as follows: All of the following counties: Aitkin, Carlton, Cook, Itasca, Lake, St. Louis, and that part of Pine County north of T.24N, as well as the following counties in Wisconsin: Ashland, Bayfield, Douglas, Iron, Sawyer, Washburn, Burnett, and Price.

EFFECTIVE MAY 1, 2015

BASIC WAGE*	HEALTH & WELFARE	HRA	PENSION	SAVINGS*	TRAINING	TOTAL
31.24	7.23	2.00	7.94	(3.60)	.46	48.87

*The Basic Wage before the deduction of savings is the straight time wage used in determining overtime. (EXAMPLE: 1.5 X $31.24 = $46.86 TAXED, THEN MINUS $3.60 FOR SAVINGS EACH HOUR) After all taxes are deducted from the Basic Wage rate, $3.60 per hour for each hour worked shall be deducted and applied to the Minnesota Cement Masons Savings Plan.

Foreman: $1.50 above basic wage

APPRENTICE RATES:

UP TO 1000HRS	70%	21.87
1001-2000 HRS	75%	23.43
2001-3000 HRS	80%	24.99
3001-4000 HRS	85%	26.55
4001-5000 HRS	90%	28.12
5001-6000 HRS	95%	29.68

TO: ALL IRON RANGE AREA CONTRACTORS

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Business Agent

MICHAEL SYVERSRUD
Business Agent

THOMAS REGER
Apprentice Coordinator

TO: ALL DULUTH AREA CONTRACTORS

ATTN: PAYROLL DEPT

RE: 2015 WAGE RATES - **HIGHWAY/HEAVY** DIVISION

This Agreement shall govern work done in the areas defined as follows: All of the following counties: Aitkin, Carlton, Cook, Lake and that part of Pine County north of T.24N, and that part of St. Louis County south of T.55N, as well as the following counties in Wisconsin: Ashland, Douglas, Bayfield, Burnett, Iron, Washburn, Sawyer and Price.

EFFECTIVE MAY 1, 2015

BASIC WAGE*	HEALTH & WELFARE	HRA	PENSION	SAVINGS	TRAINING	TOTAL
33.70	7.23	1.75	7.94	(5.42)	.46	51.08

*The Basic Wage before the deduction of savings is the straight time wage used in determining overtime. (EXAMPLE: 1.5 X $33.70 = $50.55, TAXED, THEN MINUS $5.42 FOR SAVINGS EACH HOUR) After all taxes are deducted from the Basic Wages, $5.42 per hour for each hour worked shall be deducted and applied to the Minnesota Cement Masons Savings Plan.

Foreman: $1.50 above basic wage

APPRENTICE RATES:

UP TO 1000HRS	70%	23.59
1001-2000 HRS	75%	25.28
2001-3000 HRS	80%	26.96
3001-4000 HRS	85%	28.65
4001-5000 HRS	90%	30.33
5001-6000 HRS	95%	32.02

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MICHAEL SYVERSRUD *Business Agent*
THOMAS REGER *Apprentice Coordinator*

TO: ALL DULUTH AREA CONTRACTORS

ATTN: PAYROLL DEPT

RE: 2015 WAGE RATES - **BUILDERS** DIVISION

This Agreement shall govern work done in the areas defined as follows: All of the following counties: Aitkin, Carlton, Cook, Lake and that part of Pine County north of the northern boundaries of Dell Grove, Sandstone and Danforth townships, and that part of St. Louis County south of Co Rd 967 which is two miles north of cotton on Hwy #53, as well as the following counties in Wisconsin: Douglas, Bayfield, Washburn, Sawyer and Price.

EFFECTIVE MAY 1, 2015

BASIC WAGE*	HEALTH & WELFARE	HRA	PENSION	SAVINGS	TRAINING	TOTAL
30.61	7.23	1.25	7.94	(5.02)	.46	47.49

*The Basic Wage before the deduction of savings is the straight time wage used in determining overtime. (EXAMPLE: 1.5 X $30.61 = $45.92 TAXED, THEN MINUS $5.02 FOR SAVINGS EACH HOUR) After all taxes are deducted from the Basic Wage rate, $5.02 per hour for each hour worked shall be deducted and applied to the Minnesota Cement Masons Savings Plan.

Foreman: $2.00 above basic wage

APPRENTICE RATES:

UP TO 1000HRS	70%	21.43
1001-2000 HRS	75%	22.96
2001-3000 HRS	80%	24.49
3001-4000 HRS	85%	26.02
4001-5000 HRS	90%	27.55
5001-6000 HRS	95%	29.08

INTERNATIONAL UNION OF ELEVATOR CONSTRUCTORS

LOCAL UNION NO. 9
433 Little Canada Road E.
Little Canada, MN 55117

AFFILIATED WITH THE AFL-CIO
Phone: (651) 287-0817
Fax: (651) 287-0820

Wage & Fringe Benefits: January 1, 2015

To: All Employers doing Business within the Jurisdiction of IUEC Local 9
Subject: Wage rates effective January 1, 2015 – IUEC Local 9
Minnesota, North Dakota and Western Wisconsin

In accordance with the provisions of Article V of the current labor agreement (2012-2017) between all signatory employers and the International Union of Elevator Constructors, the following rates shall be effective on January 1, 2015:

Mechanic in Charge	(112.5%)	$50.55
Mechanic	(100.0%)	$44.93
4th Year Apprentice	(80.0%)	$35.94
3rd Year Apprentice	(70.0%)	$31.45
2nd Year Apprentice	(65.0%)	$29.20
1st Year Apprentice	(55.0%)	$24.71
Probationary Apprentice	(50.0%)	$22.47
Helper	(70.0%)	$31.45

The company will make fringe benefit contributions per hour worked in accordance with the following schedule:

Health Benefit Plan	$13.575
Pension	$ 8.46
Annuity	$ 5.75
Education	$ 0.60
Elevator Ind. Work Preservation Fund	$ 0.30
TOTAL	$28.685

Vacation: 6% Hourly pay under 5 years
8% Hourly pay over 5 years

Local 106 Glaziers Wage Rates
Effective May 4, 2015

Journeyperson Wage Rates:

	Base	Health & Welfare	Pension	Annuity	Industry & Appr	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**	
Glaziers	$29.67	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$46.51	$2.30	$1.83	
Auto Glass	$23.74	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$40.58	$2.30	$1.62	

Apprentices Indentured BEFORE May 1, 2014:

Hours	**%**	Base	Health & Welfare	Pension	Annuity	Industry & Appr	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**	
0-1000	50	$14.84	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$31.68	$1.15	$1.31	
1001-2000	55	$16.32	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$33.16	$1.27	$1.36	
2001-3000	60	$17.81	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$34.65	$1.38	$1.42	
3001-4000	70	$20.77	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$37.61	$1.61	$1.52	
4001-5000	80	$23.74	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$40.58	$1.84	$1.62	
5001-6000	90	$26.71	$6.85	$5.67	$3.65	$0.56	$ 0.10	$0.01	$43.55	$2.07	$1.73	

Apprentices Indentured on or AFTER May 1, 2014:

Hours	**%**	Base	Health & Welfare	Pension	Annuity	Industry & Appr	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**	
0-1000	50	$14.84	$6.85	$5.67	$1.83	$0.56	$ 0.10	$0.01	$29.86	$1.15	$1.25	
1001-2000	55	$16.32	$6.85	$5.67	$2.01	$0.56	$ 0.10	$0.01	$31.52	$1.27	$1.31	
2001-3000	60	$17.81	$6.85	$5.67	$2.19	$0.56	$ 0.10	$0.01	$33.19	$1.38	$1.37	
3001-4000	70	$20.77	$6.85	$5.67	$2.56	$0.56	$ 0.10	$0.01	$36.52	$1.61	$1.48	
4001-5000	80	$23.74	$6.85	$5.67	$2.92	$0.56	$ 0.10	$0.01	$39.85	$1.84	$1.60	
5001-6000	90	$26.71	$6.85	$5.67	$3.29	$0.56	$ 0.10	$0.01	$43.19	$2.07	$1.72	

*The Vacation Contribution is included in the taxable wage listed above, then deducted and remitted along with your Health & Welfare Contribution.

Revised 5/4/15

LOCAL UNION #242

Effective Dates	**05/31/15**		**05/29/16**		**06/04/17**		**06/03/18**	
JW Rate	**$33.90**		**$35.01**		**$35.92**		**$36.80**	
Foreman	**12.5%**		**12.5%**		**13.0%**		**13.0%**	
General Foreman	**22.5%**		**22.5%**		**23.0%**		**23.0%**	
NEBF	3.00%	$ 1.02	3.00%	$ 1.05	3.00%	$ 1.08	3.00%	$ 1.10
Vacation	11.00%	$ 3.73	11.00%	$ 3.85	11.00%	$ 3.95	11.00%	$ 4.05
H & W	27.64%	$ 9.37	26.76%	$ 9.37	26.75%	$ 9.61	26.77%	$ 9.85
Local Pension	13.55%	$ 4.59	13.55%	$ 4.74	13.55%	$ 4.87	13.55%	$ 4.99
Annuity	16.00%	$ 5.42	16.00%	$ 5.60	16.00%	$ 5.75	16.00%	$ 5.89
****Total Package**	**$58.05**		**$59.65**		**$61.20**		**$62.70**	
LLMCC Employee .02	$58.03		$59.63		$61.18		$62.68	
Total Package %	**71.19%**		**70.31%**		**70.30%**		**70.32%**	

****These total packages do not include Apprenticeship (1%), NECA Service Charges (1.25%), Admin. Maint. Fund (.006%/hr.), NLMCC (.01 cent/hr.), or LLMCC (.04 cents/hr.).**

Apprenticeship	1% / .34	1% / .35	1% / .36	1% / .37
Service Charge	1.25% / .42	1.25% / .44	1.25% / .45	1.25% / .46
NLMCC	0.01	0.01	0.01	0.01
Local LMCC	0.04	0.04	0.04	0.04
Admin Maint Fund	0.20	0.21	0.22	0.22
	1.01	**1.05**	**1.08**	**1.10**

401k deduction - $1.00, $3,00 & $5.00 per hour (at employees discretion)

Subsistance for all jobs outside of 35 mile radius of Lake Ave & Superior Street in Duluth - $15.00
Subsistance for all jobs outside of 70 mile radius of Lake Ave & Superior Street in Duluth - $50.00

DULUTH APPRENTICE WAGE RATE INFORMATION

6th	6,500 - 8,000	85%	Full Benefits - 5th year
5th	5,000 - 6,500	75%	Full Benefits - 4th year
4th	3,500 - 5,000	65%	Full Benefits - 3rd year
3rd	2,000 - 3,500	55%	Full Benefits - 2nd year
2nd	1,000 - 2,000	50%	H & W / NEBF - 1st year

INTERNATIONAL ASSOCIATION OF

Heat & Frost Insulators & Allied Workers

Local 49

2002 London Road
Duluth, MN 55812

Tel: 218-724-3223
Fax: 218-724-1870
Cell: 218-590-0374

May 28, 2015

To whom it may concern,

The allocation of the wage increase effective June 1st 2015 is as follows:

Base Wage	$27.82	$21.18	$18.64	$16.14	$13.59
Savings	$8.00	$6.00	$4.76	$3.50	$2.26
Union Dues	$3.49	$2.79	$2.44	$2.09	$1.75
Health & Welfare	$6.85	$6.85	$6.85	$6.85	$6.85
Pension	$9.00	$7.20	$5.76	$4.30	$2.86
Local Training	$0.30	$0.30	$0.30	$0.30	$0.30
Nat'l Training	$0.05	$0.05	$0.05	$0.05	$0.05
Industry Fund	$0.15	$0.15	$0.15	$0.15	$0.15
LMCT	$0.05	$0.05	$0.05	$0.05	$0.05
Total	**$55.71**	**$44.57**	**$39.00**	**$33.43**	**$27.86**
Total Taxable	*$39.31*	*$29.97*	*$25.84*	*$21.73*	*$17.60*

Please feel free to call the Local office with questions or concerns.

Sincerely,

David Cartwright

David Cartwright
Business Manager

Twin Cities Ironworkers Apprenticeship & Training
Local 512 · A.G.C.
835 Pierce Butler Route · St. Paul, Minnesota 55104
JATC Office Phone: 651-489-3829 · JATC Office Fax: 651-489-1440
Larry Gilbertson *Director of Training* email: larry@iw512jac.com

Attention: Payroll Department

Enclosed is the following wage information regarding Ironworkers Local No. 512 apprentices:

- Applicable wage and percentage rates for apprentices effective May 1, 2015
- .List of apprentices graduating to journeyperson status effective May 1, 2015.
- List of apprentices with the applicable pay and percentage rates for Regions A, B and C. Please use this updated list because there may be first year apprentices that have received credit for past work experience and education since the last mailing.
- Apprentice Performance Report – please have the foreman/superintendent complete one for each apprentice and email or fax back to the Training Center. This will enable us to ensure that the apprentices are receiving the necessary training for the job.

Please adjust your payroll records accordingly.

In addition, we would like to email the wage information to your company instead of via mail. Please email Lori at lori@iw512jac.com the email address you would like to use to receive information on apprentices' wages. Thank you.

If you have any questions, please contact me.

Sincerely,

Larry Gilbertson
Director of Training

APPRENTICE WAGE SCALE

The wage scale listed below is effective 5/1/15 to 10/31/15.

Regions A, B & C wages are as follows:

PERIOD	%	REGION A RATE EFFECTIVE 5/1/15	REGION B RATE EFFECTIVE 5/1/15	REGION C RATE EFFECTIVE 5/1/15
1st - 6 months	70	$24.85	$21.73	$20.86
2nd - 6 months	75	$26.63	$23.28	$22.35
3rd - 6 months	80	$28.40	$24.83	$23.84
4th - 6 months	85	$30.17	$26.38	$25.33
5th - 6 months	90	$31.95	$27.94	$26.82
6th - 6 months	95	$33.72	$29.49	$28.31

Apprentices receive all fringe benefits listed below:

	DEFINED BENEFIT PENSION	DEFINED CONTRIBUTION PENSION	HEALTH & WELFARE	APPRENTICE/ TRAINING FUND	IMPACT	FAIR CONTRACTING FOUNDATION	TOTAL PACKAGE
Region A	$9.75	$5.00	$7.90	$0.80	$0.27	$0.02	$23.74
Region B	$9.75	$5.00	$7.90	$0.80	$0.27	$0.02	$23.74
Region C	$9.75	$5.00	$7.90	$0.80	$0.27	$0.02	$23.74

Region A Journeyman rate is $35.50 effective 5/1/15
Region B Journeyman rate is $31.04 effective 5/1/15
Region C Journeyman rate is $29.80 effective 5/1/15

May 1, 2015

The following seventy (70) graduating apprentices from Regions A, B and C will be upgraded to journeyperson status effective May 1, 2015.

REGION A

1. Arnal, Mike
2. Bertilson, Jesse
3. Blair, Nate
4. Bourgal II, Tom
5. Breitenbucher, Dan
6. Buchanan, Robert
7. Burke, Sam
8. Conrad, Nick
9. Cook, Brian
10. Cooke, Cody
11. Dalager, Dale
12. DeMarre, Nick
13. Dinsmore, William
14. Downs, Megan
15. Duscher, Brian
16. Filipczak, Michael
17. Haack, Nate
18. Hackett, BillieRae
19. Hellquist, Jon
20. Hite, Jr., Todd
21. Jochim, Michael
22. Johnson, Ivan
23. Justen, Tyler
24. Linder, Glen
25. Mangum, Matt
26. Maull, Damell
27. Mickle Van Sickle, Shawn
28. Miskavige, Jacob
29. Miskavige, Jr., Tim
30. Monson, Neil
31. Novotny, Dustin
32. Pearson, Matt
33. Pederson, Jordan
34. Peters, Ben
35. Rodeck, Ryan
36. Roden, Derek
37. Sanders, Andrew
38. Sanders, Garrett
39. Seidel, Buster
40. Sigala, Alex
41. Sozio, Chris
42. Steffens, Alex
43. Stellick, Kyle
44. Tripp, Jeremiah
45. Vieths, Stephen
46. Warner, Joe
47. West, Dakota

REGION B

1. Anderson, Isaac
2. Asuma, Michael
3. Bragee, Matt
4. Buskala, Ashlee
5. Fischer, Andrew
6. Godbout, Jamie
7. Johnson, Marcus
8. Koivisto, Shay
9. Landwehr, Matt
10. Larson, Tyler
11. Lyons II, James
12. Olson, Dain
13. Pearson, Ken
14. Povhe, Ben
15. Prentice, Grant
16. Spindler, Cole
17. Switzer, Tom
18. Trader, Erik
19. Vollmer, Jake

REGION C

1. Early, Sean
2. Morris, Russell
3. Roden, Tyler
4. Gross, Kurtis

REGION A APPRENTICES
ST. PAUL, MN

95%=$33.72

1. Billings, George
2. O'Reilly, Adam
3. Sobtzak, James

90%=$31.95

1. Cook, Cory
2. Dulas, BJ (William)
3. Fidler, Melinda
4. Gill, Raivadus
5. Holtzbauer, Justin
6. Horsley, Kristofer
7. Jacobs, Mitchell
8. Johnson, Brian
9. Johnson, Jesse
10. Kuchta, Karl
11. Lanphear, Joseph
12. Latkiewicz, Michael
13. Lemieux, Andy
14. Lentsch, Rory
15. Mahowald, Matthew
16. Merritt, Anthony
17. Moebakken, Edward
18. Monn, Thomas
19. Mooney, Michael
20. Nelson, Nicholas
21. Neubauer, Daniel
22. New, Michael
23. Norby, Alex
24. Nordlund, Andrea
25. Peters, Mike
26. Phillips, Jeremy
27. Pieper, Brian
28. Ricks, Lane
29. Rodriguez-Garcia, Edwin
30. Ryan, John
31. Schneider, Heidi
32. Smith, Juan
33. Stover, Lorina
34. Sutton, Casey
35. Tricola, Paul
36. Waldner, Matthew
37. Wild, Eric

REGION A APPRENTICES
ST. PAUL, MN

85%=$30.17

1. Andersen, Adam
2. Andraschko, Ryan
3. Billings, Jeremiah
4. Blue, Sireena
5. Burns, Joe
6. Carvajal, Adrian
7. Cavazos, Fernando
8. Clowe, Kasey
9. D'Ambra, Joseph
10. Darst, Ashley
11. Davis, Dominic
12. Drake, Alexander
13. Folk, Doug
14. Green, Lance
15. Haviken, Tim
16. Hedican, Patrick
17. Jackson, Jason
18. Johnson, Keith
19. Kackman, Aaron
20. Kampa, Daniel
21. Kath, Brandon
22. Klimstra, Travis
23. Kray, Tim
24. Martin, Christopher
25. Massie, Alonzo
26. McPartland, Ryan
27. Meyer, Maxwell
28. Moore, Jr., Toussaint
29. Neubauer, Adam
30. Palacios, Cecilio
31. Peterson, Joseph
32. Petron, Seith
33. Reichert, Jedidiah
34. Reinardy, Randy
35. Rosales, Miguel
36. Shoutz, Brandon
37. Smith, Juan
38. Stoehr, Joe
39. Strong, Brandon
40. Tator, Michael
41. Teigland, Reid
42. Twidt, Kelly
43. Walker, Victor
44. Wallack, Daniel
45. Warner, Jeffrey
46. Yang, Jerry
47. Ziebol, Kellan
48. Ziegler, Robert

REGION A APPRENTICES
ST. PAUL, MN

80%=$28.40

1. Berg, Kyle
2. Berglund, Christopher
3. Birdsall, Shawn
4. Blakesley, Jared
5. Brown, Nashaw
6. Buck, Colin
7. Carpenter, Daniel
8. Casey, Sean
9. Christiansen, Chad
10. Christofferson, Cory
11. Danaher, Joshua
12. Fitzpatrick, James
13. Frank, Eric
14. Gapen, Dan
15. Goerger, Adam
16. Graddy, Devon
17. Hamm, Allan
18. Hanninen, Cody
19. Hilde, Ryan
20. Hillmyer, Tim
21. Hostutler, Blake
22. Hylton, Matthew
23. Johnson, Brandon
24. Johnson, Joseph
25. Kleinsasser, Wyatt
26. Kolstad, Cody
27. Korum, Anthony
28. Kotzer, Ryan
29. Kuck, Jesse
30. Lewis-Alvarez, David
31. Lindell, Luke
32. Lopez, Roger
33. Lubansky, Luke
34. Lusignan, Torey
35. Lyseth, Andrew
36. McCabe, Jon
37. Megega, Valeriy
38. Messerschmidt, Ryan
39. Milbrandt, Michael
40. Minor, Derek
41. Neumann, Jesse
42. Nierman, Sam
43. Novak, Nathaniel
44. O'Brien, Jacob
45. Pearl, Mollie
46. Peterson, Matthew
47. Pogones, Jesse
48. Reinardy, Jared
49. Rodriguez, Cris
50. Rosenbush, Nathan
51. Ruzynski, Rusty
52. Sapp, Matthew
53. Schwantes, James
54. Scott, Sylvester
55. Smith, Ivan
56. Swain, Keegan
57. Tufigno, Charles
58. Turner, Brenda
59. Walther, Jennifer
60. Wheeler, Kyle
61. Wissler, Michael
62. Workman, Christopher
63. Yang, Kim
64. Zachman, Jayson
65. Zinos, Alexander

REGION A APPRENTICES
ST. PAUL, MN

75%=$26.63

1. Barnes, Bert
2. Coyer, Travis
3. DeBace, Mark
4. Deschene, Adam
5. Garletz, Joe
6. Gossman, Payten
7. Goodsky, Jordan
8. Hansen, Wyatt
9. Heroff, Jr., Keith
10. Howell, Aaron
11. Huebscher, Jeffery
12. Johnson, Andrew
13. Johnson, Justin
14. Kinches, Tara
15. Kopaygorodskiy, Eduard
16. Leseman, Zachary
17. Mahowald, Nicholas
18. Mahowald, Stuart
19. Martin, Marandus
20. Meeks, Zachery
21. Metobo, Polycarp
22. Moncada, Genry
23. Montgomery, Justen
24. O'Malley, Jonathan
25. Palmer, Brandon
26. Petty, Dennis
27. Pitoscia, Matthew
28. Pliego-Quintero, Juan
29. Potter, Lawrence
30. Roquemore II, Freeman
31. Sell, Chad
32. Sherry, Todd
33. Shrader, Tyler
34. Shrode, Andria
35. Smith, Richard
36. Swenson, Brody
37. Thole, Mark
38. Tweten, Trent
39. Ugro, Michael
40. Wolff, Caleb
41. Yingling, Ross

REGION A APPRENTICES
ST. PAUL, MN

70%=$24.85

1. Abston, Trent
2. Albertson, Levi
3. Asquith, Sarah
4. Baker, Jacob
5. Bauman, Grace
6. Bettis, Kenneth
7. Bondeson, Brandon
8. Booth, Matthew
9. Cembrinski, Ryan
10. Cobb, Josef
11. Davies, Max
12. Demanou, Jean
13. Din, Makara
14. Donaghue, Russell
15. Dougherty, Jason
16. Duerst, Jack
17. Ellis, Mitchell
18. Ellison, Patrick
19. Epperson, Aron
20. Farnsworth, Philip
21. Finch, Walter
22. Freeman, Winston
23. Guild, Michael
24. Hamilton, Demetrius
25. Hendrickson, Wesley
26. Jackson, Debra
27. Jensen, Kody
28. Johnson, Andrew
29. Johnson, Caleb
30. Johnson, Jake
31. Junker, Jordan
32. Kaufer, Corey
33. Koch, Matthew
34. Koller, Brandon
35. Kujawa, Jed
36. Larson, Troy
37. Laulunen, Ebbelisa
38. LeMay, Michael
39. Linders, Jordan
40. Lochen, Shani
41. Marten, Derek
42. Martinez Perez, William
43. McCloskey, Jonathan
44. Meyer, Edward
45. Mitchell, Robert
46. Munion, Patrick
47. Nervig, Matthew
48. Neumann, Martin
49. Neumann, Paul
50. Neuschwander, Jake
51. Nguyen, Caophi
52. Nordman, Alan
53. Palmer, Nicholas
54. Patton-Alvarez, Alonzo
55. Paxton, Jason
56. Peace, Brian
57. Pearson, Dante
58. Porter, Joseph
59. Potts, Garet
60. Rathbun, Trevor
61. Rivera, John
62. Robeck, Kyle
63. Rogerson, Demontez
64. Ruschmeier, Ryan
65. Rust, Jack
66. Saas, Brandon
67. Sames, Luke
68. Sanders, Andrew
69. Scherber, Travis
70. Schickling, Eric
71. Scott, Matthew
72. Sebion, Riley
73. Seifert, Travis
74. Smith, Fabian
75. Smoczyk, Paul
76. Stamper, Travis
77. Teigland, Robert
78. Thompson, Dylan
79. Toney, Patrick
80. Trevino, Jesus
81. Tschida, Jacob
82. Turcotte, Nathane

REGION A APPRENTICES
ST. PAUL, MN

70%=$24.85

83. Turner, Michael
84. Vandevere, Sheila
85. Weinke, Maxwell
86. Welch, Travis
87. Whitman, Mark
88. Wigand, Jason
89. Weiland, Dustin
90. Wright, Eliot
91. Wright, Ryan
92. Zahler, Benjamin

REGION B APPRENTICES
HERMANTOWN, MN

95%=$29.49

1. Anderson, Dean
2. Betts, Casey
3. Bishop, Scott
4. Buffalo, Kurt
5. Edblom, Adam
6. Harju, Jordan
7. Higgins, Michael
8. Johnson, Dakota
9. Lahti, Stuart
10. Nikunen, Evan
11. Nylund, Timothy
12. Olson, Erik
13. Rahja, Dustin
14. Salo, Trevor
15. Schaefer, Josh
16. Seppanen, Peter
17. Smith, Tony
18. Stokes, Micah
19. Templer, Colton
20. VanGuilder, Shawn
21. Worth, Jeff

90%=$27.94

1. Arnold, Tyler
2. Badavinac, Bron
3. Buse, Kelly
4. Carswell, Jeff
5. Christianson, Jorn
6. Harris, Josh
7. Hatfield, Chad
8. Hicks, Derek
9. Jensen, Nicholas
10. Kolb, Taylor
11. Kraemer, Derek
12. Mendoza, Joseph
13. Morse, Travis
14. Nichols, Jeremy
15. Sebesta, Jared
16. Torgerson, Jared
17. Wekseth, Cody

85%=$26.38

1. Engen, Katie
2. Kowitz, Benjamin

REGION B APPRENTICES
HERMANTOWN, MN

80%=$24.83

1. Almer, Garrett
2. Bean, Kyle
3. Bonstell, Justin
4. Conaway, Patrick
5. Cooper, Jonathan
6. Davin, Nathan
7. Fallos, Jake
8. Fogelberg, David
9. Forrest, Thomas
10. Gibson II, Thomas
11. Gustafson, Tyler
12. Hink, William
13. Holecek, Adam
14. Jaksa, Hector
15. Johnson, Greg
16. Johnson, Jerod
17. Jokinen, Chaise
18. Kolb, Jonathan
19. Lovdahl, Zachary
20. MacDougall, Chad
21. McConnell, Jonathan
22. Palmisano, Anthony
23. Pitzen, Clay
24. Prasnicki, Cody
25. Rinta, Dustin
26. Shamp, Barry
27. Turkula, Joshua
28. Tveiten, Curtis

75%=$23.28

1. Olson, Jeff
2. Pederson, Brandon

REGION B APPRENTICES
HERMANTOWN, MN

70%=$21.73

1. Allen, Aaron
2. Almer, Wade
3. Anderson, Anthony
4. Anderson, Cody
5. Anderson, Jacob
6. Anderson, Jason
7. Anderson, Zachary
8. Ayers, Justin
9. Barnes, Nicholas
10. Bates, Garrett
11. Benepe Bischoff, Jonathan
12. Berg, Andy
13. Bober, Tanner
14. Bock, Nicholas
15. Bryant, Jared
16. Burnside, Jaye
17. Carlson, Daniel
18. Cordero, George
19. Cortes, Rodrigo
20. Couture, Joseph
21. Emery, Kendall
22. Erickson, Michael
23. Evanson, Beau
24. Eyer, Mickey
25. Fabini, Laura
26. Fenhouse, Joshua
27. Feth, Josiah
28. Fisher, Kyle
29. Forsman, Kenny
30. Frey, Jason
31. Gaare, Philip
32. Gavol, Ezekiel
33. Gunderson, Bruce
34. Harrison, Jr., Gregory
35. Hart, Lukas
36. Huffman, Joshua
37. Humphrey, Justice
38. Isham, William
39. Jackman, Tyler
40. Jackson, Jacob
41. Johnson, Tristan
42. Johnson, Zachary
43. Johnston, Christopher
44. Kuhlman, Walker
45. Laine, Peter
46. Lamoreaux, James
47. Lamoreaux, William
48. Lamphier, Scott
49. Larsen, Taylor
50. LeBrasseur, Corey
51. LeFebvre, Ben
52. LePage, Robert
53. Lincoln, Joseph
54. Lind, Bradley
55. Lind, Brian
56. Littlehawk, Jeremiah
57. Lueck, Kyle
58. Mackenhausen, Hunter
59. Manee, Patric
60. Manning, Kent
61. Martin, Gregory
62. McGregor, Matthew
63. McQuade, Robert
64. Mehtala, Scott
65. Meyer, Justin
66. Miller, Dinero
67. Olson, Trent
68. Ortloff, Bryce
69. Parson, Kurt
70. Perry, Dustin
71. Perry, Jeremy
72. Petersen, Tanner
73. Peterson, Joseph
74. Petrey, Tyler
75. Pletschett, Taylor
76. Podgorsek, Matthew
77. Poissant, Matthew
78. Povhe, Bradley
79. Quade, Daniel
80. Ressler, John
81. Rivord, Tylor
82. Roske, Shawn
83. Saari, Travis
84. Salo, Spencer
85. Sanoski, Matthew
86. Shumate, Jeremy
87. Singewald, Brandon
88. Skaggs, Nicholas
89. Slocum, Kanyon
90. Smerz, Mitchell
91. Sojka, Steve
92. Spolar, Cory
93. Stolfa, David
94. Suonvieri, Evan
95. Tassoni, Anthony
96. Terry, William
97. Trunt, Luke
98. Turkula, Justin
99. Tyson, Cody

REGION B APPRENTICES
HERMANTOWN, MN

70%=$21.73

100. Ullyott, Jr., Scot

101. Villeneuve, Braden

102. Wagner, Zach

103. Walker, Tyrone

104. Wehmanen, Nicholas

105.White, Darrell

106. Wichterman, Daniel

107. Wilhelm, Jeremy

108. Winger, Richard

109. Zakula, Aaron

110. Zakula, Jeffrey

111. Zoltak IV, Elmer

REGION C APPRENTICES
MANDAN, ND

95%=$28.31

1. Ackerman, John
2. Fender, William
3. Hayes, Joey
4. Kalstabakken, Marvel
5. Medina, Jose
6. Salgado, Henry

90%=$26.82

1. Augustin, Jakob
2. Bachiochi, Jake
3. Hatten, Michael
4. Loken, Christopher
5. Medina, Jose
6. Salgado, Henry
7. Singelton, Matt
8. Snyder, Matt
9. Voegele, Brandon
10. Warren, Jeremy
11. Zinke, Lane

80%=$23.84

1. Alanis, Rueben
2. Bachler, Ryan
3. Branstietter, Ben
4. Gappert, Dillan
5. Green, Dustin
6. Gustin, Damen
7. Komrosky, Edwin
8. Lux, Dylan
9. Matheson, Michael
10. Miltich, Jacob
11. Owens, Phil
12. Pfeiffer, David
13. Poitra, Jacob
14. Poitra, Jr., Duane
15. Rawley, Jonah
16. Winiecki, Derek
17. Zinke, Logan

REGION C APPRENTICES
MANDAN, ND

70%=$20.86

1. Airhart, Joseph
2. Bjerkness, Brandon
3. Estable-Mora, Juan
4. Grounds, Jon
5. Herbst, Jeff
6. Linstad, Cody
7. Lobato, Julian
8. Mittlesteadt, Matthew
9. Olson, Lee
10. Pavlicek, Zach
11. Peltier, Wyatt
12. Pike, Zach
13. Pritchard, Jeremiah
14. Runge, Ryan
15. Runge, Ryan
16. Schweigert, Eric

APPRENTICE WORK PERFORMANCE REPORT

CONFIDENTIAL

Apprentice: _____ Region A Region B Region C

Training Period 1st year, 2nd year or 3rd year (Circle applicable training period if known)

Employer: _____

Scoring – 0 = poor……10 = best

ATTENDANCE & TARDINESS
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

ON THE JOB PERFORMANCE (Reliability)
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

ATTITUDE (Positive Attitude, Shows Leadership Ability)
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

INITIATIVE & PRODUCTIVITY (Ambition & Effort)
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

COMPREHENSION & ABILITY (Shows interest in learning job)
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

COOPERATION & CONDUCT (Ability to work with others)
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

SAFETY & AWARENESS
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

QUALITY OF WORK & ACCURACY
RATING: 0 1 2 3 4 5 6 7 8 9 10
COMMENTS:

TOOLS: FEW SOME MANY CONDITION: POOR OK EXCELLENT

COMMENTS: _____

_____

_____

REVIEWED BY Forman/Supervisor _____ DATE: _____

PLEASE MAIL OR FAX THIS REPORT TO THE FOLLOWING:

Twin Cities Ironworkers Apprenticeship & Training Program
835 Butler Route – St. Paul, MN. 55104
JATC Office & Training Center Phone: 651-489-3829 – Fax: 651-489-1440
Pete Teigland, Training Coordinator – Region A
Brian Nelson – Training Coordinator – Region B

BUILDING WAGE RATES

Duluth/Cloquet Local #1091

Effective May 1, 2015:

Class	(Taxable) Wages	(Taxable) Vacation	H & W	Pension	Trng/Appr	LECET	SAFE		Total
1	$ 23.54	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 40.04
2	$ 23.64	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 40.14
3	$ 23.94	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 40.44
4	$ 24.24	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 40.74
5	$ 21.19	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 37.69

Example: Apprentice at 80% of Class 1 ONLY

Class 1	$ 18.83	$ 2.10	$ 7.55	$ 6.40	$ 0.22	$ 0.08	$ 0.15	.....	$ 35.33

Foreman/Leadman $1.50 above highest classification employed in.

Effective May 1, 2016 - $1.25 increase per hour

*** Vacation is a taxable wage and shall be paid for all hours worked and at 1 1/2 or 2 times the hourly rate when overtime is worked.

"All" Fringes are to be sent to :

Minnesota Laborers' Fringe Benefits Fund
P. O. Box 124
Minneapolis, MN 55440-0124
(651) 256-1800

HIGHWAY HEAVY WAGE RATES
District 2A - Duluth Local #1091

Effective May 1, 2015:

Class	(Taxable) Wages	(Taxable) Vacation	H & W	Pension	Trng/Appr	LECET	FCF		Total
1	$ 28.11	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 44.78
2	$ 28.31	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 44.98
3	$ 28.46	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 45.13
4	$ 28.56	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 45.23
5	$ 28.81	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 45.48
6	$ 30.61	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 47.28
7	$ 24.56	$ 2.30	$ 7.55	$ 6.25	$ 0.22	$ 0.08	$ 0.02	.....	$ 40.98

Increase May 1, 2016: $1.57 Allocation of increase TBD

Example: Apprentice at 80% of Class 1 ONLY

Class 1	$ 22.49	$ 2.30	$ 7.55	$ 6.50	$ 0.22	$ 0.08	$ 0.02	.....	$ 39.16

Pipelayer, Laser Beam (sewer, water, gas) Classification 6 rate.
Foreman/Leadman $1.50 above highest classification employed in.
General Foreman $2.25 above Foreman scale (appointed at employers discretion).

*** Vacation is a taxable fringe and part of the gross wage, it shall be paid for all hours worked and at 1 1/2 or 2 times the hourly rate when overtime is worked

"All" Fringes are to be sent to :

Minnesota Laborers' Fringe Benefits Fund
P. O. Box 124
Minneapolis, MN 55440-0124
(651) 256-1800

NORTH CENTRAL STATES Regional Council of CARPENTERS

LOCAL 1348 MILLWRIGHT AGREEMENT

NORTHERN MINNESOTA

MILLWRIGHTS & MACHINE ERECTOR WAGE RATES

Effective May 3, 2015

Classification		Percent (%)	Gross Wages	Deductions: Savings	Deductions: Dues	Fringe Benefits: Health	Fringe Benefits: DB Pension	Fringe Benefits: DC Pension	Fringe Benefits: Apprentice/ Education	Fringe Benefits: Industry Promo Fund	Total Package
General Foreman	F + $1.75	100%	$36.57	-$3.50	$1.46	$6.33	$5.90	$1.90	$0.60	$0.05	$51.35
Foreman	JP + $2.25	100%	$34.82	-$3.50	$1.39	$6.33	$5.90	$1.90	$0.60	$0.05	$49.60
Journeyperson		100%	$32.57	-$3.50	$1.30	$6.33	$5.90	$1.90	$0.60	$0.05	$47.35
Apprentice	6001-7000	95%	$30.94	-$3.50	$1.24	$6.33	$5.90	$1.90	$0.60	$0.05	$45.72
	5001-6000	90%	$29.31	-$3.50	$1.17	$6.33	$5.90	$1.90	$0.60	$0.05	$44.09
	4001-5000	85%	$27.68	-$3.50	$1.11	$6.33	$5.90	$1.90	$0.60	$0.05	$42.46
	3001-4000	80%	$26.06	-$3.50	$1.04	$6.33	$5.90	$1.90	$0.60	$0.05	$40.84
	2001-3000	75%	$24.43	-$3.50	$0.98	$6.33	$5.90	$1.90	$0.60	$0.05	$39.21
	1001-2000	70%	$22.80	-$3.50	$0.91	$6.33	$5.90	$1.90	$0.60	$0.05	$37.58
	0 - 1000	65%	$21.17	-$3.50	$0.85	$6.33	$5.90	$1.90	$0.60	$0.05	$35.95

Covering the following Counties in the State of Minnesota, Aitkin, Becker, Beltrami, Carlton, Cass, Clearwater, Cook, Lake, Crow Wing, Hubbard, Itasca, Kittson, Koochiching, Lake of the Woods, Manomen, Marshall, Norman, Otter Tail, Pennington, Red Lake , Roseau, St. Louis, Wadena, Wilkin and that part of Clay County outside of a 5 mile radius of Moorhead and that part of Polk County outside of a 5 mile radius of East Grand Forks. In Wisconsin the County of Douglas and that portion of Bayfield County west of Highway 63, and west of a line drawn between Drummond and Herbster and the Lake Superior shore, including the cities of Drummond and Herbster.

May 1, 2016 Increase: $1.75 Allocation TBD

May 7, 2017 Increase: $1.85 Allocation TBD

INTERNATIONAL UNION OF OPERATING ENGINEERS, LOCAL No. 49 FOR THE:

HIGHWAY AND HEAVY WAGES EFFECTIVE MAY 1, 2015

EASTERN METROPOLITAN ZONE-(ZONE 1) -*See Wage District Map-*

Group	Wages	1 ½% of Gross Wages Excluding Fringes	H/W	HRA	Pension	Appren.	Totals	FCF $.02	"Voluntary" **NOT** Incl. in total Pkg IPF $.04
1	$34.78	**	$8.70	$1.00	$7.70	$.50	$52.68	$.02	$.04
2	33.78	**	8.70	1.00	7.70	.50	51.68	.02	.04
3	33.23	**	8.70	1.00	7.70	.50	51.13	.02	.04
4	32.93	**	8.70	1.00	7.70	.50	50.83	.02	.04
5	29.89	**	8.70	1.00	7.70	.50	47.79	.02	.04
6	28.68	**	8.70	1.00	7.70	.50	46.58	.02	.04

REMAINDER OF EASTERN ZONE-(ZONE 2) -*See Wage District Map-*

Group	Wages	1 ½% of Gross Wages Excluding Fringes	H/W	HRA	Pension	Appren.	Totals	FCF $.02	"Voluntary" **NOT** Incl. in total Pkg IPF $.04
1	$32.12	**	$8.70	$1.00	$7.70	$.50	$50.02	$.02	$.04
2	31.12	**	8.70	1.00	7.70	.50	49.02	.02	.04
3	30.67	**	8.70	1.00	7.70	.50	48.57	.02	.04
4	30.37	**	8.70	1.00	7.70	.50	48.27	.02	.04
5	27.80	**	8.70	1.00	7.70	.50	45.70	.02	.04
6	26.93	**	8.70	1.00	7.70	.50	44.83	.02	.04

WESTERN ZONE-(ZONE 3) -*See Wage District Map-*

Group	Wages	1 ½% of Gross Wages Excluding Fringes	H/W	HRA	Pension	Appren.	Totals	FCF $.02	"Voluntary" **NOT** Incl. in total Pkg IPF $.04
1	$26.85	**	$8.70	$1.00	$7.70	$.50	$44.75	$.02	$.04
2	25.85	**	8.70	1.00	7.70	.50	43.75	.02	.04
3	24.92	**	8.70	1.00	7.70	.50	42.82	.02	.04
4	24.61	**	8.70	1.00	7.70	.50	42.51	.02	.04
5	22.90	**	8.70	1.00	7.70	.50	40.80	.02	.04
6	22.30	**	8.70	1.00	7.70	.50	40.20	.02	.04

INTERNATIONAL UNION OF OPERATING ENGINEERS, LOCAL NO. 49
RATES FOR THE:

BUILDERS AGREEMENT – MINNESOTA

WAGES EFFECTIVE MAY 1, 2015 - ZONE 1

Group	Wages	1 ½% of Gross Wages Excluding Fringes	H&W	HRA	Pension	Appren-ticeship Training	Total	FCF $.02***	"Voluntary" **NOT** Included In Total Pkg C.A.F. $.04**
1	$37.74	*	$8.70	$.25	$7.70	$.50	$54.89	$.02	$.04
2	$37.40	*	$8.70	$.25	$7.70	$.50	$54.55	$.02	$.04
3	$35.99	*	$8.70	$.25	$7.70	$.50	$53.14	$.02	$.04
4	$35.65	*	$8.70	$.25	$7.70	$.50	$52.80	$.02	$.04
5	$35.48	*	$8.70	$.25	$7.70	$.50	$52.63	$.02	$.04
6	$33.97	*	$8.70	$.25	$7.70	$.50	$51.12	$.02	$.04
7	$32.85	*	$8.70	$.25	$7.70	$.50	$50.00	$.02	$.04
8	$30.84	*	$8.70	$.25	$7.70	$.50	$47.99	$.02	$.04

WAGES EFFECTIVE MAY 1, 2015 - ZONE 2

Group	Wages	1 ½% of Gross Wages Excluding Fringes	H&W	HRA	Pension	Appren-ticeship Training	Total	FCF $.02***	"Voluntary" **NOT** Included In Total Pkg C.A.F. $.04**
1	$35.85	*	$8.70	$.25	$7.70	$.50	$53.00	$.02	$.04
2	$35.53	*	$8.70	$.25	$7.70	$.50	$52.68	$.02	$.04
3	$34.20	*	$8.70	$.25	$7.70	$.50	$51.35	$.02	$.04
4	$33.88	*	$8.70	$.25	$7.70	$.50	$51.03	$.02	$.04
5	$33.72	*	$8.70	$.25	$7.70	$.50	$50.87	$.02	$.04
6	$32.30	*	$8.70	$.25	$7.70	$.50	$49.45	$.02	$.04
7	$31.24	*	$8.70	$.25	$7.70	$.50	$48.39	$.02	$.04
8	$29.35	*	$8.70	$.25	$7.70	$.50	$46.50	$.02	$.04

Local 106 Painters & Drywall Wage Rates
Effective May 4, 2015

Journeyperson Wage Rates:

Res., Comm. & Indus. Repaint	Base	Health & Welfare	Pension	Annuity	FTI/UM	FTI/NT'L	FCF	LMCI	MPWEA	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**
Class I	$27.86	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$44.08	$2.70	$1.74
Class II	$28.46	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$44.68	$2.70	$1.76

New Comm. & New Indus.	Base	Health & Welfare	Pension	Annuity	FTI/UM	FTI/NT'L	FCF	LMCI	MPWEA	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**
Class I	$29.36	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$45.58	$2.70	$1.80
Class II	$29.96	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$46.18	$2.70	$1.82

Foremen in charge of five (5) or more journeypersons shall be paid $1.00 per hour over the journeyperson rate.
Fair Contracting Foundation: $0.01 paid by employer, $0.01 paid by employee from Total Package.

Painter Apprentice

Hours	**%**	Base	Health & Welfare	Pension	Annuity	FTI/UM	FTI/NT'L	FCF	LMCI	MPWEA	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**
0-1000	50	$14.68	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$30.90	$2.70	$1.28
1001-2000	55	$16.15	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$32.37	$2.70	$1.33
2001-3000	60	$17.62	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$33.84	$2.70	$1.38
3001-4000	70	$20.55	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$36.77	$2.70	$1.49
4001-5000	80	$23.49	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$39.71	$2.70	$1.59
5001-6000	90	$26.42	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$42.64	$2.70	$1.69

Drywall Taper Appr

Hours	**%**	Base	Health & Welfare	Pension	Annuity	FTI/UM	FTI/NT'L	FCF	LMCI	MPWEA	STAR	DC82/FCF	**Total**	Vac *	Check-off Dues**
0-500	50	$14.98	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$31.20	$2.70	$1.29
501-1000	60	$17.98	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$34.20	$2.70	$1.40
1001-1500	70	$20.97	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$37.19	$2.70	$1.50
1501-2000	75	$22.47	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$38.69	$2.70	$1.55
2001-2500	80	$23.97	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$40.19	$2.70	$1.61
2501-3000	85	$25.47	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$41.69	$2.70	$1.66
3001-3500	90	$26.96	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$43.18	$2.70	$1.71
3501-4000	95	$28.46	$6.85	$5.15	$3.50	$0.37	$0.10	$0.01	$0.10	$0.03	$ 0.10	$0.01	$44.68	$2.70	$1.76

*This Vacation Contribution is included in the taxable wage listed above, then deducted and remitted along with your Health & Welfare contribution.

PLUMBERS & STEAMFITTERS LOCAL #11

4402 AIRPARK BLVD.
DULUTH, MN 55811

JEFFREY DAVEAU SR.
BUSINESS MANAGER

218-727-2199 PHONE
218-727-2298 FAX

WAGE & BENEFIT REVISION EFFECTIVE MAY 4, 2015

BUILDING TRADES JOURNEYMAN

Base Pay	**$34.79**
Savings Fund	2.00
Dues Check off	.96
Building Fund	.20
Organizing Fund	.15
UA-PEC	.05
Local PAC	.01
Death Assessment	.01
Total Taxable	**$38.17**

Fringes	
Health & welfare	**6.85**
H R Fund	**.15**
Local Pension	**6.00**
National Pension	.78
Money Purchase	3.50
Training Fund	.50
International Training Fund	.10
Industry Fund	.35
H.V.A.C	.25
Total Fringes	**$18.48**
Total package	**$56.65**

Foreman $2.50 over Base Pay
General Foreman $3.50 over Base Pay

WAGES AS OF 5-4-2015	JOURNEYMAN	95%	90%	85%	80%	75%	70%
TAXABLE		⬇	⬇	⬇	⬇	⬇	⬇
BASE PAY	$ 34.79	$ 33.05	$ 31.31	$ 29.57	$ 27.83	$ 26.09	$ 24.35
SAVINGS FUND	$ 2.00	$ 1.90	$ 1.80	$ 1.70	$ 1.60	$ 1.50	$ 1.40
UNION DUES & ASSESSMENTS	$ 1.38	$ 1.38	$ 1.38	$ 1.38	$ 1.38	$ 1.38	$ 1.38
TOTAL TAXABLE	$ 38.17	$ 36.33	$ 34.49	$ 32.65	$ 30.81	$ 28.97	$ 27.13
FRINGES							
TRAINING FUND	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50
H R FUND	$ 0.15	$ 0.15	$ 0.15	$ 0.15	$ 0.15	$ 0.15	$ 0.15
HVAC	$ 0.25	$ 0.25	$ 0.25	$ 0.25	$ 0.25	$ 0.25	$ 0.25
UA TRAINING FUND	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10
HEALTH & WELFARE	$ 6.85	$ 6.85	$ 6.85	$ 6.85	$ 6.85	$ 6.85	$ 6.85
UA PENSION	$ 0.78	$ -	$ -	$ -	$ -	$ -	$ -
LOCAL PENSION	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00
MONEY PURCHASE	$ 3.50	$ 3.33	$ 3.15	$ 2.98	$ 2.80	$ 2.63	$ 2.45
INDUSTRY DEVELOPMENT	$ 0.35	$ 0.35	$ 0.35	$ 0.35	$ 0.35	$ 0.35	$ 0.35
TOTAL FRINGES	$ 18.48	$ 17.53	$ 17.35	$ 17.18	$ 17.00	$ 16.83	$ 16.65
TOTAL PACKAGE	$ 56.65	$ 53.86	$ 51.84	$ 49.83	$ 47.81	$ 45.80	$ 43.78
WAGES AS OF 5-4-2015	65%	60%	55%	50%	45%	40%	
TAXABLE	⬇	⬇	⬇	⬇	⬇	⬇	
BASE PAY	$ 22.61	$ 20.87	$ 19.13	$ 17.40	$ 15.66	$ 13.92	
SAVINGS FUND	$ 1.30	$ 1.20	$ 1.10	$ 1.00	$ 0.90	$ 0.80	
UNION DUES AND ASSESSMENTS	$ 1.38	$ 1.38	$ 1.38	$ 1.38	$ 1.38	$ 1.38	
TOTAL TAXABLE	$ 25.29	$ 23.45	$ 21.61	$ 19.78	$ 17.94	$ 16.10	
FRINGES							
TRAINING FUND	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	
HR FUND	$ 0.15	$ 0.15	$ 0.15	$ 0.15	$ 0.15	$ 0.15	
HVAC	$ 0.25	$ 0.25	$ 0.25	$ 0.25	$ 0.25	$ 0.25	
UA TRAINING FUND	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	
HEALTH & WELFARE	$ 6.85	$ 6.85	$ 6.85	$ 6.85	$ 6.85	$ 6.85	
UA PENSION	$ -	$ -	$ -	$ -	$ -	$ -	
LOCAL PENSION	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00	$ 6.00	
MONEY PURCHASE	$ 2.28	$ -	$ -	$ -	$ -	$ -	
INDUSTRY DEVELOPMENT	$ 0.35	$ 0.35	$ 0.35	$ 0.35	$ 0.35	$ 0.35	
TOTAL FRINGES	$ 16.48	$ 14.20	$ 14.20	$ 14.20	$ 14.20	$ 14.20	
TOTAL PACKAGE	$ 41.77	$ 37.65	$ 35.81	$ 33.98	$ 32.14	$ 30.30	

WAGE BREAKDOWN FOR LOCAL UNION # 11 APPRENTICES - BEGINNING MAY 4, 2015

Wages/Benefits Roofers Local Union 96 - Duluth Area

Effective July 1, 2014
Through June 30, 2015

	Classification	Basic Hourly Wage	Vac. After Taxes	Assess. After Taxes	Taxable Wage Rate	National Pension Rate	Educ Fund Rate	Annuity Fund Rate	Health/ Welfare Rate	H&W HRA Rate	Appr. Training Rate	Roofing Industry Rate	Total Cost to Employer
	Journeyman	28.65	2.50	0.50	31.65	3.40	0.03	3.09	7.10	0.50	0.25	0.30	46.32
	Foreman	30.40	2.50	0.50	33.40	3.65	0.03	3.09	7.10	0.50	0.25	0.30	48.32
Apprentice Percentages Based on Hours Worked for Advancement:													
45%	A 0-250	14.04		0.20	14.24	0.25	0.03				0.25	0.30	15.07
45%	B 251-1500	13.74		0.50	14.24	0.25	0.03		5.50		0.25	0.30	20.57
50%	1501-2500	15.33		0.50	15.83	0.25	0.03	0.25	6.50		0.25	0.30	23.41
Freeze Unless 144 Hours (Phase 1) of Related Training is Completed													
60%	2501-3000	18.49		0.50	18.99	0.50	0.03	0.50	7.10	0.50	0.25	0.30	28.17
70%	3001-3500	21.66		0.50	22.16	0.50	0.03	0.50	7.10	0.50	0.25	0.30	31.34
75%	3501-4000	23.24		0.50	23.74	0.50	0.03	0.50	7.10	0.50	0.25	0.30	32.92
80%	4001-4500	22.32	2.50	0.50	25.32	0.75	0.03	0.75	7.10	0.50	0.25	0.30	35.00
Freeze Unless 288 Hours (Phase 2) of Related Training is Completed													
85%	4501-5000	23.90	2.50	0.50	26.90	0.75	0.03	0.75	7.10	0.50	0.25	0.30	36.58
90%	5001-5500	25.49	2.50	0.50	28.49	1.00	0.03	0.75	7.10	0.50	0.25	0.30	38.42
95%	5501-6000	27.07	2.50	0.50	30.07	1.00	0.03	0.75	7.10	0.50	0.25	0.30	40.00

Advancement to Journeyman if All Related Training (Phase 3) is Completed and **6000** Hours Worked

Due: July 1, 2015: $0.80

Expiration date: June 30, 2016

DULUTH
COMMERCIAL & INDUSTRIAL
SHEET METAL WAGE RATES

EFFECTIVE MAY 4, 2015 - April 30, 2016

SOUTHERN ST. LOUIS, AITKIN, CARLTON, LAKE, COOK, AND DOUGLAS COUNTIES

			TAXABLE BASE*	SASMI	Health Fund	NATL PENSION	SUPP. PENSION	LOCAL 10 PENSION	FCF & LOCAL T.F.	SMOHI NEMI & ITI	LOCAL I.F. & DRUG TESTING	TOTAL PACKAGE
Journeyman			$31.56	$1.61	$9.02	$10.45	$2.15	$0.45	$0.64	$0.17	$0.23	$56.28
Foreman			33.56	1.61	9.02	10.45	2.15	0.45	0.64	0.17	0.23	58.28
General Foreman			35.56	1.61	9.02	10.45	2.15	0.45	0.64	0.17	0.23	60.28
Apprentice	HOURS											
	0-1000	55	17.36	1.01	9.02	5.75	1.18	0.25	0.64	0.17	0.23	35.61
	1001-2000	59	18.62	1.06	9.02	6.17	1.27	0.27	0.64	0.17	0.23	37.45
	2001-3000	63	19.88	1.11	9.02	6.58	1.35	0.28	0.64	0.17	0.23	39.26
	3001-4000	68	21.46	1.18	9.02	7.11	1.46	0.31	0.64	0.17	0.23	41.58
	4001-5000	72	22.72	1.23	9.02	7.52	1.55	0.32	0.64	0.17	0.23	43.40
	5001-6000	76	23.99	1.29	9.02	7.94	1.63	0.34	0.64	0.17	0.23	45.25
	6001-7000	80	25.25	1.34	9.02	8.36	1.72	0.36	0.64	0.17	0.23	47.09
	7001-8000	84	26.51	1.40	9.02	8.78	1.81	0.38	0.64	0.17	0.23	48.94
Classified worker												
	0-500	45	14.20	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	14.84
Plan B Single	501-on	45	14.20	0.00	2.69	2.45	0.00	0.00	0.64	0.00	0.00	19.98
Plan B Family	501-on	45	10.35	0.00	6.54	2.45	0.00	0.00	0.64	0.00	0.00	19.98

*The Taxable Base Pay rate includes $2.58 Vacation and Organizing deduction for journeymen and $1.58 for apprentices. The Vacation Fund deduction is $2.00 per hour for journeymen ($1.00 per hour for apprentices) and $.58 per hour for Organizing for both Journeymen and apprentices. For classified workers, the Vacation Fund deduction is $.55 per hour and there is a $.23 deduction for Organizing for a total deduction of $.78.

SASMI NOTE: The SASMI rate for Foreman and General Foreman are the same as the rate for Journeymen and there is no longer a different SASMI rate for overtime hours on any classification. All SASMI hours are paid at the straight time rate.

The current IRS mileage rate is $.575

April 17, 2015 Contract expires May 1, 2016

Shawn Broadrick
Business Manager

Brian W. Dunn
Financial Secretary-Treasurer

James E. Tucker
President-Organizer

Minnesota Breakdown of Wage and Benefit Package

Wage Rate	4/1/13	7/1/13	4/1/14	4/1/15
	$31.88	$32.52	$33.17	$33.83

Foreman's Rate: $2.75 above journeyman scale
General Foreman: $5.00 above journeyman scale (22+ men on job)
Local Union 669 has a 5% dues check-off; 2 1/2% for Apprentices Class 1-4

Extended Benefit Fund: $.25 per hour for all hours worked payable to Local Union 669
Industry Advancement-State of Minnesota
Class 5 and higher $.25 per hour for all hours worked payable to Local Union 669

Benefit Package

Health & Welfare 4/1/13	$8.42 per hour for all hours worked
Health & Welfare 1/1/14	$8.52 per hour for all hours worked
Health & Welfare 1/1/15	<To be determined>
Health & Welfare 1/1/16	<To be determined>
Pension 4/1/13	$5.50 per hour for all hours worked
Pension 1/1/14	$5.75 per hour for all hours worked
Pension 1/1/15	$5.90 per hour for all hours worked
Pension 1/1/16	$6.05 per hour for all hours worked
Education 4/1/13	$ .35 per hour for all hours worked
International Training Fund 4/1/13	$ .10 per hour for all hours worked
Industry Promotion 4/1/13	$ .25 per hour for all hours worked
Supplemental Pension 4/1/13	$2.50 per hour for all hours worked

Travel Expenses	4/1/13	4/1/14	4/1/15
0-60 miles	No expenses	No expenses	No expenses
60-80 miles	$15.00	$16.50	$17.50
80-100 miles	$25.00	$26.50	$27.50
100+ miles	$75.00	$80.00	$80.00

If you should have any additional questions, please feel free to contact Business Agent James Westby at (507) 493-5671 or this office.

Created June 2013

Road Sprinkler Fitters Local Union No. 669
7050 Oakland Mills Road • Suite 200 • Columbia, Maryland 21046
(410) 381-4300 • fax: (301) 621-8045 • www.sprinklerfitters669.org

SPECIAL PROVISIONS

Lakewood Water Treatment Plant Heating, Ventilation, and Cooling System Improvements

City Project # 1340

City of Duluth, Minnesota
411 West 1st Street
Duluth, MN 55802

SPECIAL PROVISIONS
City Job Number: 1340
Lakewood Water Treatment Plant Heating,
Ventilation, and Cooling System Improvements
March 7, 2016

CERTIFICATION

I HEREBY CERTIFY THAT THIS plan, SPECIFICATION or report
was prepared by me or under my direct supervision and that I am a duly
Licensed Professional Engineer under the laws of the State of Minnesota.

CIVIL, PROCESS MECHANICAL, PROCESS I&C, ELECTRICAL

Signature — Scott Chilson, P.E. (Typed or Printed Name)

March 7, 2016 (Date) — 44287 (License No.)

STRUCTURAL AND ARCHITECTURAL

Signature — Al Szymanski, P.E., AIA (Typed or Printed Name)

March 7, 20156 (Date) — 20405 (License No.)

MECHANICAL AND PLUMBING

Tom Wentz, P.E. (Typed or Printed Name)

March 7, 2016 (Date) — 18609 (License No.)

SPECIAL PROVISIONS
City Job Number: 1340
Lakewood Water Treatment Plant Heating,
Ventilation, and Cooling System Improvements
March 7, 2016

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SPECIAL PROVISIONS
City Job Number: 1340
Lakewood Water Treatment Plant Heating,
Ventilation, and Cooling System Improvements
March 7, 2016

The following forms and regulations/rules/statutes and interpretations, which are incorporated by reference in this contract, are available on the World Wide Web at the sites listed below. The City of Duluth will use its best efforts to ensure that the most recent, applicable forms and regulations/rules/statutes and interpretations are included on the web sites provided; however, if you are the successful bidder, prior to signing the contract, you are responsible for comparing the versions of the forms and regulations/rules/statutes and interpretations attached to the contract which you are signing with the versions on the web to ensure conformity. Hard copies of all forms are available at the Engineering Division.

THE VERSIONS OF THE FORMS AND REGULATIONS/RULES/STATUTES and INTERPRETATION ATTACHED TO THE CONTRACT WILL BE CONTROLLING.

FORM	FUND	WEB SITE
Affidavit of Non-Collusion (required by awarded contractor only)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Affirmative Action Policy Statement/Certificate - EEO (required by awarded contractor only)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Certified Payroll Form WH347	All	http://www.dol.gov/whd/forms/
Contractor's Haul Route	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Debarment/Suspension Notice (most current version)	All	http://www.dot.state.mn.us/bidlet/howtobid.html
IC-134 Contractor Affidavit - Form	All	http://www.revenue.state.mn.us/Forms_and_Instructions/ic134.pdf
IC-134 Contractor Affidavit – Online	All	https://www.mndor.state.mn.us/tp/contractoraffidavit/
MN Rules 5200.1105	All	https://www.revisor.mn.gov/rules/?id=5200.1105
MN Rules 5200. 1106	All	https://www.revisor.mn.gov/rules/?id=5200.1106
MN Statutes 177.41 to 177.44	All	https://www.revisor.mn.gov/statutes/?id=177
Notice to Bidders - Prompt Payment to Subs – CITY (MS 471.425)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
One-Call Instructions	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Request to Sublet TP-21834	All	http://www.dot.state.mn.us/const/labor/forms.html
Request to Sublet Summary	All	http://www.dot.state.mn.us/const/labor/forms.html
Responsible Contractor Certification (MS 16C.285)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Statement of Compliance Form (8-2013)	All	http://www.dot.state.mn.us/const/labor/forms.html
Supplemental General Conditions Part II 4/15/11	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/

SPECIAL PROVISIONS
City Job Number: 1340
Lakewood Water Treatment Plant Heating,
Ventilation, and Cooling System Improvements
March 7, 2016

SP-1 NOTICE TO ALL BIDDERS

The 2016 Edition of the City of Duluth Public Works & Utilities Department/Engineering Division "Construction Standards" book and any addendums or supplements is incorporated by reference and is deemed to be a part hereof as if fully incorporated and set forth herein. The 'Construction Standards' is available on the City website at: http://www.duluthmn.gov/engineering/standard-construction-specifications/.

SP-2 SCOPE OF WORK

This project involves furnishing all labor, work, materials, and equipment necessary:
Improvements and reconstruction of the Heating Ventilation and Cooling (HVAC) system of the main Water Treatment Plant building at the City of Duluth Lakewood Water Treatment Plant (WTP) located at 8130 Congdon Boulevard, Duluth, MN, 55804. The Lakewood WTP is a gravity filtration plant that treats and supplies water from Lake Superior. The Lakewood WTP is a critical facility and shall remain in operation at all times during construction. Improvements to the facilities HVAC system will include replacement of existing Make-Up air Units, dehumidifiers, unit heaters, motor damper, hot water circulation pumps, and other appurtenances within the existing WTP building. The project work includes project management and coordination, temporary control and operation, building and equipment demolition, process mechanical piping/valve and equipment, painting, high performance coatings, HVAC, plumbing, electrical, HVAC DDC system and hardware integration, concrete work, carpentry, metal fabrication, restoration, startup services, testing, etc.

SP-3 CONTACT INFORMATION

Questions regarding this project should be directed to: Howard Smith, P.E., Project Engineer of Utilities (ph. 218-730-5092), or email at hsmith@duluthmn.com.

Or questions concerning the project should be directed to Scott R. Chilson, Senior Project Manager at MSA Professional Services, Inc., 301 W. 1st Street, Suite 408, Duluth, MN 55802, (608) 355-8868 or (608) 963-6527, schilson@msa-ps.com.

SP-4 PRE-BID CONFERENCE

A Pre-Bid Conference will be held on Friday, March 18 at 10:30 PM at the Lakewood Water Treatment Plant Conference Room, located at 8130 Congdon Boulevard, Duluth, MN. Following the meeting potential bidders will have access to review the project area until 1:00 PM. Representatives of the owner and engineer will be available for questions at the Lakewood Water Treatment Plant. Potential bidders are strongly encouraged to attend. **This will be the only time bidders will be granted access to the water plant to review the project.**

SP-5 (1209) DELIVERY OF PROPOSALS

The provisions of MN/DOT 1209 and section 1209 of the City's Construction Standard are modified with the following:

The Bidder shall return paper copies of the following with the submitted Proposal:

(1) The Bid Proposal on the form attached to the proposal package, with signatures and all Addenda acknowledged;
(2) Bid Guaranty (certified check, bank draft, government bond, or bid bond);
(3) Responsible Contractor Certification forms;
(4) Equal Employment Opportunity Affirmative Action Policy Statement; and
(5) Affidavit of information Required of Bidders.

The Bidder shall return paper copies of the entire Proposal Package booklet with the submitted Proposal and required forms completed:

SP-6 (1507) UTILITY PROPERTY AND SERVICE

Control shall perform construction operations near utility properties in accordance with provisions of MNDOT 1507, except as modified below:

All utilities related to this Project are classified as "Level D," unless the Plans specifically state otherwise. This utility quality level was determined according to the guidelines of CI/ASCE 38-02, entitled "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data."

The following utility owners have existing facilities which the work under this Contract may affect:

MN Power

City of Duluth Utilities (Water and Natural Gas)

Any relocation or adjustment of in place utility shall occur concurrently with the Contractor's work.

Any exposed utility or pipe shall be rebidded in clean, compactible sand (or as required by the facility owner) by the Contractor and all such work shall be considered incidental.

SP-7 (1702) PERMITS, LICENSES, AND TAXES

Contractor shall obtain building, electrical, demolition Permits as required by the city, county, and Town.

1. City of Duluth Building Demolition Permit
2. City of Duluth Building, Mechanical, Plumbing, and Electrical Permit

Contractor shall be responsible for all associated costs of permits listed above. Contractor shall also abide by other permits obtained by others.

SP-8 (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME

The Contract Time will be determined in accordance with the provisions of MN/DOT 1806 and the following:

1. Construction operations shall be started on or before May 9, 2016 within ten (10) calendar days after the date of **Notice to Proceed**, whichever is later.

2. Substantial Completion (aka Intermediate Completion Requirements). All work under this Contract shall be substantially complete on or before November 18, 2016. For this project, Substantial Completion shall be deemed to include ALL work in the Contract, except the following items:

   Milestone1: Develop and submit all equipment and materials Shop Drawings to Owner and Engineer.
   Milestone 2: All critical material and equipment stored on-site or at secure location off-site. Begin Construction
   Milestone 3: Complete HVAC, Plumbing, and Electrical System constructed, started-up, tested, Training, and commissioned. Submittal of O&M Manuals, Record Drawings, Start-up reports, Power Study, warranties, Lien waivers, etc.
   •

3. Final Completion. ALL work required under this Contract shall be complete on or before May 11, 2017. *[The Final Completion Date does NOT include time for warranty or plant establishment.]*

   Completing all items addressed in final project closeout punch list.
   - Complete follow up trainings and system operation optimization adjustments.
   - Final restoration and landscaping.
   - Submitting final project closeout documentation inclusive of closeout letter and final pay request.

4. The third exemption listed under the second paragraph of the provisions of MN/DOT 1806.3 is modified to the extent that the phrase "(3) During the inclusive period from November 15 through April 15, except as specified in 1806.1…" is deleted.

5. No work which will restrict or interfere with traffic shall be performed between 12:00 noon on the day preceding and 6:30 a.m. on the day following any consecutive combination of a Saturday, Sunday, and legal holiday without written permission from the Engineer.

   (A) If the Contractor chooses not to work at all on the day preceding the holiday period, no working day charges will be assessed.

   (B) If the Contractor chooses to work prior to 12:00 noon on the day preceding the holiday period or if the Contractor obtains written permission to work after 12:00 noon on the day preceding the holiday period, working day charges will be assessed only for the actual hours worked.

6. No work shall occur on the project during the days of June 17th through June 19th, 2016 to avoid project related congestion and conflicts with Grandma's Marathon setup and race related activities.

7. When all, or a portion, of the Contract Time is specified as a calendar completion date, the time is presumed to have been determined by considering the Proposal quantities,

normal weather for the locality and season of the year, and the necessity of having the work completed by the specified date. The time may be extended by the Engineer only if the delay is considered "Excusable" in accordance with MN/DOT 1806.2 Types of Delays.

1). Delays caused by failure of the City Council to award the Contract at least 10 calendar days in advance of the latest date specified for beginning construction operations.

2) Delays caused by an earthquake, flood, cloudburst, cyclone, tornado, or other cataclysmic phenomenon of a nature beyond the power of the Contractor to foresee and make preparations in defense against.

3) Delays caused by acts of the Government or a political subdivision, or by acts of the public enemy, including fires, epidemics, and strikes not caused by improper acts or omissions of the Contractor.

4) Delays caused by an action or non-action of the Department, such as suspension of work by order of the Engineer through no fault on the Contractor.

5) Delays caused in incompletion of work being done by other Contractors or utility owners, or due to other unforeseeable interferences not the fault of the Contractor.

6) Delays direction attributable to the performances of Extra Work or increased quantities or work.

7) Extraordinary delays in delivery or materials, resulting from strikes, lockouts, freight embargoes, governmental acts, or sudden disaster, or a nature beyond the power of the Contractor or his/her supplier to foresee and forestall.

Delays caused by plant and equipment failure, and delays due to unsuitable weather or conditions resulting therefrom, will not be allowed as justification for time extension except when and only to the extent the Engineer considers justified in view of unavoidable circumstances or events. Normal weather delays and the usual plant and equipment failures must be allowed for establishing work schedules. An extension of time may be granted for such delays as are considered to be in excess of the normal, but only when it is shown that the lost time would not reasonably be made up through acceleration of the remaining work. Failure to prosecute the work continuously and effectively for the full time allowed, with adequate work force and schedule, will be cause for denial of any such time extension that may otherwise be allowed.

SP-9 (1807) FAILURE TO COMPLETE WORK ON TIME

The provisions of MN/DOT 1807 shall apply in full to both the Substantial Completion Date and the Final Completion Date.

Liquidated damages will be assessed at a rate of $2,500.00 for each calendar day that Substantial Completion or Final Completion objectives are not satisfied. The liquidated damages as set forth above may apply equally, separately, and may be assessed concurrently.

Contractor shall adjust work schedule to accommodate events and operational needs critical to the operation of the water plant and city staff. The contractor is responsible for temporary HVAC equipment as required to keep the WTP 100% operation and safe. The city staff and operators

will assist the contractor in operations. The contractor shall have on-call services to support city during construction. Work shall not be allowed during Friday and Monday and weekend of the following event(s), ie holidays.

SP-10 METHOD OF PAYMENT

Payment for construction items described below shall be included with the bid items listed in the "Request for Bids". Any construction activities, items, or materials not specifically listed under one of the following payment items shall be incidental to the WTP HVAC System Improvements.

1) Lakewood Water Treatment Plant HVAC System Improvements shall be paid for as a unit price item(s).
    a. Mobilization, Insurance, and Bonding item include costs incurred by mobilization; insurance, bonding, and any other incidental project cost not clear covered in another bid item.
    b. WTP HVAC System Improvements: item includes all work, labor, fees, materials, permits, and equipment incidental to a complete and operable project.
        i. Demolition item include all work, labor and materials related to removal and disposal work on the project. The owner retains ownership and first right of refusal for all materials and equipment removed for the project. The Contractor shall be responsible for disposal of items and materials the owner refuses.
        ii. Site Restoration: item includes all work, labor, materials, and equipment to restore all disturb areas incidental to the contact in addition to minimum areas shown on the drawings.
        iii. Temporary Equipment & Materials and Standby Operation item shall include all materials, permits, fees, labor, and equipment necessary to provide automatic and safe tempera HVAC equipment to keep the WTP 100% operation and safe during construction. This is the contractors responsibility because the need and execution of the contraction is defined by the contractors means and methods, and schedule.
        HVAC, Plumbing, Electrical, and minor building demolition shall include all work, labor, equipment, and materials to decommission, disconnect, remove, clean, dispose and execute the work shown on the drawings.
        iv. Relocation Sample Pumps, piping, process valves shall include all work necessary to relocated existing sample pump system as shown on the drawings.
        v. Design and construction of DDC HVAC System as specified.
        vi. Electrical Upgrades includes all work, labor, materials, and equipment to provide complete system as described herein and shown on the drawings.
        vii. HVAC Control Panel, MC, devices, etc.
        viii. Electrical Construction including Electrical Demolition item includes all work, labor, materials, and equipment to install electrical shown herein by a certified and licensed Master Electrician.
    c. Roof Hand Rail item shall include all materials, permits, fees, labor, and equipment necessary to provide new hand rail on the roof and repair the roof damaged during the project.

d. Washwater Building Equipment item shall include procurement of equipment and delivery to the owner. Equipment shall include:
   i. Fan:
   ii. (2) Gas Fired Duct Heaters:
   iii. (3) Motor Dampers:
   iv. (3) Louvers
e. Utility Allowance shall be paid for as a lump sum item. This allowance will be adjusted to cover the actual costs of the utility power company to provide the upgraded service to the project site.

SP-11 CONSTRUCTION STAGING AREA

Contractor shall limit construction activities to work area indicated on drawings. Off-site storage and staging areas shall be arranged and paid for by Contractor, costs for any required off-site storage and staging areas shall be inclusive to lump sum WTP HVAC System Improvements bid item.

SP-12 MAINTAINING HVAC SYSTEMS

1. Contractor shall schedule and conduct operations to allow existing the WTP to remain functional (operational and safe) at all times until successful completion and start-up of the new HVAC System. Contractor shall provide any necessary temporary equipment and materials required for modifications to the Lakewood WTP.

2. The contractor shall remove all debris, materials, tools, equipment, etc. from the WTP at the end of each work day.

SP-13 EXISTING UTILITY LOCATION AND TEST DIGS

Prior to beginning construction, the contractor shall perform test digs to locate the existing gas piping and electrical within the construction limits. The location of the existing utilities shown on the plans has been made using the best available information, but is not guaranteed to be accurate. The contractor will be required to call for utility locations prior to digging. Any damage caused by performing the test digs to the existing force main or other utilities will be the responsibility of the contractor to repair.

SP-14 COLD WEATHER PRECAUTIONS

The Contractor shall be prepared to provide construction blankets or ground thawing as needed to facilitate construction activities during the winter months. Ground thawing or insulating shall be incidental to the construction of the associated piping and buried utilities.

SP-15 LAKEWOOD WTP IS A SECURE FACILITY

The Contractor shall note the only access to WTP is through the controlled access gate. Any costs related to access to the site shall be inclusive and incidental to the contract.

SP-16 SPECIAL PERMITS

The Contractor is required to obtain and abide by the following permits and restricting conditions.

3. City of Duluth Building Demolition Permit
4. City of Duluth Building and Electrical Permit

SP-17 (2451) STRUCTURE EXCAVATION AND BACKFILLS

Non-frost susceptible engineered fill is to be used as backfill material for all structures and excavations within 5 feet of the structure perimeter. Non-frost susceptible soils are required full depth below pavement structures within 5 feet of the concrete structures. Testing frequency and requirements shall be in accordance with 2015 City of Duluth Standard Construction Specifications and 2015 Supplement and all costs associated with testing are incidental to associated pay item.

1. Non-frost susceptible engineered fill shall meet the following gradations recommended in Table 1.

Table 1: Non-Frost Susceptible Engineered Fill Gradation	
Sieve Size of Number	Percent Passing by Weight
4”	100
2”	80 - 100
#4	60 - 100
#200	0 - 7

2. Backfill material that is not native to the site shall be documented as clean fill per MPCA requirements. The Engineer will be responsible to coordinate and perform testing required by the MPCA. Contractor shall provide Engineer with backfill source location(s) and provide access for sample collection by the Engineer

3. Existing excavated low-impact fill material obtained from above or outside of the contaminated fill layer may be acceptable to be reused as fill as approved by the Engineer. Granular backfill material (MNDOT spec. 3149.2D, 7% Mod.) shall be imported for placement in utility trenches above select granular fill in areas below parking area, roadways, and other paved areas with the exception that acceptable low-impact fill material may be used above the select granular backfill associated with the piping. Contractor will not be permitted to stockpile native or low-impact fill excavated material on-site longer than 24 hours without containment precautions.

4. Backfill shall be placed in a maximum of 8” lifts and achieve a compaction requirement of 95% of the maximum Modified Proctor dry density. Base layers for structural slabs shall be compacted to 95% of the maximum Modified Proctor dry density.

   All costs for structural excavation and backfill not associated with Excavation or Excavation and Disposal of Materials bid items shall be incidental to the WTP HVAC System Improvements bid item.

5. Storage of all excavated materials within disturbance limits shall be limited to materials excavated and replaced on that day except where Contractor provides temporary

containment to prevent migration of materials by wind and water. Typical containment will consist of covering piles with tarps or plastic.

6. No excavated materials or construction equipment shall be placed outside of Disturbance limits. Storage of materials and equipment outside of the region bound by the disturbance limits is not permitted. Contractor will be responsible for obtaining any off-site storage or staging if necessary.

7. The Contractor shall notify Engineer a minimum of 14 days in advance of beginning excavation activities to allow for inspection and testing of soils in excavations for possible contamination. Requirements for excavation and disposal provisions are included in the attached technical specification Section 02 61 13R Excavation and Handling of Contaminated Materials. Hazardous soil remediation shall be in accordance with attached technical specification Section 02 55 00 Remediation Soil Stabilization. Additional payment for mobilizations as the result of non-compliance will not be paid.

SP-18 (3877) TOPSOIL

Topsoil shall meet the requirements of Mn/DOT 3877.2A. Areas where seed and mulch are the final restoration shall receive 4 inches of select topsoil. The contractor may at his option strip topsoil from the existing site. If existing topsoil on the site is not sufficient to meet the minimum depth requirements stated above, the Contractor shall import all additional topsoil as necessary.

SP-19 (2505) GAS SERVICES AND MAIN

The Contractor is responsible to coordinate with City of Duluth Public Works and Utilities to furnish service upgrades and relocation of gas fuel lines between the filter building and the washwater building. The Contractor is responsible for all necessary coordination, scheduling, demolition permitting, and incidental items associated with the gas line relocation.

SP-20 (2476) PAINTING

The Contractor shall paint in accordance to the technical specification section provided in Division 09.

SP-21 CONSTRUCTION SEQUENCING

1. Notice to Proceed
2. Develop and submit Schedule of Values, Project Schedule, and description of Means and Methods
3. Preconstruction Meeting
4. Building and project review to identify constructability and implementation concerns.
5. Develop and submit the DDC System layout.
6. Shop Drawings
7. Utility Coordination Request
8. Mobilize
9. Implementation of Temporary HVAC System if required.
10. Selective and General Demolition

11. General Construction and Installation.
12. Start-up, testing, and commissioning of the new equipment and system.
13. Site restoration and removal of traffic control.
14. Complete project start-up and close out.

SP-22 RECORD DRAWINGS

1. The Engineer will provide the Contractor with a suitable set of contract drawings on which the Contractor shall record daily records of changes and deviations from the contract. All buried or concealed piping, conduits, or similar items shall be located by dimensions and elevations on the record drawings.

2. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups shall be permitted. At completion of the project, the Contractor shall submit the marked-up record drawings to the Engineer.

SP-23 (1508) CONSTRUCTION STAKES, LINES, AND GRADE

The Engineer will set stakes establishing line and grade as required. The Contractor is responsible to preserve staking provided by the Engineer or transfer the line and grade stakes to a safe location from construction disturbances. Staking replaced because of Contractor negligence will be at Contractor's expense.

- END –

TECHNICAL SECTIONS INDEX

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish all materials, equipment, tools, labor and supervision necessary for the execution of work of this section.

B. Removal of designated building equipment and fixtures.

C. Removal of designated construction.

D. Disposal of materials. Recycle removed materials to the greatest extent possible.

E. Identification of utilities.

F. Refer to items/work on drawings.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. American National Standards Institute (ANSI) Specifications and Standards: ANSI A10.6 - Safety Requirements for Demolition, Current Edition.
2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.
3. NESHAP 40 CFR Part 61 “Clean Air Act”
4. Minnesota Rules, Parts 4620.3410, 4620.3415 and 4620.3420.
5. Minnesota Department of Health MDH 326.70 to 326.81 “Asbestos Abatement Act”
6. Minnesota Pollution Control Agency (MPCA), Pre-Demolition Inspection Rule MN Rule 7035.0805, MN Rule 7045 and MN Stat. Ch 115A, Current Editions.
7. Minnesota Pollution Control Agency (MPCA) Pre-Demolition Environmental Checklist and Guide, form w-sw4-20.doc.
8. Guidance on Environmental Concerns Associated with Building Demolition, MPCA Waste/W7-01/April 1999.
9. Guidance for the Removal, Transport, and Disposal of Category I Asbestos-Containing Materials, MPCA Air Quality / Asbestos Program/#4.04/December 2000.

10. Guidance for the Removal, Transport, and Disposal of Category II Asbestos-Containing Material, MPCA Air Quality/Asbestos Program/#4.05/January 2002.

1.03 REGULATORY REQUIREMENTS

A. Contractor shall comply with applicable rules, regulations, codes, and ordinances of local, state, and federal authorities including ANSI A10.6, Safety Requirements for Demolition. Solid and hazardous waste removal and disposal procedures shall be performed in compliance with MN Rule Chapters 7035 and 7045, and MN Stat. Ch. 115A, and all other application rule and regulations. Asbestos Containing Material (ACM) may be present within the structures to be demolished.

B. Contractor shall comply with all Health and Safety Regulations that apply in the construction of this project. All materials and equipment shall comply with current OSHA / NESHAP safety standards. Contractor is notified that workers may come into contact with HAZARDOUS SUBSTANCES during the construction of this project.

C. Each Contractor working on site during removal of the ACM shall have a Health and Safety Program (HASP) that complies with the Code of Federal Regulations, Chapter 29 Part 1910.120. This plan should be prepared or reviewed and approved by an American Board Industrial Hygiene (ABIH®) Certified Industrial Hygienist (CIH).

D. Do not close or obstruct egress width to any building or site exits.

E. Conform to procedures applicable when hazardous or contaminated materials are discovered.

F. Obtain and pay for all required permits and approvals.

G. Submit and pay for submittal of required permits.

1.04 SUBMITTALS

A. Submit Demolition Waste Management (DWM) plan within 15 days of receiving notice to proceed and prior to any demolition or hauling activities. The DWM plan shall identify waste reduction goals targeting materials for reuse or recycling and explain waste hauling activities to be taken, by whom and when. In addition, the plan shall address recyclable waste materials by designating items for salvage or recycle. Waste disposal in a landfill shall be minimized to the greatest extent possible.

B. The Engineer will initiate the City of Duluth Demolition Permit by documenting the expected ACM and other materials of concern. The Contractor shall complete City of Duluth Demolition Permit, obtained from City of Duluth Building Inspectors

office, at least 30 days prior to start of demolition. All permits fees required to perform the demolition, removals, and disposals at this site will be the responsibility of the contractor.

C. Contractor shall complete and submit MPCA Notification of Intent to Perform a Demolition, MPCA Form w-sw4-21.doc with required fee at least 30 days prior to start of demolition.

D. Contractor shall complete and submit MPCA/ MDH Notification of Asbestos Related Work, MPCA w-sw4-06.doc with required fee at least 45 days prior to start of demolition. The notification must outline facility information, owner/ operator information, emission control procedures, disposal location and other information.

E. Contractor shall complete and submit an asbestos emission control plan as required by MPCA/MDH w-sw4-06 permit and in conformance with the requirements of 40 CFR 61.145. This plan will outline the site's characteristics, describe wetting procedures, site control, signage and air monitoring plan. All permits fees required to perform the Asbestos abatement at this site will be the responsibility of the contractor.

F. Contractor shall document solid waste disposal and diversion at substantial completion. Include the date of removal, type of waste removed, quantity by weight and volume, final destination and use (recycled, reused or landfilled) and net cost or income. Submit all landfill disposal documentation, recycling receipts, invoices and manifests.

G. Landfill disposal tickets and manifests shall be submitted with the application for payment.

H. Contractor must submit all OSHA Hazardous Waste Operations and Emergency Response and NESHAP/MDH Licensed Asbestos Contractor **and** training certificates for Contractor personal and all subcontractors involved in work associated with asbestos removal within three (3) working days of bid opening.

1.05 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Provide, erect, and maintain temporary barriers at locations indicated.

B. Erect and maintain weatherproof closures for exterior openings.

C. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

D. Protect existing materials which are not to be demolished.

E. Prevent movement of structure; provide required bracing and shoring.

F. Notify affected utility companies before starting work and comply with their requirements.

G. Mark location and termination of utilities.

3.02 DEMOLITION

A. Demolish in an orderly and careful manner. Protect existing supporting structural members.

B. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

C. Remove materials as work progresses. Upon completion of work, leave areas in clean condition.

D. Remove temporary work.

END OF SECTION

SECTION 03 11 13

CAST-IN-PLACE CONCRETE FORMING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all materials, equipment and labor required to furnish all formwork for cast-in-place concrete as shown on the contract drawings and specified herein.

B. The work shall include formwork, shoring for cast-in-place concrete, and installation into formwork of items by other such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, and other items to be embedded in concrete.

PART 2 PRODUCTS AND MATERIALS

2.01 DESIGN

A. The design and engineering of the formwork and its accessories shall be the responsibility of the Contractor. Formwork shall be designed, erected, supported, braced and maintained so as to safely support all vertical and lateral loads until such loads can be supported by the concrete structure.

B. Determination of loads and design shall be in accordance with ACI 301 and ACI 347.

2.02 FORMS

A. Forms may be wood, plywood, concrete-form-grade hardboard, metal or other acceptable material which will produce smooth, true surfaces.
   1. Provide lumber dressed on at least two edges and one side for tight fit.
   2. Metal forms shall have smooth surfaces free from any pattern, irregularities, dents, bends and sags.

2.03 FORM TIES AND ACCESSORIES

A. Form ties shall be factory-fabricated, adjustable-length, removable or snap-off metal, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

B. For exposed concrete surfaces, provide ties so that the portion remaining with the concrete after removal is 1 inch to 1-1/2 inches inside the finished face of the concrete. Provide form ties which will not leave holes larger than 1 inch in diameter in concrete surfaces.

2.04 FORM COATING COMPOUND

A. Form coating compound shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces and not impede the wetting of surfaces to be cured with water or curing compounds. Forms for concrete surfaces requiring subsequent treatment shall receive a type of coating that will not impair bond or adhesion.

B. Form coating compound for steel forms shall conform with all requirements stated above and shall be of rust-preventative type.

PART 3 CONSTRUCTION METHODS

3.01 GENERAL

A. Responsibility. The design and construction of formwork shall be the sole responsibility of the Contractor.

B. Earth forms are not acceptable or permitted.

C. Construct forms to the exact sizes, shapes, lines and dimensions shown, as required to obtain accurate alignment, location, grades, level and plumb in finished construction and to maintain tolerances in accordance with ACI 301. Provide for openings, offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages, and other features required. Chamfer corners of concrete exposed to view using chamfer strips, unless noted otherwise. Use selected materials to obtain required finishes.

D. Forms shall be sufficiently tight to prevent leakage of concrete. Temporary openings shall be provided in the inside form of all wall forms and in column forms to facilitate cleaning and inspection immediately before placing concrete.

E. Assemble forms so their removal will not damage concrete and adjacent materials.

3.02 FORMWORK

A. Forms shall conform in general to shape, line, grade and dimensions of members as shown on contract drawings, and shall have the strength and stability to insure finished concrete within the tolerances specified in ACI 347.

1. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from those other trades.
2. Exterior edges of all exposed concrete, unless otherwise specified, shall have a chamfer strip placed in form to provide bevel of sharp edges. Chamfer strips shall be 3/4-inch by 3/4-inch by 45º wood, plastic, or rubber.

3. Accurately place and secure in position, prior to placing concrete, all anchors, bolts, inserts and other items furnished under other sections of the specifications and for other contractors on the project.

B. Formwork shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports.

C. Formwork shall be properly braced or tied together so as to maintain position and shape and insure safety to workman and passersby.

D. All forms shall be cleaned and rubbed smooth prior to placing to insure true forming surfaces for all concrete surfaces.

3.03 FORM TIES AND ACCESSORIES

A. Internal wall ties shall contain positive stops at the required wall thickness.

B. Accessories shall be used only for the purpose intended and shall in no way interfere with the placing of concrete. Removal of accessories shall in no way impair or disturb finish concrete surfaces. Accessories shall be compatible with formwork and ties and shall maintain the watertight integrity of the formwork system.

C. Design of all form ties and accessories shall be adequate for all concrete placement, horizontal and vertical, to prevent failures and blowouts.

3.04 FORM COATINGS

A. Coat form contact surfaces with form bond breaker compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

C. Clean reinforcing steel that has become contaminated with form coating to the satisfaction of the Engineer prior to placing concrete.

3.05 EMBEDDED ITEMS

A. Items embedded in concrete shall be properly cleaned to be free from oil or foreign matter that would weaken the bond of the concrete to these items.

B. Install in the formwork requisite inserts, anchors, sleeves and other items specified under other sections of these specifications; close end conduits, piping and sleeves embedded in concrete with caps or plugs.

3.06 CONSTRUCTION JOINTS

A. Make construction joints where indicated on the contract drawings; additional construction joints are subject to prior approval of the Engineer.

B. Form keyways and joints as indicated on the contract drawings.

3.07 EXPANSION JOINTS

A. Expansion joints shall be placed where indicated on the contract drawings.

B. Joints between slabs on earth and vertical surfaces, including walls and other fixed structures, shall have expansion joint material placed on abutting vertical surfaces.

3.08 CONTROL JOINTS

A. Install vertical control joints as indicated on the contract drawings.

B. Install control (contraction) joints in slabs as indicated on the contract drawings.

3.09 FORM/SHORING REMOVAL

A. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

B. Removal of forms shall be accomplished in such a manner as will prevent injury to concrete and insure complete safety of structure. Removal times listed below are minimum and may be increased by the Engineer as job conditions warrant.

1. Wall forms shall not be removed in less than 24 hours after pouring, unless otherwise required for curing.
2. Supporting forms must remain in place until concrete can carry any loads to be imposed upon it and in no case shall be removed in less than seven (7) days.
3. Forms ties, requiring any operation in removal of forms which would tend to destroy bond between tie and concrete in order to remove form, shall not be disturbed for seven (7) days after completion of pour.
4. The time periods stipulated above may be reduced if strength results of concrete so indicate adequate conditions.

C. Notify the Engineer before the forms are removed in order that an examination of the newly-stripped surfaces may be made prior to patching.

3.10 EXPOSED SURFACES

A. Exposed surfaces shall be Carborundum rubbed to take off fins; fill pores, stone pickets, honeycombs, etc., with non shrink grout as follows:

1. Repair immediately after form removal and inspection by the Engineer.

2. Remove concrete surrounding defect to sound concrete, then wet affected area.
3. Brush on bonding agent, mixed and applied in accordance with manufacturer's recommendations.
4. Consolidate patch grout and strike off to leave the patch slightly higher than the surrounding surface.
5. Finish the repaired area flush with the surrounding area after the patch has been in place for one hour, or as prescribed by the manufacturer.

B. Perform patching before curing compound is applied; cure patched areas in the same manner as adjacent concrete; make repairs uniform in color and finish with surrounding concrete.

C. Exposed surfaces shall be protected from excessive sun, wind and rain, and kept wet until curing compound is applied. When ambient temperature falls below 40ºF heat aggregate and mixing water; clear all forms, reinforcement and subgrade of snow and ice; cover all freshly placed concrete with tarpaulins, and provide heat to maintain a temperature of 70ºF for at least three days or 50ºF for five days; rate of cooling after end of protection period shall be accomplished in a manner approved by the Engineer.

3.11 REUSE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for the new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

C. Do not use "patched" forms for concrete surfaces exposed to view.

END OF SECTION

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing concrete accessories as shown on the contract drawings and specified herein.

PART 2 PRODUCTS AND MATERIALS

2.01 EXPANSION JOINT FILLER

A. Preformed Bituminous. Bituminous expansion and contraction joint filler shall be preformed bituminous strips which complies with ASTM D994.

B. Rigid Insulation. Polystyrene, ASTM C578, Type IV, extruded cellular type. Minimum compressive strength of 25 PSI. Thickness as indicated on drawings.

C. Removable Plastic Expansion Joint Cap: Snap-Cap by W.R. Meadows.

2.02 CONCRETE REPAIR COMPOUND

A. Concrete repair compound shall be Sonopatch, Sonneborn Building Products; Embeco 411 Mortar, Master Builders, or equal.

2.03 PIPE SLEEVES

A. Shall be furnished, installed, and anchored solid in their final location.

PART 3 CONSTRUCTION METHODS

3.01 INSTALLATION

A. Install accessories where shown on contract drawings and as specified herein.

B. Install rigid insulation with butt edges and ends tight to adjacent board. Prevent insulation from being displaced during concrete placement.

C. Remove cap from expansion joint for the installation of joint sealant under Division 07.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing concrete reinforcing as shown on the contract drawings and as specified herein.

PART 2 PRODUCTS AND MATERIALS

2.01 REINFORCEMENT

A. Steel Bar Reinforcement. Main reinforcing and stirrups; ASTM A615, Grade 60.

B. Steel Tie Wire. Steel tie wire, ASTM A82, plain, cold-drawn, 16 gauge or heavier.

C. Supports For Reinforcement. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place complying with CRSI Manual of Standard Practice. For slabs on grade where base material will not support chairs, use supports with sand plates or horizontal runners to locate mesh properly in slab. Clay brick are not allowed.

PART 3 CONSTRUCTION METHODS

3.01 FABRICATION

A. Fabricate and place to shapes and dimensions indicated or required to carry out intent of contract drawings and these specifications.

B. Bends for stirrups and ties shall be made around a pin having a diameter not less than four times the diameter of reinforcing bar. Bends for other bars shall be made around a pin having a diameter not less than six times diameter of bar, except that for bars larger than 1 inch, pin shall be not less than eight times diameter of bar.

1. Perform cutting and bending in the shop; bend and cut steel cold. Heating of reinforcement will not be permitted. Do not bend or straighten bars in a manner that will injure the material.
2. Field bending of bars shall not be allowed without the Engineer's approval.

C. Reinforcing bars shall conform accurately to the dimensions shown on the contract drawings.

3.02 CLEANING

A. Before placing and before pouring concrete, all reinforcement shall be thoroughly cleaned of all oil, dirt, loose mill scale, loose rust, or foreign matter that will destroy or reduce bond.

3.03 PLACING REINFORCEMENT

A. Placement.
   1. Metal reinforcement shall be accurately placed and adequately secured in position.
   2. Nails shall not be driven into forms to support reinforcement nor shall wire ties come in contact with forms.
   3. Reinforcement in the footings shall be secured in place with rebar staked into the ground and the reinforcing tied to the rebar stakes.
   4. Reinforcement in wall forms shall be tied to the formwork ties.

B. Splicing. Lap at splices shall be sufficient to transfer stress between bars by bond and shear.
   1. Furnish reinforcing bars in full lengths as indicated on the contract drawings and approved Submittals.
   2. Do not splice bars unless indicated on the contract drawings or approved by the Engineer in writing. When authorized, make splices in accordance with ACI 318; perform welding in accordance with AWS D12.1.
   3. Splices generally shall be avoided at points of maximum stress. Minimum splice lap for stressed bars shall be forty times bar diameter.

C. Offsets in longitudinal bars at change of cross section shall be placed in region of lateral support. Slope of inclined portion of offset shall not be more than one in six and, in tied columns, ties shall be spaced not over 3 inches on centers for a distance of 1 foot below actual point of offset.

D. Embedded Items. The Contractor shall provide for the installation of all items embedded in the concrete, such as coil rod inserts, anchor bolts, dowels, etc., as shown on the contract drawings or as provided for in other Divisions of these specifications.
   1. All dowel bars shall be tied securely in place before pouring concrete.
   2. Provide for clearances with appurtenant materials and devices.

E. Concrete Cover. The minimum cover of concrete for all reinforcement shall conform to the dimensions indicated on the contract drawings, which indicate the clear distance from the edge and end of the reinforcement to the face of the concrete surface. Provide clearance and spacing indicated on the contract drawings and approved Submittals, where so indicated.

1. Where no clearances are indicated, the thickness of the concrete cover over reinforcement shall be as follows:
   a. Concrete cast against and permanently exposed to earth - 3 inches;
   b. Formed concrete exposed to earth or weather - 2 inches;
   c. Formed concrete not exposed to earth or weather - 1-1/2 inches;
   d. Slabs not exposed to earth or weather - 1 inch.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered under this section shall cover furnishing all materials, equipment and labor required to construct all cast-in-place concrete as shown on the contract drawings and as specified.

PART 2 PRODUCTS AND MATERIALS

2.01 CEMENT

A. Cement shall be Portland Cement ASTM C150 Type I or IA, except as otherwise noted or approved.

B. A singular brand and manufacturer of cement shall be used for the entire work.

2.02 FLY ASH

A. Fly ash shall conform to ASTM C618 Class C.

B. A singular source of fly ash shall be used for the entire work.

2.03 SLAG

A. Slag shall be ground granulated blast furnace slag conforming to ASTM C989.

2.04 AGGREGATE

A. Aggregate shall consist of clean, hard durable sand, gravel, crushed gravel or crushed rock.

B. Aggregate shall conform to the requirements of ASTM C33. Fine and coarse aggregate shall meet ASTM C33 grading requirements. Coarse aggregates shall be graded in accordance with ASTM gradations as follows:
   1. 3/4 inch maximum coarse aggregate - ASTM No. 67
   2. 1-1/2 inch maximum coarse aggregate - ASTM No. 467

C. Maximum aggregate size shall be as defined in the Concrete Schedule, or where not defined in the Concrete Schedule, as defined by dimensional constraints for cast-in-place concrete as follows.
   1. Not larger than one-fifth of the narrowest dimension between sides of the forms;
   2. Not larger than one-third the thickness of the slab;

3. Not larger than three-fourths of the minimum clear spacing between individual reinforcing bars or wire, bundles of bars, or prestressing tendons or ducts.

2.05 MIXING WATER

A. Mixing water shall be natural or treated water, clean and free from injurious amount of oil, acid, alkali, chlorides and sulfates, other common salts, organic matter or other deleterious substances.

B. Mixing water shall yield cement paste complying with the requirements ASTM C109 and ASTM C191.

2.06 ADMIXTURES

A. All admixtures are subject to the written approval of the Engineer and shall be used in strict accordance with the manufacturer's recommendations.

1. Air-Entraining Admixture
   a. All concrete exposed to weather and freeze-thaw cycles shall be air-entrained, unless otherwise specified.
   b. Air-Entraining admixture shall conform to ASTM C260.
   c. Air-Entrainment shall be as indicated for each class as in the Concrete Schedule.
2. Water-Reducing, Set-Controlling Admixtures
   a. Water-Reducing, Set-Controlling admixtures shall conform to ASTM C494, Type A for water-reducing, Type C for accelerating, Type D for water-reducing and retarding, and Type E for water-reducing and accelerating.

B. Admixtures containing calcium chloride or soluble chloride shall not be used.

2.07 CURING AND SEALING COMPOUND - INTERIOR

A. Membrane-forming curing compound shall meet the moisture retention requirements of ASTM C309, Type 1. Kure-N-Seal, Sonneborn Division of BASF; Sealtight CS-309-25, W.R. Meadows, Inc.; Aqua-Cure VOX, Euclid Chemical Co.; or equal.

B. Shall be compatible with surface finish.

2.08 CURING COMPOUND - EXTERIOR

A. Curing compound shall comply with ASTM C309, Type 2; resin, white pigmented.

PART 3 CONSTRUCTION METHODS

3.01 COORDINATION

A. Examine the drawings and specifications for work of other sections or other contractors and coordinate such work with the requirements of this Section; make provisions for installation of such items as sleeves, pipes, conduits, inserts and hangers in a manner that will not impair or weaken concrete construction.

3.02 READI-MIX CONCRETE

A. Acceptability and Use. Readi-mix concrete shall be designed on the basis of strength, durability, impermeability, and exposure condition, as required for the intended use of the structure by methods specified in ACI 211.1 and ACI 318. All readi-mix concrete shall comply with the water-cement ratio for each specific class of concrete as specified in the Concrete Schedule. Concrete design mix, complete with sample test results shall be submitted to the Engineer for approval prior to placing any concrete.

1. Failure to Meet Strength Requirements. Failure to meet strength requirements shall be as defined in Concrete Quality Control- Division 01 of these specifications.

B. Mix Proportioning. Mix proportioning shall be the responsibility of the Contractor and shall be submitted for review and approval by the Engineer, in accordance with these specifications.

1. Select proportions for concrete to obtain the quality requirements for the class of concrete as specified in the Concrete Schedule. Contractor, at their expense, shall have an approved independent laboratory prepare design mixes for each specified concrete class.
2. Slump. Slump for class of concrete shall be as specified in the Concrete Schedule. The Contractor shall at their expense, make field slump tests in accordance with ASTM C143 and Concrete Quality Control-Division 03 of these specifications.
3. Adjustment to Concrete Mixes. Design mix adjustments may be requested by the Contractor when characteristics of materials, conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised design mixes and strength results shall be submitted and approved before using in the work. No change in contract price will be allowed for these changes.
4. Addition of Water to the Batch. Addition of water to the batch delivered to the site shall be in strict accordance with ASTM C94. This shall be the Contractor's responsibility and by their direction, following consultation with the Engineer.
    a. Addition of water to the batch shall be one time only. Total gallons of water added to the batch shall be recorded on the load ticket, which shall be supplied to the Engineer prior to that delivery truck leaving

the site. If water is permitted to be added to mixed concrete upon arrival at the job, an additional mixing of 30 revolutions of the drum shall be required.

b. Contractor shall adjust the water-cement ratio of the batch to the corresponding value based on the addition of water to the batch and shall submit this information to the Engineer with adjusted strength data for the final batch proportion.

c. At no time shall the addition of water cause the water-cement ratio specified in the concrete class schedule to be exceeded.

3.03 GENERAL

A. Unless otherwise specified, conform to ACI 304, 305, and 306 for concrete installation requirements such as preparation, mixing, conveying, depositing, curing, and cold and hot weather requirements; consolidate concrete in accordance with ACI 309.

B. Concrete not placed within 90 minutes or 300 revolutions, whichever occurs first, after the first mixing of the cement and aggregates will be rejected.

C. Contractor shall indicate on record set of Drawings at site, for review prior to installation, a pouring program for concrete work showing unit of operation, method of pouring, installation of construction/control joints, expansion joints and all necessary work.

D. Proper grade marker or stakes shall be used by Contractor to establish grades for ramps, platforms, sidewalks, slopes to drains, inlets, etc.

E. Trenches, forms, conveying equipment shall be prepared to receive concrete in accordance with ACI 304.

F. Place concrete footings upon undistributed clean surfaces, free from frost, ice, mud and water; when foundation is on dry soil or pervious material, lay waterproof sheathing paper over earth surfaces to receive concrete.

G. Rock surfaces upon which concrete is to be placed, make level, clean, free from all objectionable coatings, water, mud, debris, loose semi-detached or unsound fragments; level surfaces to receive sand cushion placed to minimum thickness of 2 inches.

H. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature and mechanical injury; maintain with minimum moisture loss and relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.

I. All freshly cast concrete shall be protected from damaging effects of the elements freezing, rapid drop in temperature and loss of moisture and from future construction operations.

3.04 PREPARATION OF EQUIPMENT AND PLACE OF DEPOSIT

A. Before placement, clean equipment for mixing and transporting the concrete; remove debris and ice from all surfaces upon which concrete is placed; clean reinforcement of dirt, loose rust, and mill scale, or other coatings.

B. Remove water from all areas before depositing concrete; before depositing new concrete on or against concrete that has set, thoroughly roughen; clean existing surfaces of laitance, foreign matter or loose particles; retighten forms; slush existing surfaces with neat cement grout coat; place new concrete before grout has attained initial set; give horizontal construction joints grout brush coat of cement, fine aggregate, in same proportions as concrete to be placed.

C. Thoroughly wet the stone base on which slabs are to be placed where no vapor barrier is indicated.

D. Check compaction of fill and proper grade for slabs-on-grade. Check screeds and exercise care to prevent disturbing screeds during placement.

E. Remove debris, excess form oil, and water from formwork; avoid washing newly deposited concrete.

3.05 MIXING

A. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 and ACI 304. The production facilities shall comply with the requirements of the National Ready Mixed Concrete Association Certification Plan as regards materials storage and handling, batching equipment, central mixer, truck mixers, agitators, non-agitating units, ticketing system, etc.

B. Do not over-mix; do not use concrete which is retained in mixers so long as to require additional water in excess of design mix water to permit satisfactory placing; retempering of mix is not permitted.

C. Concrete shall be delivered to the site of the work and the mixed concrete discharged completely within 1-1/2 hours after water has been added to cement. In hot weather, or under conditions contributing to quick stiffening of concrete, this time may be reduced by the Engineer.

D. Concrete delivered shall arrive at the site having a temperature not less than 50 Degrees F nor greater than 85 Degrees F, unless otherwise permitted by the Engineer.

3.06 CONVEYING

A. Convey concrete from the mixer to the final deposit by methods that will prevent segregation or loss of materials.

B. Use of aluminum conveyances is not permitted.

3.07 CONCRETE PLACEMENT

A. Place concrete, including drops greater than 60 inches using recommended practices in accordance with ACI 304 and ACI 318. Once pouring operation commences, it shall be carried out as a continuous operation until a section is completed.

B. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing; do not use vibrators to move concrete horizontally within the forms.

C. Do not use retempered concrete or concrete contaminated by foreign material.

D. Plan and conduct concrete placement to insure that the concrete is kept plastic and that the concrete is free of cold joints.

E. Where there is a time delay greater than 45-minutes between adjacent concrete placement, a bulkhead construction joint, must be installed.

F. Do not commence placing when the sun, heat, wind or limitations of facilities provided prevent proper finishing or curing.

G. Discontinue concreting when the descending natural air temperature falls lower than 40 Degrees Fahrenheit unless preparations are made and in place to heat or insulate concrete in accordance with the cold weather concreting requirements of this specification.

H. Concrete for walls shall be deposited in approximately horizontal layers not to exceed 18 inches in height to avoid segregation due to rehandling and flowing.

I. Concrete shall not be placed or poured in water. Excess water shall not be permitted. Powdering a mixture of cement to absorb excess water shall not be permitted.

J. Concrete shall be placed before initial set has occurred. Placing should be carried on in such manner that the concrete in the form is still plastic and can be integrated with fresh concrete.

K. Contractor shall notify Engineer of concrete pouring schedule one day in advance of pour to allow for inspection of reinforcing and forms.

L. Bottom dump buckets may be used for transporting mixed concrete to the desired location. Particular care shall be taken to avoid jarring or bumping as this may cause segregation.

M. Where chutes are used to transport concrete, they shall be of metal or wood with metal lining and should have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials. The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the form.

N. Elephant trunks and/or tremies shall be used in walls and columns to prevent free fall of the concrete and to allow the concrete to be placed through the cage of reinforcing steel.

O. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity. Loss of slump in pumping shall not exceed 1-1/2 inches.

3.08 CONSOLIDATION

A. Each concrete layer placed shall be compacted by mechanical internal vibrating equipment supplemented by hand spading, rodding, or tamping.

B. The period of concrete vibration shall not be less than two seconds nor more than five seconds at any one point.

C. Consolidate concrete thoroughly as it is placed in order to secure a dense mass; work concrete well around the reinforcement and embedded items and into the corners of the forms.

D. Use internal vibrators inserted vertically over the entire area of the placement; form vibrators not permitted; internal vibrators shall maintain a minimum of 5000 impulses when submerged in concrete.

E. Vibrate until voids are eliminated, coarse aggregate is suspended in mortar, and entrapped air bubbles begin to rise to the surface; concrete should move back into the space vacated by the vibrator; vibration duration shall be limited only to the time necessary to produce consolidation without causing segregation.

F. Space vibrator insertions such that the area visibly affected by the vibrator overlaps the adjacent just-vibrated area by a few inches.

G. Penetrate at least 6 inches into previously placed layers in order to bond between layers and avoid cold joints.

H. Take care not to over-vibrate air entrained concrete; place vibrator to eliminate honeycombing but avoid excess vibrating that bleeds all entrapped air from the mix.

I. Do not use vibrators to transport concrete.

3.09 JOINTS AND KEYWAYS

A. Construct expansion, control, and isolation joints and keyways only where indicated on the drawings.

B. Where the placing of concrete is discontinued, clean off laitance and other objectionable material to a sufficient depth to expose sound concrete as soon as concrete is firm enough to retain its form; smooth the top surface of concrete adjacent to the forms with a trowel to minimize visible joints on exposed faces.

C. Immediately upon completion of the work of placing concrete, remove accumulations splashed upon the reinforcement and the surfaces of the forms; perform this removal before concrete takes its initial set; clean reinforcing steel carefully to prevent damage to the concrete steel bond.

D. Do not halt work within 18 inches of the top of any face.

E. For bonded horizontal joint construction, roughen the surface and expose the aggregate; clean the surface thoroughly by wet sandblasting, by cutting with high-pressure water jet or by other approved methods; perform cleaning after the concrete has hardened to prevent raveling of the surface below the desired depth.

F. Before bonding concrete is placed, clean the surface of loose or soft particles or other objectionable materials and keep wet for a minimum period of 12 hours.

G. Cover the cleaned and saturated surface with a coating of neat cement grout and deposit new concrete before the grout has attained its initial set.

3.10 CURING

A. Use a curing compound on all flat work.

B. For exposed slabs with fiber mesh, before applying the curing compound, the exposed fibers shall be melted or burned off with a heat source.

C. Slabs: Immediately following slab finishing, apply liquid membrane-forming curing compound before the surface becomes dry.

D. Vertical Surfaces: When the forms are removed entirely, spray the surface with water and allow it to reach a uniformly damp appearance with no free water on the surface; apply curing compound or begin water curing.

E. For curing concrete under hot weather conditions, see Hot Weather Requirements in this section.

F. For curing concrete under cold weather conditions, see Cold Weather Requirements in this section.

3.11 CONCRETE WALL FINISHES

A. Complete screeding and darbying of top of walls before excess moisture or bleeding water is present on the surface.

B. Do not begin subsequent finishing operations until surface water has disappeared.

C. Refer to Concrete Schedule, included in this specification section, for finish type at each location, defined as follows:

1. Rough Form Finish: (Type W1)
   a. No form facing materials specified.
   b. Patch tie holes and defects.
   c. Chip off fins 1/4 inch or more in height.
2. Smooth Form Finish: (Type W2)
   a. Use a form facing material that will produce a smooth, hard, uniform texture on the concrete.
   b. Keep seams to a practical minimum.
   c. Patch tie holes and defects.
   d. Remove all fins.
3. Smooth Rubbed Finish: (Type W3)
   a. Produce a Smooth Form Finish.
   b. Wet surface and rub with a Carborundum brick until uniform color and texture are produced.
   c. Perform rubbing no later than 24 hours after forms are removed.
   d. Do not use any cement grout other than the paste drawn from the concrete itself by rubbing.
   e. Thoroughly wash the surface with water.
4. Smooth Troweled Finish: (Type W4)
   a. Produce a Smooth Rubbed Finish.
   b. After wet-rubbing, finish with a steel trowel to increase compaction of fines and to provide maximum density.
5. Smooth Finish (Grout Cleaned): (Type W5)
   a. Use for architectural surfaces exposed to general view, unless other indicated.
   b. Mix 1 part portland cement and 1-1/2 parts fine sand with sufficient water to produce grout having consistency of thick paint; use white portland cement in combination with normal portland cement to achieve uniform surface color after drying.
   c. Wet surface of concrete and uniformly apply grout with brush or spray gun completely filling air bubbles; surface with a wood float scouring wall vigorously.
   d. Allow grout to partially set for one to two hours, depending on weather conditions; in hot dry weather, keep damp, using fine fog spray.

e. When grout has hardened sufficiently to be scraped from wall with edge of steel trowel without removing grout from small air holes, cut off all grout that can be removed with trowel.

f. Allow surface to dry thoroughly then rub vigorously with dry burlap to completely remove dried grout; there shall be no visible film or grout remaining after this rubbing.

g. The entire cleaning operation for any area must be completed the day it is started; no grout shall be left on overnight, and sufficient time shall be allowed for grout to dry after it has been cut with trowel so it can be wiped off clean with burlap.

h. After entire surface has been grout cleaned, wipe off any slightly dark spots or streaks with fine abrasive hone.

3.12 CONCRETE SLAB FINISHING

A. Complete screeding and darbying slabs before excess moisture or bleeding water is present on the surface.

B. Do not begin subsequent finishing operations until surface water has disappeared and the concrete will sustain foot pressure with only approximately 1/4 inch indentation.

C. Refer to Concrete Schedule, included in this specification section, for finish type at each location, defined as follows:

1. Smooth Float Finish: (Type S1)
   a. Consolidate concrete with a power-driven disc-type float or a combination floating-troweling machine with metal float shoes attached.
   b. Machines which have a water attachment for wetting the concrete during the finishing operation are prohibited.
   c. Check and level surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge. Cut down high spots and fill low spots; immediately after re-leveling, refloat surface to a uniform, smooth, granular texture.
   d. Where slab drainage is indicated, take care to maintain accurate slopes for drainage.
2. Steel Troweled Finish: (Type S2)
   a. Produce a dense, smooth, and hard steel troweled surface finish. Comply with ACI 302.1R, paragraph 8.3.11.
   b. The floor shall meet ACI Class 5 minimum requirements.
   c. Appearance: Ridges, trowel marks, bumps, pits, splatter or other imperfections in the surface of the concrete floor are not allowed. The floor appearance shall be uniform over the entire surface.
   d. Floor flatness and levelness shall comply with the following ACI117 4.3, 4.4, and 4.5 and 302.1R 8.15 requirements as follows:
      1) $F_F = 35$
      2) $F_L = 25$

3. Broom Finish: (Type S4)
    a. Draw stiff broom over previous Smooth Float Finish, to obtain non-slip finish.

3.13 HOT WEATHER REQUIREMENTS

A. Comply with ACI 305R unless otherwise specified herein below.

B. Hot weather conditions are deemed to exist when the temperature in the forms is 75 Degrees Fahrenheit or above, or a combination of high air temperature, low relative humidity and wind velocity impair the quality of fresh or hardened concrete; take protective measures for mixing, transporting and placing concrete in accordance with ACI 305R.

C. The temperature of the concrete at the place of discharge may not exceed 85 Degrees Fahrenheit.
    1. If ice is used to lower temperature, place crushed, shaved or chipped ice directly into the mixer as part or all of the mixing water; mix until ice is completely melted.
    2. Record the concrete temperature at the time of discharge.

D. Do not add water that will cause the proportions to exceed the maximum water-cement ratio shown in Table I.
    1. Notify the Engineer before adding any water to the concrete mix.
    2. Record the amount of water added to the concrete at the jobsite.

E. Discharge concrete within 45 minutes or 100 revolutions, whichever occurs first, after the first mixing of cement and aggregates.

F. Placing and Curing:
    1. Place concrete promptly upon arrival.
    2. Provide at least one standby vibrator for each 3 vibrators in use.
    3. Protect concrete from direct sunlight; keep forms covered and moist by means of water sprinkling or the application of continuously wetted burlap or cotton mats for a minimum of 24 hours. Windbreaks and/or sunshades shall be provided as directed by the Engineer.
    4. When forms are removed, provide wet cover to the newly exposed surfaces to avoid exposure to hot sun and wind.
    5. Continue specified water curing methods for 10 days; leave covering in place 4 additional days; do not permit alternate wetting and drying cycles.
    6. For slabs on grade, beam and deck concrete, and other horizontal placements protect the surface between finishing operations using one or more of the following methods:
        a. Careful use of a fog nozzle.
        b. Spreading and removing polyethylene sheeting between finishing operations.

c. Application of mono-molecular film after the strike-off.

G. During extremes in weather, floor slabs shall not be cast unless the slab is protected by a roof and other suitable protective measures are provided. After curing has been completed, the floor shall be exposed to the air for 48 hours prior to allowing traffic on the floors.

3.14 COLD WEATHER REQUIREMENTS

A. Comply with ACI 306.1 (R2002) unless otherwise specified herein below.

B. Cold weather is defined any time when the daily temperature is 40 Degrees Fahrenheit or lower during placement and the protection period. If at any time during the progress of the work, the temperature drops below 40 Degrees F., the Contractor shall make suitable provisions to protect the concrete by use of insulation materials such as blankets, mats, etc., and equipment for providing artificial heat.

C. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelope. Combustion gases shall not be allowed in any temporary enclosure and building envelope.

D. Protect concrete surfaces from freezing for at least 24 hours after placement.

E. All surfaces in contact with newly-placed concrete including formwork, reinforcement and subgrade must be above 35 Degrees Fahrenheit.

F. Use preparation methods capable of producing concrete with a temperature not more than 85 Degrees Fahrenheit, and not less than 55 Degrees Fahrenheit, at the time of placement.

G. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, within the specified temperatures. (Do not heat water in excess of 140 Degrees Fahrenheit.)

H. Concrete shall have a temperature of not less than 55 Degrees Fahrenheit when placed; mix concrete at a temperature between:
   1. 60 Degrees Fahrenheit and 70 Degrees Fahrenheit when outside air temperature is above 30 Degrees Fahrenheit.
   2. 65 Degrees Fahrenheit and 75 Degrees Fahrenheit when outside air temperature is between 0 Degrees Fahrenheit and 30 Degrees Fahrenheit.
   3. 70 Degrees Fahrenheit and 80 Degrees Fahrenheit when outside air temperature is below 0 Degrees Fahrenheit.

I. Follow concrete placement with tarpaulins or other readily movable coverings, so only a few feet of concrete is exposed to the outside air at any time.

J. Maintain the temperature and moisture conditions specified in all parts of the newly placed concrete by covering, insulating, housing or heating; arrange for protection methods in advance of placement.

K. Maintain concrete at a temperature of not less than 55 Degrees Fahrenheit nor more than 70 Degrees Fahrenheit for a period of 3 days after placement.

L. A thermometer accurate to plus or minus 2 Degrees F shall be placed under the curing blanket. Additional insulation shall be supplied as required to maintain the temperature above 55 Degrees F.

M. After the curing period, the temperature of the exposed surface shall not be permitted to drop faster than 30 Degrees F in 24 hours.

N. Do not remove forms during the initial protection period.

O. Protect insulation against wetting that will impair its insulating value using moisture-proof cover material; keep insulation in close contact with concrete.

P. Construct enclosure to withstand wind and snow loads and be reasonably airtight; provide sufficient space between the concrete and enclosure to permit free circulation of heated air.

Q. Use vented heaters; do not permit heaters to heat or dry concrete locally. Unvented salamanders or other heaters which produce carbon dioxide as by-products shall not be permitted within enclosures or inside buildings. If heaters are used, precautions shall be taken to prevent drying of the slab through the use of water jackets or other suitable methods.

R. Maintain relative humidity above 40% within heated enclosures before construction supports are removed.

S. Monitor temperature to insure concrete is kept within specified limits recording time and concrete temperature every 8 hours.

T. Assure concrete has developed necessary strength before removing forms; provide additional test cylinders with the same protection as the structure they represent to verify concrete strength before construction supports are removed.

U. If water curing is used, terminate at least 12-hours before end of temperature protection period. Permit concrete to dry.

V. After the required protection period gradually reduce the concrete temperature within an enclosure or insulation at a rate not to exceed 20 Degrees Fahrenheit per day until the outside temperature has been reached.

W. Apply membrane forming curing compound to concrete surfaces during the first period of above-freezing temperatures after forms are stripped and before air temperature rises to 50 Degrees Fahrenheit; apply membrane forming curing compound to slabs as soon as finishing operations are completed, except where live steam curing is used.

3.15 DELIVERY TICKETS

A. With each load of concrete delivered to the job there shall be furnished by the ready-mixed concrete producer delivery tickets for the Contractor. Delivery tickets shall provide the following information:

1. Date and serial number of ticket;
2. Name of ready-mixed concrete plant;
3. Job location;
4. Contractor;
5. Type and brand name of cement;
6. Mix number or specified cement content in bags per cubic yard of concrete;
7. Truck number;
8. Time dispatched stamped by a time clock;
9. Amount of concrete in load in cubic yards;
10. Admixtures in concrete, if any;
11. Maximum size of aggregate;
12. Water added at job, if any;
13. Slump of concrete ordered

TABLE 1
CONCRETE CLASS SCHEDULE

Parameter Value	Compressive Strength (PSI) 28-Day	Water-Cement Ratio Maximum	Air Content Range (%) Minimum-Maximum	Slump Range (Inches) Minimum-Maximum	Coarse Aggregate (Inches) Maximum
Class A	4,000	0.5	1 to 2	2 to 4	3/4
Class B	4,000	0.5	1 to 2	2 to 4	1-1/2
Class C	4,000	0.5	5 to 7	2 to 4	3/4
Class D	4,000	0.5	4 to 6	2 to 4	1-1/2

TABLE 2
CONCRETE SCHEDULE
USES AND PROPERTIES

Use	Finish	Class and Considerations
Base Slabs and Foundation Walls	W2 S1 on top of the wall	Class C or D
Exterior Flat Work	S4	Class C or D
Interior Floor Slabs and Housekeeping Pads	S2	Class A or B

END OF SECTION

SECTION 04 05 00

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar and grout for masonry.

1.02 SUBMITTALS

A. Samples: Submit 3/8”x3/8”x4” mortar samples illustrating the proposed brick mortar color, for review by the Engineer and Owner.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Hot and Cold Weather Requirements: TMS MSJC Specification.

B. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mortar For Back-Up Wall Construction:
   1. Use premixed Portland cement, lime, and sand: SpecMix or BMI complying with ASTM C270. Type S (1800 psi).
   2. Factory mixed with products complying with the following:
      a. Portland Cement: ASTM C150, Type I, gray color.
      b. Mortar Aggregate: ASTM C144, standard masonry type.
      c. Hydrated Lime: ASTM C207, Type S.
   3. Masonry cement and site mixed mortars as not permitted.
   4. Mortar shall be standard gray.

B. Water: Clean and potable.

C. Grout Course Aggregate: ASTM C404.

2.02 MORTAR FOR FACE BRICK

A. Contractor shall perform an analysis on the existing mortar to determine what type and composition of materials it is.

B. Contractor shall determine what ratios of materials the mortar composition needs to be, including color, to match the existing mortar.

2.03 MORTAR MIXING

A. Thoroughly mix portland cement-lime mortar ingredients in accordance with ASTM C270 property specification requirements.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, re-temper only within two (2) hours of mixing.

E. Use mortar within two (2) hours after mixing at temperatures of 90 degrees F, or two-and-one-half (2½) hours at temperatures under 40 degrees F.

2.04 GROUT MIXES

A. Engineered Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; premixed type in accordance with ASTM C94 or mixed in accordance with ASTM C476 course grout.

2.05 GROUT MIXING

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 course grout.

B. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install mortar and grout to requirements in Section 04 20 00.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Existing Face Brick shall be salvaged where removed, cleaned, and reinstalled.

B. Bracing and shoring for existing walls where openings are being provided.

C. Concrete Masonry Units.

D. Reinforcement, Anchorage, and Accessories.

E. Masonry Cleaning.

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

A. Section 03 20 00 - Concrete Reinforcement: Reinforcing bars.

B. Section 04 05 00 - Mortar and Masonry Grout: Mortar and grout.

C. Section 05 50 00 - Metal Fabrications: Loose steel lintels. Lintel for exterior masonry wall shall be hot-dip galvanized after fabrication.

D. Section 07 21 13 - Board Insulation: Insulation for cavity spaces.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.04 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.05 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

B. The Engineer/Architect, general contractor on-site foreman, the on-site mason foreman, and the mason project manager must be in attendance at this meeting.

C. Review conditions of installation, installation procedures, and coordination required with related work.

D. All submittals must be submitted for all items and must have been accepted prior to this meeting.

E. No masonry work shall begin on site until after this meeting occurs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Concrete block, salvaged existing brick, and other materials stored on-site must be stored off the ground and be covered with plastic to prevent the material from becoming wet or covered with ice and snow. The material shall remain covered until it is used.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Hot and Cold Weather Requirements: International Building Code and The Masonry Society ACI 530.

1.08 COLD WEATHER PROTECTION

A. Temporary enclosures shall be constructed around the areas of work.

B. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelope. Combustion gases shall not be allowed in any temporary enclosure and building envelope.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Hollow Loadbearing Block Units: ASTM C90, Grade N, Type II, normal weight, 3275 psi minimum compressive strength on the net area.

B. Nonloadbearing Units: ASTM C129, Type II, hollow, normal weight, 3275 psi minimum compressive strength on the net area.

C. Masonry Units: Modular sized to thickness as indicated on drawings; provide special units for 90-degree corners, bond beams, sash units, end units, lintels, etc.

2.02 BRICK UNITS

A. Face Brick: Care shall be taken during the removal of the existing face brick so that it may be used in the wall reconstruction. Salvaged brick that will be reused shall be cleaned of all mortar and stored.

2.03 REINFORCEMENT AND ANCHORAGE

A. Face Brick Veneer Anchor: ASTM A580, type 304 stainless steel, 14 gauge adjustable wall anchor with back plate and solid legs through insulation at anchors to prevent crushing of the insulation and 3/16-inch diameter vee wall tie. Length of masonry anchors shall be to provide minimum 1 1/2-inch embedment in back-up wall. Length of wire tie shall be as required to provide 2-1/2 inches minimum embedment in the brick. Fasteners to be type 304 stainless steel, 3/16-inch masonry or concrete screws with minimum 1-inch embedment in masonry.
   1. X-Seal Anchor with VBT Vee Byna-Tie by Hohmann and Barnard.
   2. #1004X Type III X Screw On Veneer Anchor with #1100 Triangle by Wire-Bond.

B. Reinforcing Steel: Type as specified in Section 03 20 00.

C. Acceptable Manufacturers:
   1. Heckmann Building Products, Inc., 1501 N. 31st Avenue, Melrose Park, IL 60160; 800-621-4140.
   2. Hohmann & Barnard, Inc. (a MiTek – Berkshire Hathaway Company), 6100 S. New England Ave., Chicago, IL 60638; 800-323-7170.
   3. Wire-Bond (formerly Masonry Reinforcing Corp. of America), 400 Roundtree Road, Charlotte, North Carolina 28224; 800-849-6722.

2.04 MASONRY FLASHINGS

A. Flashing: 40 mil thick by 18 inch wide roll, self-adhering, self-sealing, and self-healing flexible composite membrane with a release sheet. Water based wall primer.
   1. Perm-A-Barrier Wall Flashing and Perm-A-Barrier WB Primer by Grace Construction Products.
   2. TeXtroflash Flashing and Primer-SA by Hohmann & Barnard.

B. Drip Plate: Type 304 stainless steel, 26 gauge flashing drip edge, 5-inch wide with 1/2-inch 45-degree factory bent hemmed exposed edge. Provide manufacturer's prefabricated corners and end dams, field formed are not acceptable.
   1. #1007 Hemmed Drip-Edge Flashing by Heckmann.
   2. Drip plate (DP) by Hohmann & Barnard.
   3. #4165 Drip Edge Flashing by Wire-Bond.

C. Termination bar: 1 inch to 1 1/2 inch tall, 26 gauge Type 304 stainless steel bar with 3/8-inch 45-degree bent top edge for sealant and 1/4-inch diameter holes at 8-inches on center for fasteners.
   1. #T2 Termination Bar by Hohmann and Barnard.
   2. #4210 Termination Bar by Wire-Bond.

D. Fasteners: Drive nail, Type 304 stainless steel. Zamac Alloy anchor body.
   1. Powers Fasteners Zamac Nailin stainless steel mushroom head, 1/4-inch diameter, 1.25 inch long fasteners for masonry walls.

2.05 ACCESSORIES

A. Building Paper: (as lintel slip plane) 15# asphalt saturated felt.

B. Expansion Joint Material: Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent, if not compressed more than 50 percent of original thickness.

C. Weeps: Polyester with 90% open weave mesh, flame retardant, anti-microbial, 2 1/2-inch by 3 1/2-inch, 3/8-inch to 1/2-inch thick. Color selected by Architect from manufacturer's standard colors.
   1. WeepVent by Mortar Net Solutions.
   2. Driwall Weep Vents by Keene Building Products.
   3. Or equal.

D. Backer Rod: Polyethylene foam rod or rope or other compatible non-waxing, non-extruding, non-staining resilient material as recommended by sealant manufacturer, closed cell, sized 25 percent wider than joint width.

E. Sealant: One-component elastomeric, non-priming, gun-grade polyurethane sealant. For concealed installation.
   1. Tremco Dymonic
   2. Master Builders MasterSeal NP 1

F. Hot-Dip Galvanizing Touch-Up Paint: Yield shall be 93% pure zinc metallic powder; meet ASTM B-117-64 salt spray (2000 hours); meets performance requirements of MIL-D-46105 and DOD-P-21035A.
   1. Crown Premium 7007 (formerly Aervoe #141) by Aervoe Industries
   2. or equal

2.06 MASONRY CLEANING SOLUTION

A. Provide type of cleaner from those listed and as recommend by brick manufacturer.
   1. Sure Klean Van Trol as manufactured by Prosoco, Inc.
   2. Sure Klean 600 detergent as manufactured by Prosoco, Inc.

2.07 LINTELS

A. Concrete block bond beams and lintels - size and reinforcement as shown.

B. Steel lintels - provided under Section 05 50 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

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

C. Verify built-in items are in proper location and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

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

C. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.03 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform dimension. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay concrete masonry units in stacked bond to match existing – field verify. Course one (1) block unit and one (1) mortar joint to equal 8 inches. All mortar joints shall be tooled concave (including concealed joints).

D. Lay brick in full running bond to match existing – field verify. Three (3) bricks and three (3) mortar joints to equal 8 inches. Mortar joints shall be tooled concave.

3.04 PLACING AND BONDING

A. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints and deep or excessive furrowing of mortar joints are not permitted.

C. Remove excess mortar as Work progresses.

D. Back bevel brick when placing in cavity wall.

E. Fully bond intersections at external and internal corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Take care to prevent breaking masonry unit corners or edges.

H. Cut mortar joints flush where a finished base is scheduled.

3.05 CAVITY WALL

A. Build inner wythe ahead of outer wythe to receive flashing and cavity insulation.

B. Install steel lintels as provided under Section 05 50 00. Galvanized coating shall be touched up as required. Install backer rod at each end of lintel to separate the steel plate from the face brick and masonry; set back from face of wall 1/2-inch.

C. Install masonry flashing as required by this section. Drip edge shall be exposed after installation of exterior escutcheon plate installed under Division 23.

D. Install insulation as required in Section 07 32 13 after installation of masonry flashings.

E. Do not install veneer until insulation of Section 07 32 13 is installed.

F. Install weeps in veneer at 16 inches on center horizontally above through wall flashing above lintels. Set face of weep back 3/8 inch from face of exterior wall to be flush with face of tooled mortar joint.

G. Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes. Back bevel mortar on cavity wall side of brick.

3.06 TOLERANCES

A. Variation from Unit to Adjacent Unit: 1/32 inch maximum.

B. Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

C. Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Variation from Level Coursing: 1/8 inch in 3 feet.

E. Variation of Joint Thickness: 1/8 inch in 3 feet.

F. Maximum Variation from Cross Sectional Thickness of Walls: Plus or minus 1/4 inch.

3.07 REINFORCEMENT AND ANCHORS

A. Install horizontal joint reinforcement 16 inches on center, unless noted otherwise.

B. Existing wall horizontal joint reinforcement (installed at 16-inches on center – verify) shall be cut back so that it extends 6-inches from existing masonry at wall openings.

C. Lap joint reinforcement ends minimum 6 inches.

D. Do not extend horizontal joint reinforcement across control or expansion joints, unless noted otherwise.

E. Reinforce all bond beams with two (2) #5 bars placed 1 inch from bottom web, unless noted otherwise.

F. Place reinforcing bars supported and secured against displacement. Maintain position within 1/2 inch of true dimension. Use rebar positioners to secure vertical reinforcement bars in place.

G. At all wall openings: Grout cores of blocks solid, minimum 24-inches below lintel bearing, and as shown on Drawings.

H. Anchors for veneer at masonry construction shall be placed at 16 inches on center vertically and horizontally.

3.08 MASONRY FLASHINGS

A. Install membrane flashing per manufacturer's instruction.

B. Apply primer to substrate. Allow to dry.

C. Install a stainless steel drip edge at the face of the veneer with the hemmed drip edge exposed out of the wall. Set drip in two beads of sealant. Flexible flashing to adhere on top of drip. Flashing shall extend to the wall face. Drip edge shall span the space between the back of the brick and the face of the wall insulation.

D. Form water dams located at the end of all flashing runs over openings.

E. Install aluminum termination bar the full length of the flashing at the top edge. Secure with fastener at 8 inches on center. Apply sealant along the top edge for the entire length.

3.09 LINTELS

A. Install loose steel lintels as scheduled and furnished under Section 05 50 00.

B. All steel lintels shall be hot-dip galvanized after fabrication, under Section 05 50 00. Touch up marks and scratches on lintels with hot-dip galvanizing spray paint prior to placement in wall construction.

C. Install reinforced unit masonry lintels over openings where steel lintels are not scheduled. Construct lintels using grout fill and reinforcing. Maintain minimum 8 inch bearing on each side of opening.

D. Use single piece reinforcing bars only.

E. Place and consolidate grout fill without displacing reinforcing.

F. Allow masonry lintels to attain specified strength before removing temporary supports.

3.10 GROUTED COMPONENTS

A. Install grout as provided under Section 04 05 00.

B. Remove excess mortar from grout spaces.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening, unless noted otherwise.

E. Work grout into masonry cores and cavities to eliminate voids.

F. Install grout per ACI 530.

3.11 BUILT-IN WORK

A. As work progresses, build in lintels and other items furnished by other Sections.

B. Build in items plumb and level.

C. Do not build in organic materials subject to deterioration.

3.12 CUTTING AND FITTING

A. Cut and fit for sleeves and lintels. Coordinate with other Sections of work to provide correct size, shape, and location.

B. Obtain Architect/Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

A. The face brick shall be cleaned with water and non-metallic tools at the end of each workday or within 24 hours of laying the units of excess mortar and mortar smears.

B. The concrete block shall be cleaned with water and non-metallic tools at the end of each workday or within 24 hours of laying in units of excess mortar and mortar smears.

C. Within two (2) weeks of initial placement, the face brick shall be cleaned of all excess mortar, smears, and residue with a masonry cleaning solution.

1. **Extreme caution must be taken with cleaning the wall or damage to the masonry can result.** The mortar must be maintained in a condition that after cleaning, the "skin" still remains on the mortar and no discoloration occurs to the mortar, brick, stone, or other components in or around the wall. The mason will take full responsibility for all damage that occurs during cleaning which could result in the requirement to replace the masonry construction.
2. All cleaners utilized must be acceptable to the brick manufacturer.
3. Follow the brick manufacturer and cleaning solution manufacturer's procedures and recommendations.
4. The cleaning solution must be premixed at the mason's shop in 55-gallon drums to the recommended dilution rate by the cleaning products manufacturer's recommendations.
5. A small test area of the building will be cleaned with the solution.
6. The wall is to be washed starting at the top and working all the way down to the bottom. Before applying the cleaning solution, the wall must be thoroughly soaked with water.
7. The wall must be thoroughly rinsed with water to remove the masonry cleaning solution.

D. Power washing of any kind is not acceptable.

3.14 PROTECTION OF INSTALLED CONSTRUCTION

A. At day's end, cover unfinished walls to prevent moisture infiltration.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated and primed steel equipment base and duct supports.

B. Shop fabricated and hot-dip galvanized steel equipment base supports.

C. Shop fabricated and hot-dip galvanized masonry lintel.

1.02 WORK PROVIDED BUT INSTALLED UNDER OTHER SECTIONS

A. Section 04 20 00 – Unit Masonry: Steel lintels.

1.03 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded constructions using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.04 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum three (3) years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept metal fabrications on site in labeled shipments. Inspect for damage.

B. Protect metal fabrications from damage by exposure to weather.

1.06 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC Codes of Standards Practice.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Shop Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plates, Angles, Studs and Dowels: ASTM A36, Fy = 36 ksi.

B. Fasteners: Expansion anchors.

C. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153/A153M for galvanized components.

D. Anchor Bolts: ASTM A307

E. Welding Materials: AWS D1.1; type required for materials being welded.

F. Shop and Touch-Up Primer: Tnemec Tneme-Zinc 90-97, no substitutions.

G. Paint: Tnemec Series 161 epoxy, no substitutions.

2.02 COMPONENTS

A. Following is list of principal items only. Refer to drawings for items not specifically scheduled.

B. Fabricated Lintels: Hot-dip galvanized after fabrication.

C. Welded Angles for Equipment Support: Hot-dip galvanized after fabrication.

D. Channel Frame for Equipment Support and Duct Supports: Shop primer – see Section 09 96 00 for requirements.

E. Anchor Bolts: Unfinished.

2.03 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FACTORY APPLIED FINISHES

A. All items to be galvanized shall be completely fabricated for field assembly before the application of zinc coatings.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Hot-dip galvanize fabricated items as indicated on Drawings.

2.05 GALVANIZING

A. Zinc coatings on assembled steel products shall meet the requirements of ASTM A123 and shall be applied in conformance with ASTM A385 for the recommended practice for providing high quality zinc coatings on assembled products, unless otherwise specified.

B. Zinc coatings on iron and steel hardware shall meet the requirements of ASTM A153 except that bolts, screws and other fasteners, 1/2 inch or less in diameter, may be coated with electro-deposited zinc or cadmium coating meeting the requirements of ASTM B633, Type RS, or ASTM B766, Type TS unless otherwise specified.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify equipment size prior to fabrication of equipment supports.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Field welding and cutting is not permitted.

C. Furnish lintel to Section 04 20 00 for installation.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum stair frame of structural sections, with closed risers.

1.02 REFERENCES

A. Minnesota State Building Code (MSBC), 2015 Edition.

1.03 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.04 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum three (3) years documented experience.

1.05 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum alloy products, unless otherwise specified, shall be Alloy 6061-T6.

B. Aluminum alloy products shall meet the requirements of the applicable ASTM Standard as follows.
   1. Sheet and plate: ASTM B209
   2. Drawn seamless tubes: ASTM B210
   3. Rolled or cold-finished bars, rods and wire: ASTM B211
   4. Extruded bars, rods, wire, shapes and tubes: ASTM B221
   5. Standard structural shapes: ASTM B308
   6. Extruded structural pipe and tube: ASTM B429

C. Stair Treads: Diamond plate aluminum; 12 inches deep; safety nosing; closed riser.

D. Bolts, Nuts, and Washers: ASTM A325.

E. Welding Materials:
   1. AWS D1.1; type required for materials being welded.
   2. Aluminum welding electrodes shall conform to the requirements of AWS A5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes".

2.02 FABRICATION

A. Fabrication of structural aluminum shall meet the requirements of Sections 6 and 7 of the Aluminum Construction Manual, "Specifications for Aluminum Structures", The Aluminum Association.

B. Fit and shop assemble in largest practical sections, for delivery to site.

C. Fabricate components with joints tightly fitted and secured.

D. Continuously seal jointed pieces by continuous welds.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Accurately form components required for anchorage of stairs to building structure.

H. Stairs shall be fabricated to be removable. The platform shall be a single, rigid section, with posts and stair run (stringers, treads/risers, and railing) being removable from the platform.

2.03 FINISHES

A. Aluminum shall be mill finished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

A. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates and angles required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Conceal bolts and screws whenever possible.

E. Field welding is not permitted.

F. Mechanically fasten joints butted tight, flush, and hairline.

G. Aluminum items to be in contact with concrete shall have a bituminous coating.

3.04 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 52 00

GUARDRAILS AND HANDRAILS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Aluminum guardrail on roof for fall protection at existing equipment where indicated on Drawings.

B. Aluminum guardrail and handrail at aluminum stair.

1.02 RELATED SECTIONS

A. Section 05 51 00 – Metal Stairs: Aluminum stair with landing and support posts.

1.03 REFERENCES

A. Minnesota State Building Code (MSBC), 2015 Edition.

1.04 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS AND MATERIALS

2.01 MATERIALS

A. Guardrails and handrails shall be 1-1/2 inch round, 6063 anodized aluminum alloy, Schedule 40 pipe size.

B. Post members shall be one continuous piece and spaced not more than 6 feet on center.

C. Toe boards to be 1/4-inch by 4-inch high aluminum plate.

D. Rails and connection shall be designed to resist a 200 pound load applied at any point on the handrail system per OSHA requirements.

E. Use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding.

PART 3 CONSTRUCTION METHODS

3.01 QUALITY ASSURANCE

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible, without delay to job progress. Allow for trimming and fitting wherever taking field measurements before fabrications.

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

3.02 FABRICATION

A. Where details are not shown:
   1. Guardrail: Top of top rail shall be 42 inches above floor or above stair treads measured vertically at the stair riser line. Center rail shall be equally spaced between floor or stair stringer and top rail.
   2. Handrail: top of top rail shall be 42 inches above floor or 36 inches above stair treads measured vertically at the stair riser line.

B. Fit and shop assemble components in largest practical sizes, for delivery to site.

C. Fabricate components with joints tightly fitted and secured.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Railings shall have mechanical connections consisting of internal plugs with stainless steel screws or rivets. Railings shall be mechanically fastened to the building structure.

F. Continuously seal joined pieces by continuous welds.

G. Form exposed work true to line and level with accurate angles and surfaces and straight, true edges. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown on the contract drawings. Form bent-metal corners to the smallest radius possible without causing grain separation of otherwise impairing the work. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline.

H. Accurately form components, to each other and to building structure.

I. Toe boards to be attached to railings with stainless steel bolts. Joints shall be provided as necessary to allow for expansion and contraction of toe board.

J. Fabrication of structural aluminum shall meet the requirements of Sections 6 and 7 of the Aluminum Construction Manual, "Specifications for Aluminum Structures", The Aluminum Association.

3.03 INSTALLATION

A. Perform cutting, welding and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack. Fit exposed connections accurately together to form tight hairline joints.

B. Do not weld, cut or abrade the surfaces of units which have been coated or finished after fabrication, and are intended for field connections.

C. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.

D. Space posts not more than 6 feet on centers, unless otherwise shown on the contract drawings. Plumb posts in each direction. Secure posts and rail ends to building construction as shown on drawings.

END OF SECTION

SECTION 07 21 13

BOARD INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and exterior cavity wall construction.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Section 04 20 00 - Unit Masonry: Insulation materials for cavity wall construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Polystyrene Insulation Type A: ASTM C578 Type IV; extruded cellular type, conforming to the following:
   1. Thermal Resistance: 5-year aged R-values of 5.4 and 5.0 minimum per inch thickness at 40°F and 75°F, respectively.
   2. Water Absorption: In accordance with ASTM C272, 0.1 percent by volume maximum.
   3. Compressive Strength: Minimum 25 psi.
   4. Flame Spread Index: Less than 75.
   5. Smoke-Developed Index: Less than 450.
   6. Thickness: Thickness indicated in schedule.

B. Manufacturers:
   1. DiversiFoam Products.
   2. Dow Chemical: Styrofoam brand.
   3. Foamular.
   4. Owens Corning.

2.02 ADHESIVES

A. Adhesive: Type recommended by insulation manufacturer for application.

2.03 FOAM SEALANT

A. Polyurethane insulating foam sealant; one-component, gun or straw applied; UL classified; containing no solvents, CFC's or VOC's; moisture-resistant.

B. Products:
   1. Great Stuff Pro by Dow Chemical Company.
   2. Handi-Foam by FOMO.

3. Kwik Foam by DAP, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

B. Verify substrate surface is flat, free of fins, irregularities, and materials or substances that may impede adhesive bond.

3.02 INSTALLATION

A. Foundation Perimeter:
   1. Adhere insulation to wall by applying 2 inch diameter spots of adhesive to insulation boards at 16 inches on center both ways.
   2. Butt edges and ends tight to adjacent board and to protrusions.
   3. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

B. Cavity Walls:
   1. Do not install until flashing of Section 04 20 00 installation is complete.
   2. Apply 2-inch diameter daubs of adhesive spaced approximately 12 inches on center both ways on inside face of insulation.
   3. Install boards horizontally.
   4. Place boards in a method to maximize contact bedding. Stagger joints. Butt edges and ends tight to adjacent board and to protrusions.
   5. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
   6. Install foam sealant at insulation joints and around penetrations through insulation. Once foam has set up, cut foam back to plane of insulation, so that it does not protrude beyond face of insulation.

3.03 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit Work to be damaged prior to covering insulation.

3.04 SCHEDULES

A. Perimeter Foundation Wall Insulation: Type A, extruded polystyrene, square edges, thickness to meet installation location requirements.

B. Cavity Wall Insulation: Type A, extruded polystyrene, square edges, 2-inch thick (shall match existing).

END OF SECTION

SECTION 07 51 01

BITUMINOUS ROOF FLASHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of existing built-up roofing with pea gravel and existing roofing insulation for installation of new guardrail.

B. Installation of new insulation at new guardrail and flashing new guardrail to existing roof system.

1.02 ENVIRONMENTAL REQUIREMENTS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Maintain continuous temporary protection during and prior to installation of new roofing system.

1.03 SCHEDULING

A. Remove only the existing roofing materials that can be replaced with new materials the same day.

B. Do not perform roof work on days when the weather forecast calls for rain or snow, or on days when it is raining or snowing.

1.04 QUALITY ASSURANCE

A. Applicator qualifications:
   1. Applicator shall have at least three (3) years experience in installing materials of types specified and shall have successfully completed at least three (3) projects of similar scope and complexity.

B. Single source responsibility for joint sealants:
   1. Obtain all products from single manufacturer to ensure compatibility.
   2. Manufacturer shall instruct applicator in procedures for system installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cold-applied, two-part Bituminous Flashing System:
   1. Elastomeric liquid applied flashing membrane consists of primer, flashing cement, and polyester scrim.
   2. JM Permaflash by Johns Manville or approved equal. System consists of the following:
      a. PermaFlash Primer (Low VOC): one-part solvent-based primer.
      b. MBR Flashing Cement: two-part, liquid-applied flashing material that cures to a durable, elastomeric film.
      c. PermaFlash Scrim: flexible stitch-bonded polyester scrim.
   3. Roofing Granules: Ceramic-coated roofing granules, colored pigment, bonded in a ceramic matrix and treated for long-term adhesion.

B. Insulation: Thickness and type to match existing.

PART 3 EXECUTION

3.01 MATERIALS REMOVAL

A. Remove only the amount of material required for the installation of the guardrail post and as required by the flashing system manufacturer. Cut openings square and even for neat and finished final appearance.

B. Contractor shall remove from the site all materials scheduled to be removed and dispose of properly. Removal and disposal of all materials shall be in compliance with all applicable rules, regulations, and codes.

C. The existing roof has not been tested for the presence of asbestos.

3.02 PREPARATION

A. Vacuum the deck surface at the guardrail post mounting location to remove all debris and dust from the deck before installing insulation.

B. Remove contaminates such as oils from guardrail surface with a solvent cleaner. Abrade only surfaces which will be concealed after installation.

C. Mask off with tape any areas not intended to receive flashing system.

3.03 INSTALLATION

A. Install insulation around railing post in thickness and type to match existing roofing insulation. Top of new insulation shall be flush with top of existing.

B. Install Bituminous Flashing System per manufacturer's installation instructions for each component. Apply liquid products in thicknesses per manufacturer's installation details and instructions.

C. Use masking tape to create straight and neat lines on the post and on the roof surface.

D. Broadcast granules into top coat of flashing system.

3.04 CLEAN UP

A. Dispose of unused materials per the manufacturer's recommendations and in compliance with all applicable local, State, and Federal rules, regulations, and codes.

B. Remove unused granules from existing roof surface.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Sealant and joint backing.

1.02 QUALITY ASSURANCE

A. Conform to Sealant and Waterproofers Institute requirements for materials.

B. Use skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

C. Applicator qualifications:
   1. Applicator shall have at least three (3) years experience in installing materials of types specified.

D. Single source responsibility for joint sealants:
   1. Obtain joint sealants from single manufacturer for each different product required to ensure compatibility.
   2. Manufacturer shall instruct applicator in procedures for intersecting sealants.

E. Perform work in accordance with ASTM C1193 guidelines, except where more stringent requirements are indicated or specified.

PART 2 PRODUCTS

2.01 GENERAL

A. Compatibility:
   1. Provide joint sealants, joint fillers, and accessory joint materials that are compatible with one another and with joint substrates under project conditions.
   2. Install joint sealants, joint fillers, and related joint materials that are nonstaining to visible joint surfaces and surrounding substrate surfaces.

B. Provide colors from manufacturer's standard color range, unless noted otherwise. Match color of substrate at installation location.

2.02 SEALANTS

A. Low Modulus Silicone Sealant:
   1. Vertical joints which are bordered on one or both sides by a porous building material such as concrete or masonry or a non-porous building material such as painted metal, anodized aluminum, or mill finish aluminum. Locations such as door frame perimeters; masonry joints; HVAC electrical penetrations.
   2. Tremco Spectrem 3, GE SCS2000 SilPruf.
   3. Primer for mortar, masonry, concrete, and other porous substrates: Tremsil Silicone Porous Primer.

B. Self-Leveling Polyurethane Sealant:
   1. Locations such as exterior concrete slab control and perimeter expansion joints.
   2. Color: Match floor color.
   3. BASF MasterSeal SL 1, Tremco THC-900, or Vulkem 45SSL.
   4. For areas where the slope of the slab makes self-leveling material impractical BASF MasterSeal SL 2, Tremco THC-901, or Vulkem 45SSL may be used.

2.03 ACCESSORIES

A. Primer: Non-staining type, as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, as recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Polyethylene foam rod or rope or other compatible non-waxing, non-extruding, non-staining resilient material as recommended by sealant manufacturer, closed cell, sized 25 percent wider than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces to receive sealants in accordance with sealant manufacturer's instructions and recommendations.

B. Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's recommendations for specified sealant.

C. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer, whether primers are required or not.
   1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
   2. Remove paints from joint surfaces except for permanent, protective coatings.
   3. Remove wax, oil, grease, dirt film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
   4. Remove loose materials and foreign matter.
   5. Remove dust by blowing clean with oil-free, compressed air.

D. Verify that joint backing and release tapes are compatible with sealant.

E. Measure joint dimensions and size materials to achieve required width/depth ratios.

F. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions, and SWI "Sealant: The Professional's Guide".

B. Where necessary to protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or caulking.
   1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
   2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

C. Provide backer rod uniformly to depth required by sealant manufacturer for proper joint design using a blunt instrument.
   1. Fit securely by compressing backer material 25 percent to 50 percent so no displacement occurs during tooling.
   2. Avoid stretching or twisting joint backer.
   3. Install to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where backer rod is not used or where recommended by sealant manufacturer, adhering strictly to the manufacturers installation requirements.

E. Prime joint substrates where required.
   1. Use and apply primer according to sealant manufacturers recommendations.
   2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.
   3. Prime immediately prior to caulking.

F. Install sealants immediately after joint preparation.

G. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles, and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.

H. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

I. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.

J. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

K. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities. Provide concave tooled joints.

L. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.

M. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove, and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of substantial completion.

N. Clean adjacent surfaces immediately and leave work neat and clean. Remove excess and droppings using recommended cleaners as work progresses. Remove masking tape immediately after tooling of joints.

3.04 CLEANING AND REPAIRING

A. Clean adjacent soiled surfaces.

B. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

SECTION 08 12 13

HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel frames.

1.02 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8, SDI-100 and ANSI A117.1.

B. Fire Rated Frame Construction: Conform to NFPA 252 and UL 10B.

C. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept frames on site in manufacturer's packaging. Inspect for damage.

B. Where specified, all products shall be marked with architects opening number on all doors, frames, misc. parts and cartons.

C. All materials upon receipt shall be inspected for damage, and the shipper and supplier notified if damage is found.

D. All frames shall be stored vertically under cover. Units shall be placed on at least 4-inch high wood sills or in a manner that will prevent rust or damage.

E. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided.

F. A minimum 1/4-inch space between the frames shall be provided to promote air circulation. If the wrapper becomes wet, it must be removed immediately.

G. Break seals on site to permit ventilation.

1.04 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.05 COORDINATION

A. Coordinate the work with wall opening construction, door, and hardware installation.

PART 2 PRODUCTS

2.01 FRAMES

A. Manufacturers:
   1. Ceco Door Products.
   2. Curries.
   3. Pioneer Industries.
   4. Republic Builders Products.
   5. Steelcraft.

B. Interior Frames:
   1. SDI-100 Level 2: 16 gauge minimum steel thickness.
   2. Fabricated of cold rolled steel in accordance with ASTM A1008.
   3. Rating: 1 1/2-hour.

2.02 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole. Provide three (3) single silencers for single doors on strike side.

2.03 FABRICATION

A. Fabricate frames as fully or continuously (full profile) welded unit.

B. Provide a minimum of three (3) anchors per jamb suitable for the adjoining wall construction.

C. Fabricate frames with hardware reinforcement plates welded in place.

D. Provide drilled holes in frame for silencers.

E. Fabricate frames with 4-inch head member, unless noted otherwise.

F. Attach metal fire rated label to each fire rated frame.

2.04 SHOP FINISHING

A. Prime finish: Frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion. All surfaces of the frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

B. Beginning of installation means acceptance of substrates.

3.02 INSTALLATION

A. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11, SDI-100 and DHI.

B. Install rated frames in accordance with NFPA 80. Any repair required to frame shall be conducted in accordance with NFPA 80.

C. Frames shall be installed in new opening in existing wall with existing wall anchors.

D. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 13 13.

END OF SECTION

SECTION 08 13 13

STANDARD HOLLOW METAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard steel doors.

1.02 QUALITY ASSURANCE

A. Perform work in accordance with ANSI A250.8.

B. Conform to requirements of SDI-100 and ANSI A117.1.

C. Fire Rated Door Construction: Conform to NFPA 252 and UL 10B.

D. Installed Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept doors on site in manufacturer's packaging. Inspect for damage.

B. Where specified, all products shall be marked with Architect's opening number on all doors, frames, misc. parts and cartons.

C. All materials upon receipt shall be inspected for damage, and the shipper and supplier notified if damage is found.

D. All doors shall be stored vertically under cover. Units shall be placed on at least 4-inch high wood sills or in a manner that will prevent rust or damage.

E. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided.

F. A minimum 1/4-inch space between the doors shall be provided to promote air circulation. If the wrapper becomes wet, it must be removed immediately.

G. Break seal on-site to permit ventilation.

1.04 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.05 COORDINATION

A. Coordinate the work with frame and hardware installation.

PART 2 PRODUCTS

2.01 DOORS

A. Manufacturers:
   1. Ceco Door Products.
   2. Curries.
   3. Pioneer Industries.
   4. Republic Builders Products.
   5. Steelcraft.

B. Interior Doors (Rated):
   1. SDI-100 Level 2, Model 1: 18 gauge, full flush.
   2. Fabricated of cold-rolled steel in accordance with ASTM A1008.
   3. Core: Kraftpaper honeycomb.
   4. Rating: 1 1/2-hour.

2.02 FABRICATION

A. Fabricate doors with lock, hinge, and closer reinforcement welded in place.

B. Attach metal fire-rated label to each door unit.

2.03 SHOP FINISHING

A. Prime finish: Doors shall be thoroughly cleaned, and chemically treated to ensure paint adhesion. All surfaces of the door exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

A. Install doors in accordance with ANSI A250.8, SDI-100, and DHI.

B. Install fire-rated doors in accordance with NFPA 80. Any repair required to door shall be conducted in accordance with NFPA 80.

C. Coordinate installation of doors with installation of frames specified in Section 08 12 13 and hardware specified in Section 08 71 00.

3.03 ADJUSTING

A. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Hardware for hollow steel 1 1/2-hour rated door and frame.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish templates to Sections 08 12 13 and 08 13 13 for door and frame preparation.

1.03 PERFORMANCE REQUIREMENTS

A. Fire-Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
   1. Hardware: Tested in accordance with NFPA 252.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
   1. ANSI A156 series.
   2. NFPA 80.
   3. UL 305.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.06 QUALIFICATIONS

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three (3) years experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with three (3) years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually with necessary fasteners, instrumentations, and templates; label and identify package with door opening code to match hardware schedule.

B. Protect hardware from theft by cataloging and storing in secure area.

1.08 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

B. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

C. Coordinate Owner's keying requirements during course of work, prior to submittal of shop drawings.

1.09 WARRANTY

A. Closer: Furnish 10 year warranty.

1.10 MAINTENANCE MATERIALS

A. Furnish special wrenches and tools applicable to each different or special hardware component.

B. Furnish maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hinges: Hager, McKinney, PBB, Stanley.

B. Exit Devices: Dorma, Sargent, Von Duprin.

C. Closers: Dorma, LCN. No substitutions.

D. Protection Plates: Builders Brass, Hager, Hiawatha.

2.02 FINISHES

A. Finishes are identified in Schedule at end of this Section.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Beginning of installation means acceptance of substrates.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of SDI, NFPA 80, and BHMA.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to centerline of hardware item shall comply with ADA, ANSI, and BHMA.

D. Conform to ADA and ANSI for positioning requirements for accessibility.

3.03 ADJUSTING

A. Adjust hardware for smooth operation.

3.04 PROTECTION OF INSTALLED CONSTRUCTION

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

3.05 SCHEDULE (H.S. = Hardware Set)

H.S.1 (for new mechanical room door) – 1 1/2-hour rated

3 butts	BB1199 32D	(Hager)
1 exit device	98-F 996L-BE-R/V	(Von Duprin)
1 closer	P4040XP Cush	(LCN)
1 kickplate	190S, 12 inch	(Hager)

NOTES:

1. Finishes:
   a. US26D/32D, unless noted otherwise.
   b. Closers sprayed aluminum, unless noted otherwise.
2. Hinge Size: 4½ inch by 4½ inch, unless noted otherwise.

END OF SECTION

SECTION 09 96 00

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall paint all surfaces required as indicated on the contract drawings and as specified herein. The work includes painting and finishing items and surfaces and preparation of surfaces to receive coatings throughout the project as shown on the drawings and in the Painting Schedule in this section, or by direction of the Engineer.

B. Paint all surfaces exposed to view whether or not colors are designated in "Schedules", except where the natural finish of the material is obviously intended or specifically noted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.

C. The work includes field painting of the following:
   1. existing and new masonry walls.
   2. existing and new concrete ceiling.
   3. new electrical conduit and boxes.
   4. new door and frame.
   5. miscellaneous painting.
   6. new steel lintel – shall be fully painted prior to installation.
   7. new exterior duct support – shall be fully painted prior to installation.

D. Contractor shall paint existing surfaces damaged by construction activities and surfaces to receive work. Surface preparation and painting system shall be as scheduled in this section. Color shall be selected by Owner from samples submitted by Contractor to as closely as possible match existing surfaces.

1.02 WORK NOT INCLUDED

A. Work of this section not include painting of ductwork, heating water pipes, existing surfaces not denoted to be painted on the Drawings.

B. Shop Priming: Unless otherwise specified, shop primer coats are included under the various sections for structural steel, miscellaneous metal, hollow metal work, and shop-fabricated or factory-built electrical equipment, and similar items.

C. Pre-Finished Items: Unless otherwise indicated, do not paint factory-finished or pre-finished items such as (but not limited to) finished mechanical and electrical equipment including light fixtures, switch gear and power distribution cabinets, or process piping with exterior bituminous coating.

D. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, except as otherwise directed.

E. Operating Parts: Do not paint any moving parts of operating units, slide and bearing surfaces, electrical parts, unless otherwise directed or; machined or polished surfaces of equipment where such surfaces are susceptible to rolling or sliding friction.

F. Labels: Do not paint over any required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.03 SUBMITTALS

A. Submit manufacturer's specifications, including label analysis and application instructions for each material specified.

B. Furnish a complete set of color cards of proposed products to the Engineer for color selection by the Owner.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

B. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area.

D. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Minimum Application Temperatures for Paints: 50 degrees F, unless required otherwise by manufacturer's instructions.

1.06 QUALITY CONTROL

A. Include on label of each container:
   1. Manufacturer's Name and Type of Material
   2. Federal Specification Number, if applicable
   3. Manufacturer's Stock Number and Batch Number
   4. Contents by Volume of Major Pigment and Vehicle Constituents
   5. Thinning Instructions
   6. Application Instructions
   7. Color

1.07 EXTRA MATERIAL

A. Provide a one (1) gallon container of each color, type, and finish to Owner for paint for walls and ceilings.

B. Provide one (1) quart container of each color, type, and finish to Owner for all other paint.

C. Label each container with color, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS AND MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. The products listed are intended to establish a basis for comparison of products of other manufacturers. Substitutions will be permitted but only with the prior written approval of the Engineer.

B. All materials specified herein, and approved for use under this Contract shall be manufactured by one of the Manufacturers listed as follows: Tnemec, Carboline, Ameron, Dupont, Sherwin-Williams, or equal.

2.02 MATERIALS

A. Provide the best grade (quality) of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable. Refer to the "PAINTING/COATING SCHEDULE" in this section for the types of paint and finishes to be applied to the various surfaces throughout the project.

B. Use only thinners recommended by the manufacturer and then only to the extent expressed on the latest printed data sheet.

PART 3 CONSTRUCTION METHODS

3.01 SUBSTRATE EXAMINATION

A. Examine all surfaces to which paint is to be applied, and the conditions under which the work is to be performed. The Applicator shall notify the Contractor and Engineer in writing, of any conditions detrimental to the performance of this work.

B. Do not proceed with this work until unsatisfactory conditions have been corrected and are acceptable to the Applicator. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions.

3.02 SURFACE PREPARATION, GENERAL

A. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items not to be painted, or provide surface applied protection prior to preparation and painting operations. Remove obstructions as necessary to permit complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, install the removed items by workmen skilled in the trades involved.

C. Clean surfaces to be painted before applying surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces.

3.03 PREPARATION, FERROUS METALS

A. Wash steel and iron surfaces with turpentine or mineral spirits to remove dirt and grease. Where rust or scale is present, prepare surface in accordance with the requirements as specified below:

1. Clean galvanized metal surfaces with turpentine or mineral spirits to remove oily residue. Dry with a clean cloth;
2. Touch-up paint structural steel, miscellaneous metal, hollow metal doors and frames and other materials which have been prime coated, as required, where shop coat has been damaged by welding or handling and erection; paint rivets, bolts and welds which are unpainted after assembly and erection.
3. Prepare steel substrates in accordance with the Steel Structures Painting Council surface preparation number indicated in the application schedule and as outlined below, unless otherwise required by the paint manufacturer's most recent printed application instructions:
    a. SSPC-SP-1-thoroughly wipe with aromatic/ketone solvent using clean rags and solvent;

b. SSPC-SP-6-good Commercial Finish;
c. SSPC-SP-7-surface Brush Blast using fine sand or grit to obtain finish similar to medium sand paper;
d. SSPC-SP-10-surface blast Near-White Metal Finish.

B. Apply primer immediately after surface preparation. Clean and touch up shop primer that has become marred.

3.04 PREPARATION, CEMENTITIOUS MATERIALS

A. Prepare cementitious surfaces of concrete, concrete block, cement plaster and fibrous-cement board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.
1. Fill cracks and irregularities with portland cement grout to provide uniform surface texture;
2. Etch with 5 percent solution by weight of muriatic acid. (Verify with paint manufacturer for this preparation);
3. Fill concrete masonry unit surfaces to be painted with block filler.

3.05 MATERIAL PREPARATION

A. Mix and prepare painting materials in accordance with the manufacturer's directions. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and, if necessary, strain the material before using.

3.06 COLORS

A. For estimating purposes, bidder shall assume that each individual room shall have one wall color. Ceilings may be painted different color than walls.

B. Hollow metal work will generally be enameled same color, but different color than adjacent walls.

C. Exposed conduit will be painted color and texture to match adjacent walls or ceilings.

D. Intermediate coats of paint shall be tinted slightly darker than each preceding coat unless otherwise directed. Undercoats shall be tinted slightly lighter than finish coats.

3.07 APPLICATION

A. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.

B. Apply each coat at the rate specified by the manufacturer; if material has thickened or must be diluted for application by spray gun, build up coat to the same film thickness

achieved with undiluted material; correct deficiencies in film thickness by application of additional coats of paint.

C. Do not apply exterior paint in cold, foggy, damp or rainy weather. Sprinkle floors to lay dust; do not apply finish in dusty rooms. Do not apply paint (exterior or interior) when temperature is lower than 50 degrees Fahrenheit.

D. Brush or roll materials smoothly in solid, even colors without drops, runs, lumps, defective brushing, discoloration or clogging of lines and angles. Make edges of paint adjoining other materials or colors sharp and clean without overlapping by masking edges of paint adjoining other materials or colors to obtain sharp, clean division.

E. Coats shall be thoroughly dry before applying succeeding coats. Unless otherwise approved, allow 48 hours minimum drying time between coats for interior work during favorable drying conditions. (Drying time shall be construed to mean "under normal conditions"; where conditions are other than normal because of weather or because painting must be done in confined spaces, longer drying times will be required.) Do not apply additional coats of paint or place unit in service until paint is thoroughly dry.

F. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, will be allowed; thin paint in strict accordance with the manufacturer's instructions and only with the full knowledge and approval of the Engineer.

G. Do not apply finish coats until after other trades, whose operations would be detrimental to finish painting, have completed work in the areas to be painted, and the areas have been approved by the Engineer for painting.

H. Touch up suction spots or "hot spots" in masonry or concrete after application of first coat and before applying second coat, to produce even result in finish coat. If undercoats, stains or other conditions show through the final coat of paint, apply additional coats until the paint film is of uniform finish, color and appearance.

I. Doors shall be finished on all edges, tops and bottoms in same manner as specified for faces.

J. Paint surfaces behind movable equipment the same as similar exposed surfaces.

K. Paint surfaces behind permanently fixed equipment with prime coat only.

L. Exposed conduit shall be painted to match background color, unless noted otherwise.

M. At completion, touch up and restore finish where damaged.

3.08 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damages by cleaning, repairing or replacing, and repainting, as directed by the Engineer. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.09 CLEAN-UP

A. During the progress of the work, remove from the project all discarded paint materials, rubbish, cans and rags. Upon completion of painting work, clean all window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.10 PAINTING SCHEDULE

A. Provide the following finish painting systems for the various substrates as shown on the contract drawings and/or schedules and as specified herein.
   1. Submit painting schedule to Engineer for color selection by Owner (see following for schedules);
   2. Apply paints to surfaces in accordance with the schedule;
   3. If surfaces have been primed at the mill, factory or shop, omit the surfacer coat specified hereinafter, except for touch-up; for touch-up, use surfacer of the same composition as the mill, factory or shop surfacer.

B. Substrates of "New or Previously Unpainted Surfaces" shall be defined and coated by painting systems scheduled as follows:

Substrate	System
1. Concrete and Masonry:	
Block Masonry, Interior	II
Concrete Walls, Interior	III
Concrete Floors, Interior	IV
Concrete Ceilings, Interior	V
2. Metals:	
Exterior Fabricated Steel Duct & Equipment Supports	VII
Building Accessories, Interior and Exterior (Such as trim, doors, frames, etc.)	IX
Galvanized Metals, Interior	X
Galvanized Metals, Exterior	None
Ferrous Metals, Interior and Exterior	XI
Mill, Factory Paint Piping, Equipment and Machinery, Interior and Exterior	XII
Mill Finish Aluminum	XIII

3.11 PAINTING SYSTEMS. PAINTING SYSTEMS SHALL BE DEFINED AS FOLLOWS:

A. System II

(Normal Service)

Surface Preparation:	Clean and dry and joints cured.
Surfacer:	One coat of Manufacturer, Block Filler Epoxy, applied by spray and backroller application, to a spreading rate of 90 square feet per gallon or to fill voids as needed.
Intermediate:	One coat of Manufacturer, Color, Polyamidoamine Epoxy, applied by spray and backroller application, to a spreading rate of 150 to 160 square feet per gallon.
Finish:	One coat of Manufacturer, Color, Polyamidoamine Epoxy, applied by spray and backroller application, to a spreading rate of 150 to 160 square feet per gallon.

B. System III

Surface Preparation:	Sweep blast all areas to be coated to remove laitance and create a rough sandpaper finish before coating is applied. Clean, dry and cured a minimum of 28 days and at a substrate temperature of 50 degrees Fahrenheit minimum.
Surfacer:	One coat thinned by volume per Manufacturer with Manufacturer's Thinner; Manufacturer, Color, Polyamidoamine Epoxy, and roller apply to a spreading rate of 140 square feet per gallon.
Intermediate:	One coat of Manufacturer, Color, Polyamidoamine Epoxy, roller apply to a spreading rate of 150 square feet per gallon, in the same color, this time without added thinner.
Finish:	One coat of Manufacturer, Color, Polyamidoamine Epoxy, to give longevity to the system by adding thickness, to a spreading rate of 180 square feet per gallon unthinned.

C. System IV

Surface Preparation:	Sweep blast all areas to be coated to remove laitance and create a rough sandpaper finish before coating is applied. Clean, dry and cured a minimum of 28 days and at a substrate temperature of 50 degrees Fahrenheit minimum.
Surfacer:	One coat thinned by volume per Manufacturer with Manufacturer's Thinner; Manufacturer, Color, Polyamidoamine Epoxy, and roller applied to a spreading rate of 140 square feet per gallon.

Intermediate: One coat of Manufacturer, Color, Polyamidoamine Epoxy, roller applied to a spreading rate of 150 square feet per gallon, in the same color, this time without added thinner and broadcast fine sand into it just inside doors and where non-skid additive is felt prudent.

Finish: One coat of Manufacturer, Color, Polyamidoamine Epoxy, to give longevity to the system by adding thickness, to a spreading rate of 180 square feet per gallon unthinned.

D. System V

Surface Preparation: Lightly sweep-blasted before erection or severely pole sanded before coating. Clean, dry and cured, free of form release oils, etc.

Surfacer: One coat thinned by volume per Manufacturer with Manufacturer's Thinner; Manufacturer, Color, Polyamidoamine Epoxy, applied by spray and backroller application, at a spreading rate of 150 square feet per gallon.

Finish: One coat of Manufacturer, Color, Polyamidoamine Epoxy, applied by spray and backroller application, to a spreading rate of 160 square feet per gallon.

E. System VIII

Surface Preparation: SSPC-SP-6 Commercial-grade blast level of cleanliness to 1.0-1.5 blast profile.

Surfacer: One even coat of Manufacturer, Zinc Primer, to a DFT of not less than 3.0 mils. Primer to be shop applied for new materials.

Shop or Field Intermediate: One even coat of Manufacturer, Color, Polyamide Epoxy, to an average DFT of 4.0 to 6.0 mils.

Finish: Two even coats of Manufacturer, Color, Aliphatic Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.

F. System IX

Surface Preparation: SSPC-SP-6 Commercial-grade blast level of cleanliness.

Surfacer: One even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of not less than 4.0 mils. Primer to be shop applied for new materials; field applied for existing materials.

Shop or Field Intermediate: One even coat of Manufacturer, Color, Polyamidoamine Epoxy, to an average DFT of 3.0 to 5.0 mils.

(Interior)

Touch-up in Field: Spot surface prepare by degreasing nuts and bolts and sanding and wire brushing the erection damage followed by a spot primer of Manufacturer, Color, Modified Polyamidoamine Epoxy, primer, brush applied in two coats to build a minimum of 5.0 mils over these areas. Apply a final finish coat by brush, roller or spray to these areas only to the extent of 3.0 mils DFT.

Finish: Once coat of Manufacturer, Color, Modified Polyamidoamine Epoxy, to an average DFT of 2.0 to 3.0 mils.

(Exterior)

Touch-up in Field: Spot surface prepare by degreasing nuts and bolts and sanding and wire brushing the erection damage followed by a spot primer of Manufacturer, Color, Modified Polyamidoamine Epoxy, primer, brush applied in two coats to build a minimum of 5.0 mils over these areas. Apply a final finish coat by brush, roller or spray to these areas only to the extent of 3.0 mils DFT.

Finish: Once coat of Manufacturer, Color, Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.

G. System X

(Non-Immersion Service)

Surface Preparation: Sweep-blast to roughen new spangle on the galvanized surface. Follow this with solvent cleaning to the extent of an SSPC-SP-1 level of cleanliness.

Surfacer: One coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.

Finish: Once coat of Manufacturer, Color, Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.

(Immersion Service)

Surface Preparation: Blast to the extent of an SSPC-SP-10 near-white level of cleanliness and apply primer before any rust bloom reforms.

Surfacer: One coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.

Finish: One coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 6.0 to 8.0 mils.

H. System XI

(Non-Immersion Service)

Surface Preparation:	Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness and prime before any rust bloom reforms.
Shop Primer:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Intermediate:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Field Finish:	Spray apply one field finish coat of Manufacturer, Color, Acrylic Polyurethane, to a minimum DFT of 2.0 to 3.0 mils.
(Immersion Service)	
Shop Surface Preparation:	Blast to the extent of an SSPC-SP-10 near-white level of cleanliness and apply primer before any rust bloom reforms.
Shop Primer:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Intermediate:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Field Finish	Spray apply one field finish coat of Manufacturer, Color, Polyamidoamine Epoxy, to a minimum DFT of 2.0 to 3.0 mils.

I. <u>System XII</u>

Shop Surface Preparation:	Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness and prime before any rust bloom reforms.
Shop Primer:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Intermediate:	Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Field Finish	Spray apply one field finish coat of Manufacturer, Color, Acrylic Polyurethane, to a minimum DFT of 2.0 to 3.0 mils.

J. <u>System XIII</u>

Surface Preparation:	Sweep-blast to roughen new spangle on the mill surface. Follow this with solvent cleaning to the extent of an SSPC-SP-1 level of cleanliness.
Surfacer:	One coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
Field Finish(es):	Once coat of Manufacturer, Color, Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.

PAINTING/COATING SCHEDULE
NEW OR PREVIOUSLY UNPAINTED SURFACES

SYSTEM		PROCESS		DUPONT	TNEMEC	CARBOLINE	AMERON	SHER.-WILL.
System Number	Surface	Preparation	Coats	Product	Product	Product	Product	Product
II	Block Masonry, Interior	Clean and Dry, Joint Cured	Surfacer	300P	Series 69	Flexxide Block Filler	Amerlock 400	Heavy Duty Block Filler
			Intermediate	72P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	72P	Series 69	890	Amerlock 400	Macropoxy 646
III	Concrete Walls, Interior	Sweep Blast, Clean and Dry	Surfacer	Corlar 823	Series 69	890	Amerlock 400	Macropoxy 646
			Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	25P	Series 69	890	Amerlock 400	Macropoxy 646
IV	Concrete Floors, Interior	Sweep Blast, Clean and Dry	Surfacer	Corlar 823	Series 69	890	Amerlock 400	Macropoxy 646
			Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	25P	Series 69	890	Amerlock 400	Macropoxy 646
V	Concrete Ceilings, Interior	Sweep Blast or Pole Sanded, Clean and Dry	Surfacer	Corlar 823	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	25P	Series 69	890	Amerlock 400	Macropoxy 646
VII	Exterior Duct And Equipment Supports	SSPC-SP-6	Surfacer		Series 90-97			
			Shop or Field Intermediate		Series 161			
			Touch-up		Series 161			
			Finish		Series 73			

PAINTING/COATING SCHEDULE
NEW OR PREVIOUSLY UNPAINTED SURFACES

SYSTEM		PROCESS		DUPONT	TNEMEC	CARBOLINE	AMERON	SHER.-WILL.
System Number	Surface	Preparation	Coats	Product	Product	Product	Product	Product
IX	Building Accessories, Exterior	SSPC-SP-6	Surfacer	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Shop or Field Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Touch-up	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	326 Imron	Series 73	Carbothane 134 HG	Amershield	Acrolon 218
IX	Building Accessories, Interior	SSPC-SP-6	Surfacer	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Shop or Field Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Touch-up	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	25P	Series 69	890	Amerlock 400	Macropoxy 646
X	Galvanized Metals, Interior	SSPC-SP-1	Surfacer	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Finish	326 Imron	Series 73	Carbothane 134 HG	Amershield	Acrolon 218
XI	Ferrous Metals, Interior and Exterior	SSPC-SP-6	Shop Primer	25P	Series 69	890	Amerlock 400	Copoxy
			Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646
			Field Finish	326 Imron	Series 73	Carbothane 134 HG	Amershield	Acrolon 218
XII	Mill, Factory or Shop Paint	SSPC-SP-6	Shop Primer	25P	Series 69	890	Amerlock 400	Copoxy
			Intermediate	25P	Series 69	890	Amerlock 400	Macropoxy 646

PAINTING/COATING SCHEDULE
NEW OR PREVIOUSLY UNPAINTED SURFACES

SYSTEM		PROCESS		DUPONT	TNEMEC	CARBOLINE	AMERON	SHER.-WILL.
System Number	Surface	Preparation	Coats	Product	Product	Product	Product	Product
	Piping, Equipment and Machinery (Interior)		Field Finish	326 Imron	Series 73	Carbothane 134 HG	Amershield	Acrolon 218

END OF SECTION

SECTION 22 01 20

PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL CONDITIONS

A. This section applies to and forms a part of each of the Sections of Division 22 and together with each Section, is subject to the following requirements:
   1. Instructions to Bidders
   2. General Conditions
   3. Supplementary General Conditions
   4. Division 01: General Requirements

1.02 RELATED SECTIONS

A. Section 01 30 00 - Administrative Requirements

1.03 INCLUDED SECTIONS

A. Section 22 01 55 - Plumbing Site Conditions

B. Section 22 01 60 - Plumbing Piping Procedures

C. Section 22 01 70 - Plumbing Submittals

1.04 SCOPE OF WORK

A. The Work under this Division of the Specifications consists of furnishing all construction engineering, supervision, labor, equipment, fixtures, materials, all incidentals, related items and appurtenances, and performing all operations necessary to complete the installation of Work in strict accordance with these Specifications and Drawings.

B. All work shall be finished, tested and ready for operation and use.

C. The term "provide" shall mean "furnish and install complete and ready for use".

1.05 DISCREPANCIES OR OMISSIONS FROM SPECIFICATIONS OR DRAWINGS

A. Notify the Engineer of any discrepancies in, or omissions from the Specifications or Drawings. The Owner's Construction Representative will not be responsible for any oral instructions or modifications of the Specifications or Drawings. Written interpretations will be made only by Addenda. Discrepancies discovered during construction shall immediately be called to the attention of the Construction Representative for decision.

1.06 DRAWINGS

A. The Drawings indicate the extent and general layout of the Plumbing systems

intended for the building. Furnish offsets, fittings, valves and accessories as required but not shown because of the scale of the Drawings.

B. In general, the Plumbing Drawings are drawn to scale as indicated, however, do not scale the Plumbing Drawings. Refer to the Architectural Drawings for dimensions, details of construction, locations of partitions, walls, suspended ceilings, ceiling heights and other pertinent information. Architects Drawings shall not take precedence over field measurements.

C. Coordinate Work with the work of other trades. Make reasonable modifications in layout to avoid conflict with the work of other trades and for proper execution of the Work at no additional cost to the Owner.

D. All Drawings and Specifications shall be considered in bidding. The Drawings and Specifications are complimentary, and what is called for in either shall be as binding as though called for in both.

1.07 SUBSTITUTION REQUESTS

A. Refer to Section 01 25 00 - Administrative Requirements, for proper procedures on product and equipment substitutions.

1.08 INSPECTION OF SITE

A. Contractor shall inspect the site of the proposed Work and note the conditions under which the Work is to be performed.

1.09 PERMITS AND FEES

A. Contractor shall obtain all permits required for the performance of the Mechanical Work and shall submit complete certified Drawings and Specifications with the permit application to the authority having jurisdiction.

B. Contractor shall pay for all sales tax, fees, licenses, permits, charges for connections to outside services, use of property for storage of materials and other costs pertaining to the Mechanical Work.

C. Contractor shall coordinate and request all inspections and approvals as required. Contractor shall notify the Owner's Construction Representative of date and time of all coordinated inspections and shall submit certificates of inspection and final approval of the inspection authority.

1.10 APPLICABLE CODES AND STANDARDS

A. Construction shall be in conformance with the latest amended edition of the State Building Code, including requirements of other codes, standards and regulations adopted by reference as a part thereof. Contractor shall comply with any requirements of the Drawings and Specifications that exceed the State Building Code requirements.

B. All materials, equipment and their installation shall conform to the applicable sections of the following current Codes for the State of Minnesota:

1. International Building Code, IBC 2012.
2. International Mechanical Code, IMC 2012.
3. Uniform Plumbing Code, UPC 2012.
    a. Minnesota State Plumbing Code Amendments.
4. International Fire Code, IFC 2012.

1.11 WORKMANSHIP

A. All the Work shall be performed in a craftsmanship manner by workmen thoroughly trained and experienced in the Work they are to perform.

B. Refer to Specification Section 22 01 55 - Plumbing Site Conditions and Section 22 01 60 - Plumbing Piping Procedures for further direction.

1.12 ACCIDENT PREVENTION

A. Comply with the "Safety and Engineering Practices" set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America and with all applicable state and local safety laws, regulations and ordinances as well as the Owner's established safety rules.

B. Provide and properly maintain warning signs and lights, barricades, railings and other safeguards for the protection of workmen and others on, about or adjacent to the work as required by the conditions and progress of the Work.

1.13 SITE AND BUILDING CLEANLINESS

A. During construction, provide for orderly storage and removal of all construction debris, cartons, packing cases and other such items in a manner to reduce fire and accident hazards.

B. Contractor shall clean the working area each day and shall remove all trash and waste materials, and shall maintain the Site in a neat and orderly condition throughout the construction period.

C. Contractor shall daily, or as it becomes apparent, pick up all garbage, litter, debris and other materials attributable to the Work or the activities of Contractor's employees, Sub-Contractors and Suppliers, that accumulates on the property in the vicinity of the Site.

1.14 WORK SCHEDULE

A. Examine the Drawings and Specifications to determine the extent and details of the Work to be performed.

B. Submit a construction work schedule for approval to the General Contractor.

C. The schedule must be suitable to all parties concerned.

D. The schedule shall be a guide to construction operations and progress shall conform, as nearly as possible to the schedule. Notify the General Contractor at least one week in advance of any changes to the schedule.

E. Be responsible for scheduling and arranging all Mechanical work for the orderly progress of the project.

1.15 COORDINATION OF WORK

A. Coordinate the Mechanical Work with the General Contractor and other Sub-Contractors.

B. Inform the General Contractor at least twenty-four (24) hours in advance of any service interruption or disruption to construction operations and estimate the duration of interruption or disruption. Do not proceed until the General Contractor has been fully informed and has granted his approval.

1.16 RECORD DRAWINGS

A. Contractor shall maintain one set of Drawings at the job site for use as a record copy. Each change order or other revisions, deletions, or additions, shall be clearly marked and noted by colored marker. Where any material, ductwork, piping or system component is installed different from what is shown on the Construction Documents, record such differences clearly and neatly. This record set of Drawings shall be submitted to the Owner's Construction Representative upon completion of the project.

B. Contractor shall note on the record drawings the elevations and/or inverts of water main, sanitary sewer and storm sewer where they enter or exit through and beneath the building foundation. Contractor shall record dimensions from the building to fuel tanks, oil piping, etc. located outside the building.

1.17 SHOP DRAWINGS

A. Submit Shop Drawings for all materials and equipment in accordance with General Requirements Section 01 33 00 - Submittal Procedures.

B. All cuts have complete dimensions, ratings, installation requirements, etc.

C. Shop Drawings will not be accepted for review by the Architect/ Engineer until after they have been checked and approved by the Contractor as evidenced by his approval stamp and signature.

D. Where the Specifications state "or equal" or "or approved equal", manufacturers other than those listed may be substituted in accordance with Section 01 25 00 - Substitution Procedures.

1.18 OPERATION AND MAINTENANCE MANUALS

A. Submit two (2) copies of Operation and Maintenance Manuals for all Plumbing systems and equipment in accordance with General Requirements Section 01 78 23 - Operation and Maintenance Data and Section 22 01 70 - Plumbing Submittals.

1.19 COMPLETION

A. The Work shall be completed for service on the date stipulated in the Contract.

B. Correlate and finish the Work so that the affected areas and systems will be adjusted, cleaned and placed in proper working order at the time of the substantial completion observation.

C. Prior to final inspection, thoroughly clean the surfaces of all floor drains, fixtures and equipment furnished and installed under this Work. Refer to Section 22 01 70 - Plumbing Submittals for further direction.

1.20 WARRANTIES

A. Submit two (2) copies of the Warranty Manual in accordance with Section 01 78 00 - Closeout Submittals and Section 22 01 70 - Plumbing Submittals.

B. Refer to technical sections for extended warranties on equipment where stipulated.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 22 01 55

PLUMBING SITE CONDITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waste Management Procedures

B. Cleaning and Protection.

C. Final Cleaning.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Methods of trash/ waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

C. Regulatory Requirements: The Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and Local requirements, pertaining to legal disposal of all construction and demolition waste materials.

3.02 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/ rubbish from site periodically and dispose off-site; do not burn or bury.

3.03 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual Specification Sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.04 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Provide new filters for all new equipment installed under this contract.

E. Provide an extra set of filters for all new equipment installed under this contract. Coordinate with the Owner for placement.

F. Clean debris from roofs, gutters, and drainage systems.

G. Remove waste, surplus materials, trash/ rubbish, and construction facilities from the site; dispose of in a legal manner; do not burn or bury.

H. Prior to final inspection, thoroughly clean surfaces of all floor drains, fixtures and equipment furnished and installed under this Work. Remove all stickers, rust, stains and other foreign matter or discoloration.

END OF SECTION

SECTION 22 01 60

PLUMBING PIPING PROCEDURES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers pipes, pipe fittings, valves and unions and applies to and forms a part of each of the sections of Division 22.

B. Pipes, pipe fittings, valves and unions shall be in accordance with this and other applicable Sections of these Specifications and the requirements stated in Section 22 01 20 - Plumbing General Provisions, Section 22 05 00 - Common Work Results for Plumbing.

PART 2 PRODUCTS

2.01 PIPE, PIPE FITTINGS, VALVES AND UNIONS

A. Plumbing pipe, pipe fittings, valves and unions are Specified in Section 22 10 05 - Plumbing Piping.

B. Plumbing specialties are Specified in Section 22 10 06 - Plumbing Piping Specialties.

PART 3 EXECUTION

3.01 ABOVE GROUND PIPING INSTALLATION

A. General:
   1. Install piping, valves and specialties indicated and as sized on the Drawings and supported as specified in Section 22 10 05 - Plumbing Piping.
   2. Locate piping as dimensioned, locate piping by scaling the Drawings.
   3. Coordinate piping locations with the work of Other Trades.
   4. All piping shall be installed parallel or perpendicular to adjacent walls and partitions, unless otherwise shown. All risers shall be plumb.
   5. Under no circumstances shall any pipe connection be made by punching a hole in the pipe and inserting a branch take-off.

B. Clearances:
   1. Provide clearance around each pipe to accommodate the specified insulation thickness and jacketing and to permit its free movement due to thermal expansion.

C. Preparing and Protecting Pipe:

1. All piping shall be blown out with compressed air or otherwise cleaned internally immediately prior to installation into the pipe line.
2. Cap or cover all open piping during erection to prevent entry of foreign material.

D. Pipe Termination for Future:

1. Cap terminated ends of pipe mains and branches where indicated for future extension.
2. Provide flanges or screwed unions at all connections to equipment.

E. Changes in Pipe Sizes:
1. Increasers may be concentric.
2. Reducers shall be eccentric:
   a. Flat on top for water.

F. Branch Take-Offs:
1. Service water branch take-offs shall be off the top of the mains and at a 90° angle, unless otherwise shown.

G. Equipment Piping:
1. All branch piping for connections to equipment shall consist of at least two elbows to ensure proper alignment and to eliminate pipe stresses on the equipment.
2. Cap or cover all open piping during erection to prevent entry of foreign material.

H. Piping to Automatic Control Valves:
1. Piping to automatic control valves shall be run line size as close as possible to valve connections. Install eccentric reducers at valve inlets and concentric increasers at valve outlets. Provide unions or flanges for easy removal of automatic control valves. Strainers ahead of control valves shall be line size.

I. Piping to Pumps:
1. Piping to pumps shall be run line size as close as possible to pump connections. Pump shut-off valves shall be line size. Provide eccentric reducer, flat on top, at pump suction to reduce from line size to pump suction connection size. Provide concentric increaser at pump discharge to increase from pump discharge connection to line size. Long radius reducing elbows may be substituted for reducers and increasers specified above if radius of turn is in the vertical plane.

J. Pipe Anchors:
1. Provide pipe anchors where shown on the Drawings and where they are otherwise needed to prevent excessive movement of piping and/ or excessive strain on piping and equipment connections.

K. Spring Hangers:
1. Provide spring hangers where shown on the Drawings to prevent excessive forces from being transmitted to building structure.

L. Piping Near Electrical Panels:
   1. Where it is not possible to avoid installing pipe joints or valves in piping within 3'-6" in horizontal direction from electrical panels or equipment, provide drip pan, sized to afford protection and constructed of properly supported galvanized sheet metal.

M. Wells and Pressure Taps:
   1. Install wells and pressure taps as required for thermometers and pressure gauge locations specified in Section 22 05 19 - Thermometers and Gages.

3.02 CUTTING AND THREADING

A. Pipes 2" and smaller shall be cut, threaded and reamed with appropriate sharp tools.

B. Pipe shall be accurately cut to measurement. Springing or forcing of piping resulting from error in measurement is not acceptable.

C. Clean and remove all metal chips, cutting oil and other foreign material from both inside and outside of pipe before making up joints.

D. Where welding is required, remove cuttings oils with cleaning solvents.

3.03 SCREWED CONNECTIONS

A. Threads for screwed connections shall be ANSI Standard tapered pipe threads B2.1.

B. Remove fins and burrs from pipe and fitting before making up joint.

C. Screwed connections shall be made using approved pipe thread compound or sealant.

D. Obtain full thread engagement in fittings as described in ANSI B2.1. Backing off threaded joints for alignment shall not be permitted.

E. Whenever a threaded joint is separated, remove old compound or sealant remaining on all threads before applying new.

3.04 WELDED CONNECTIONS

A. Standard seamless butt weld elbows, tees and reducers shall be used with all welded pipe. Weldolets, Thredolets, or Socolets may be used on pipe sizes 4" and larger where pipe reduction is two (2) sizes or more.

3.05 FLANGED CONNECTIONS

A. Clearance between flanged faces shall be such that joints can be gasketed and bolted tight without producing strain on the piping system.

B. Connections shall be made with faces parallel and bores concentric.

3.06 SOLDERED CONNECTIONS

A. All soldered type joints shall be made with materials specified for the respective service. The amount of solder and flux used per connection shall be the minimum required to assure a tight joint. All soldered pipe ends shall be reamed with

appropriate sharp tools prior to soldering.

3.07 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be used when joining piping of dissimilar metals such as copper to steel, cast iron, or malleable iron.

B. Connections shall be made with dielectric screwed unions or with flanges having non-conducting gasket, washers and bolt inserts.

C. Underground utility services entering buildings shall have dielectric connections installed on the outlet side of the first shut-off valve.

3.08 SOLVENT JOINED CONNECTIONS

A. All PVC and CPVC pipe and fittings shall be joined according to the pipe and fitting manufacturer's written instructions.

3.09 ROLLED GROOVE PIPING

A. Pipe shall be prepared in accordance with the latest published Victaulic specifications. Pressure ratings and end loads for roll grooved pipe shall be based upon tests on pipe prepared in accordance with Victaulic specifications using Victaulic Vic-Easy Roll Grooving Tools. Grooved end pipe shall be grooved in accordance with Victaulic standard specifications.

B. Couplings, fittings, valves and pipe shall be assembled in accordance with latest published instructions from Victaulic Company of America for the particular product to be installed.
   1. Pipe shall be checked to be certain it is sufficiently free of indentations, projections, grooves, weld seams, or roll marks on the exterior of the pipe over the entire gasket seating area to assure a leak-free seat for the gasket.
   2. Pipe ends shall be cut square.
   3. Grooving and cleaning shall be in accordance with Victaulic pipe preparation specifications.
   4. All gaskets shall be as specified.
   5. All coupling/ fitting assemblies shall be lubricated with a thin coat using Victaulic Lubricant, applied by brush or hand. The gasket exterior including the lips and/ or pipe ends and housing interiors shall be thoroughly lubricated.
   6. Ensure proper gasket seating and alignment during installation.

3.10 PLACEMENT OF VALVES

A. Furnish and install shut-off valves at the following locations:
   1. Each branch line take-off from main supply pipe or header.
   2. At all end of line equipment.
   3. Ahead of each control valve.
   4. Each branch line take-off from main supply pipe or header indicated for future extension or connection. Cap outlet side of shut-off valve.
   5. On strainer blow-down piping.

B. Furnish and install drain valves at the low points of each water piping system for

drainage.

C. Furnish and install designated valves at other locations indicated on the Drawings.

3.11 PIPE SLEEVES

A. Furnish and set pipe sleeves where pipes and tubes pass through walls, partitions, floors and roof.
   1. Sleeves in masonry walls and floor, in fire rated gyp board partitions, and in masonry or steel deck roofs shall be zinc coated steel pipe.
   2. Sleeves in non-fire rated gyp board partitions shall be zinc-coated sheet steel.
   3. Sleeves shall be at least two (2) nominal pipe sizes larger that the through-going pipe or tube. For insulated pipes and tubes, the sleeve shall be large enough to accommodate the Specified insulation thickness allowing at least 1/4" annular space between the insulation and the sleeve.
   4. Each pipe and tube shall be individually sleeved.
   5. Floor sleeves shall extend 2" above the finished floor.
   6. Roof sleeves shall extend from 4" below to 12" above the roof deck and shall be furnished with welded attachment brackets. Furnish and install a weather skirt for each roof sleeve.
   7. For below grade wall sleeves, the opening between the pipe and sleeve shall be sealed with a modular wall seal. Installation shall be in accordance with the manufacturer's instructions.

3.12 FIRESTOPPING

A. Pipe Penetrations:
   1. Provide approved through wall/ floor penetrations where pipes and tubing pass through rated walls and floors. Holes shall be a minimum of 3/4" greater in inside diameter than the external diameter of pipe and insulation passing through.
   2. Space between pipe, tubing, or insulation and the sleeve or hole shall be not less than 3/4". Seal the annular space between the pipe or tubing and the sleeve with approved brand fire barrier caulk or putty. Firmly pack the space between the piping and the sleeve with a mineral wool insulation and caulk both ends of the penetration watertight with elastic cement.
   3. Contractor shall provide to the Engineer and Code Official, two (2) copies each of intended through-penetration firestop system for each floor and wall pipe penetration. Include UL system number for proposed system including F and T rating, detailed drawing and list of components, installation procedure and manufacturer.

3.13 ESCUTCHEON PLATES

A. Furnish and install chrome plated escutcheon plates at floor, wall, roof and ceiling penetrations by un-insulated pipe and tubing in finished areas. Escutcheon plates shall completely cover penetration holes and any spalling of the wall shall be flush with adjoining surfaces and shall be secured in place.

3.14 PRESSURE TESTS

A. General:
   1. All piping systems shall be tested after erection and before concealing or covering and connecting to fixtures and equipment. The Mechanical Contractor shall arrange and pay for all tests of Mechanical Systems as required by Code and as Specified. Any materials or workmanship found faulty shall be immediately replaced or repaired and sections or systems retested.
   2. Provide all gauges, tools, pumps, gas, air or other equipment required for testing.
   3. Tests shall be made in the presence of the appropriate inspectors and/ or the Owner's Construction Representative.
   4. Any damage resulting from leakage of piping during the testing or guarantee periods shall be repaired at the expense of the Mechanical Contractor.

B. All piping shall prove absolutely tight under required tests.

C. Remedy all defects disclosed as the result of the tests. Repeat as necessary until test results are acceptable.

D. Certificates shall be furnished to the Architect/ Engineer that tests have been satisfactorily completed.

3.15 CORROSION PROTECTION OF BURIED PIPING

A. All carbon steel piping, valves, flanges and fittings indicated on the Drawings to be directly buried in earth shall be protected against corrosion.
   1. All field applied coatings and tape shall be applied only after piping system has been pressure tested by the Contractor and accepted by the Owner’s Construction Representative.
   2. Surfaces receiving corrosion protection shall be thoroughly cleaned, dry and free from oil. Rust and scale shall be removed by sandblasting to bare metal. Welding slag and spatter, sharp edges or burrs shall be removed by chipping and grinding.
   3. Application of corrosion protection shall be in strict conformance with manufacturer’s recommendations.

B. Materials:
   1. Coat external surface of pipe and fittings with X-Tru-Coat, or approved equal, extruded polypropylene or polyethylene. Coating shall be done in the shop by and approved applicator.
   2. Welded and screwed joint areas and fittings not coated with the above materials shall be wrapped with 3M Scotchrap 51 corrosion protection tape.
   3. Wrap external surface of entire piping system, including fittings, using 3M Scotchrap 51 corrosion protection tape.
   4. Coat external surface of entire piping system, including valves, flanges and fittings, using Koppers Bitumastic 50 bituminous coating material.

5. Coat external surfaces of valves and flanges in the field using 3M Scotchkote Brand 306 or 313 ambient-curable type 2-part epoxy.

C. Application Methods:

1. Prior to application of corrosion protection tape, apply a uniform continuous coating of approved primer to the cleaned surface and allow to dry. Fill all irregular shapes and surfaces with approved putty to form a uniform smooth surface. Cover weld beads with one wrap of tape, then conformally apply tape over entire area in an approved manner.
2. Surfaces to be coated at the worksite with epoxy shall be sandblasted to NACE near white metal using clean, dry 30 mesh sand or other suitable abrasive. Metal surfaces shall be coated as soon as possible after cleaning to prevent formation of rust. Fill all irregular surfaces with putty mixture of epoxy and approved filler material.
3. Bituminous coating shall be applied with a brush. It coating is to be left exposed for more than 5 days or if any part of coating is to be permanently exposed above grade, it shall be covered by Koppers Bituplastic 28 or 35 weather protective coating.

END OF SECTION

SECTION 22 01 70

PLUMBING SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operation and Maintenance Data.

B. Warranties and bonds.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal procedures; Shop drawings, product data, and samples.

B. Section 01 77 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

B. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with the Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.02 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

D. Provide servicing and lubrication schedule, and list of lubricants required.

E. Include manufacturer's printed operation and maintenance instructions.

F. Include Sequence of Operation by controls manufacturer.

G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

H. Provide control diagrams by controls manufacturer as installed.

I. Include test and balancing reports.

J. Additional Requirements: As specified in individual product specification sections.

3.03 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual. Including step-by-step instructions for operating the equipment.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment. At the beginning of each section, the equipment supplier's name, address and phone number shall be provided.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems, in order, under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Contractors, Subcontractors and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data. All data must clearly show model

numbers, sizes and capacities of the equipment installed.

b. Air and water balance reports.

c. Certificates.

d. Photocopies of warranties and bonds.

e. Factory/ Facility start-up reports.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of, Consultants, Sub consultants and names of responsible parties; schedule of products and systems, indexed to content of the volume.

L. Operation and Maintenance Manuals shall be submitted to the Engineer for approval prior to final observation of the Work. The Engineer will forward approved Manuals to the Owner's Construction Representative.

3.04 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with the Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-executive submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in Operation and Maintenance manuals, indexed separately on a Table of Contents.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of Table of Contents of the Project Manual, with each item identified with the number and title of the Specification Section in which specified, and the name of the product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

J. The Mechanical Contractor shall guarantee all workmanship and material against defects for at least one year from the date of Owner acceptance. Mechanical Contractor shall repair or replace any defects in Mechanical workmanship, materials,

fixtures and equipment that appear or cause trouble of any kind, within the one year period, without any cost to the Owner.

K. Refer to technical sections for extended warranties on equipment where stipulated.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers basic materials and methods and applies to and forms a part of each of the Sections of Division 22.

B. The Work shall be in accordance with this and other applicable Sections of these Specifications and the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS.

1.02 RELATED SECTIONS

A. The following Sections apply to and form a part of these Sections:
1. Section 22 05 40 Supports and Anchors - Plumbing
2. Section 22 05 53 Identification for Plumbing Piping and Equipment
3. Section 22 10 05 Plumbing Piping
4. Section 22 10 06 Plumbing Piping Specialties

1.03 QUALITY ASSURANCE

A. The physical and chemical properties of all materials, design, performance characteristics and methods of construction of all equipment shall be in accordance with applicable current editions of the following Standards, references and guidelines:
1. Underwriters Laboratories, Inc. (UL).
2. National Fire Protection Association Standards (NFPA).
3. American Society for Testing and Materials (ASTM).
4. American Society of Mechanical Engineers (ASME).
5. American Water/ Works Association (AWWA).
6. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE).
7. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).
8. Air Movement and Control Association (AMCA).
9. Air Conditioning and Refrigeration Institute (ARI).
10. National Environmental Balancing Bureau (NEBB).
11. American Association of Balancing Contractors (AABC).
12. Plumbing and Drainage Institute (PDI).
13. American Society of Plumbing Engineers (ASPE).
14. American Gas Association (AGA).
15. American National Standards Institute (ANSI).
16. National Electrical Manufacturers Association (NEMA).

17. Institute of Electrical and Electronic Engineers (IEEE).
18. Cast Iron Soil Pipe Institute (CISPI).
19. Plastic Pipe and Fittings Associations (PPFA).

1.04 DESIGN BASIS

A. The design and the physical sizes of equipment shown to scale on the Drawings are based on the manufacturers and model numbers of equipment scheduled on the Drawings. The Scheduled equipment establishes the quality basis and performance required. The Drawings were prepared to show the service connections, minimum clearances and accommodations required for the scheduled equipment.

B. If the Contractor elects to substitute equipment specified as "or equal" or "or approved equal", or to substitute equipment by other manufacturers where the manufacturer's name is added by addendum as "approved equal manufacturer", he/ she shall be responsible for the space requirements, configuration changes in connections, bases, supports, vibration isolation, structural members, openings in structure and its relationship to other equipment and services that may be affected by its use. Contractor shall submit scale drawings to the Engineer to show how the substituted equipment will be accommodated including manufacturer's recommended clearances and servicing provisions.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 RECEIPT, HANDLING AND STORAGE

A. Contractor shall be responsible for receiving delivery of the Plumbing materials, fixtures and/ or equipment.

B. Provide personnel to meet all delivery trucks, inspect the equipment and sign for the delivery, unload the trucks and move the equipment to locations agreed upon in advance. Uncrate the equipment and properly dispose of all crating materials off-site.

C. The Owner will not provide equipment, labor or handling assistance for this Work.

D. If the materials, fixtures and/ or equipment must be stored on-site prior to installation, the Contractor shall move the material, fixtures and/ or equipment to the location designated and provide temporary protection against weather and physical damage as directed by the Owner's Construction Representative.

3.02 EQUIPMENT INSTALLATIONS

A. Provide all necessary rigging, scaffolding, tools, tackle, labor, etc. necessary for the complete installation of the Mechanical equipment.

B. Adapt the Work to the job conditions and install the Work so that beams, joists and light fixtures, etc. have clearance with Plumbing items. Adjust risers and avoid light fixtures. Raise or lower work to permit the passing of ductwork of the work of other trades, all as required or as job conditions dictate, without additional cost to the Owner.

C. All equipment shall be installed and connected with the best engineering practices and in accordance with the manufacturer's instructions and recommendations. Ductwork, piping and electrical connections, valves and appurtenances recommended by the manufacturer or as required for proper operation shall be furnished and install to complete the installation.

D. All equipment shall be installed and located to facilitate accessibility for maintenance and/ or replacement.

3.03 EXCAVATING AND BACKFILLING

A. Excavate and backfill as required to install underground piping, pipe conduits and/or ductwork. All the Work shall be carefully protected from injury due to frost, water or other causes and any work damaged shall be promptly and properly repaired. All underground work shall be inspected and approved prior to backfilling.

B. Backfill around underground pipe conduits and/ or ductwork shall be done with sand or gravel, free from perishable material and excessive amounts of clay. If the natural earth material is of granular structure, as specified above, no additional material will be required. All buried services shall have a uniform bearing and shall be placed on undisturbed soil or compacted fill.

C. Backfill up to 2'-0" of cover over piping shall be placed by hand and tamped, being careful not to damage the Work. Backfill above this point shall be placed and compacted to not less than 95% within building limits of maximum density given by ASTM D698-70T (Standard Proctor Density).

D. Any dewatering required to install Plumbing Work shall be the responsibility of the installing Contractor.

3.04 WELDING

A. All welding shall be performed by certified welders. Certification shall be for the type of work being performed and shall be accomplished in accordance with ASME "Qualification Standard for Welding Procedures, Welders and Welding Operations."

B. Contractor shall submit copies of the welder's certification to the General Contractor's construction superintendent prior to any welds to be made by any welder.

C. All welds shall be stronger than the parent metal. A minimum of two (2) passes shall be used on all arc welded joints.

3.05 CUTTING AND PATCHING

A. Do all cutting and patching necessary for the installation of the Plumbing Work, except where otherwise indicated. All cutting shall be done in a manner directed by the General Contractor. Patching shall match adjacent surfaces.

B. Do not cut structural members.

C. Core drill all openings up to 10 inches in diameter.

3.06 ACCESSIBILITY

A. Advise the General Contractor of spaces and clearances required to accommodate the Mechanical Work. Locate all equipment which must be serviced, operated or maintained in fully accessible positions.

B. Floor, wall and ceiling access panels as required to service valves, controls, dampers, fire dampers and equipment will be provided under the general construction work.

C. Coordinate required locations with the General Contractor.

3.07 PAINTING

A. Plumbing Contractor shall touch-up the surface marring on all prefinished mechanical equipment to match existing factory finish.

END OF SECTION

SECTION 22 05 40

SUPPORTS AND ANCHORS – PLUMBING

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers supports and anchors and applies to and forms a part of each of the following Sections of Division 22.
   1. Section 22 10 05 - Plumbing Piping.

B. Supports and anchors shall be in accordance with this and other applicable Sections of these Specifications and the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS and Section 22 01 60 - PLUMBING PIPING PROCEDURES.

C. Install pipe hangers and supports as Specified in this Section and/ or as indicated on the Drawings, conforming to Manufacturer's Standardization Society Standards SP58 and SP69.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Support piping from structure with adjustable hangers:
   1. For cast iron, steel and plastic piping 2" and smaller: Anvil Fig. 269, PHD Fig. 180, Fee and Mason Fig. 202, Elcen Fig. 202, B-Line Fig. B3172 or equal.
   2. For cast iron pipe 3" size and for steel and plastic piping 2-1/2" and larger: Anvil Fig. 260, PHD Fig. 450, Fee and Mason Fig. 239, Elcen Fig. 12, B-Line Fig. B3100.
   3. For cast iron piping 4" and larger: Anvil Fig. 590, Fee and Mason, Elcen, B-Line Fig. 3100 or equal.
   4. For copper tubing 2" and smaller: Anvil Fig. CT-269, B-Line Fig. B3172CT.
   5. For copper tubing 2-1/2" and larger: Anvil Fig. CT-65, B-Line Fig. 3104CT.

B. Pipe Clamps
   1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3140 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or Trapeze Hanger

1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze hanger with 2 piece straps sized for outside diameter of pipe, B-Line B2000 Series.
3. For pipes subjected to axial movement:
    a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated pipes.
    b. Strut mounted pipe guide, B-Line B2417.

D. Wall Supports
1. Metal pipes 4 inch and smaller:
    a. Carbon steel hook, B-Line B3191.
    b. Carbon steel J-hanger, B-Line B3690.

E. Floor Supports
1. Hot metal piping under 6 inch and all cold metal piping:
    a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.
2. Hot metal piping 6 inch and larger:
    a. (Adjustable) Roller stand with base plate, B-Line B3117SL (or B3118SL).
    b. Adjustable roller support and steel support sized for elevation, B-Line B3124.

F. Vertical Supports (Riser Clamps)
1. Metal piping:
    a. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373.

G. Copper Tubing Supports
1. Hangers shall be sized to fit copper tubing outside diameters.
    a. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
    b. Malleable iron ring hanger, B-Line B3198RCT or hinged ring hanger B3198HCT.
    c. Malleable iron split-ring hanger with eye socket, B-Line B3173CT with B3222.
    d. Adjustable steel clevis hanger, B-Line B3104CT.
2. For supporting vertical runs use epoxy painted or plastic coated riser clamps, B-Line B3373CT or B3373CTC.
3. For supporting copper tube or strut use epoxy painted pipe straps sized for copper tubing, B-Line B2000 series, or plastic inserted vibration isolation clamps, B-Line BVT series.

H. Continuous Plastic Pipe Supports
1. V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, B-Line B3106 and B3106V, to form a continuous support system for

plastic pipe or flexible tubing.

I. Supplementary Structural Supports
   1. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 Steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to the Engineer for approval. Use clamps and fittings designed for use with the strut system.

2.02 UPPER ATTACHMENTS

A. Beam Clamps
   1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
   2. C-Clamps shall have locknuts and cup point set screws, B-Line B351L, or B3036L. Top flange C-Clamps shall be used when attaching a hanger rod to the top flange of structural shapes, B-Line B3034 or B3033. Refer to manufacturers recommendations for setscrew torque. Retaining straps shall be used to maintain the clamps position on the beam where required.
   3. Center loaded beam clamps shall be used where specified. Steel clamps shall be B-Line B3050, or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be B-Line B3054 or B3291-B3297 Series as required to fit beams.

B. Concrete Inserts
   1. Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
   2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.

2.03 ACCESSORIES

A. Hanger Rods shall be threaded at both ends, or be continuously threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.

C. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch

shall have a center support rib.

2.04 FINISHES

A. Indoor Finishes
1. Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper(R). Additional PVC coating of the epoxy painted hanger shall be used where necessary.
2. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish, B-Line Dura-Green(R).
3. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green(R).

B. Outdoor and Corrosive Area Finishes
1. Hangers and struts located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
2. Hangers and strut located in corrosive areas shall be type 304 stainless steel with stainless steel hardware.

PART 3 EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

A. Insulated pipe supports should be provided at hanger, support, and guide locations on pipe requiring insulation. The insert should consist of either Hydrous Calcium Silicate or Polyisocyanurate Foam insulation (Urethane) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) or galvanized steel jacket and installed during the installation of the piping system.

B. Locate hangers and supports at changes in direction and at concentrated loads. Hanger design shall permit vertical adjustment and lateral movement to allow pipe expansion.
1. Three (3) or more pipes may be supported on trapeze hangers using two (2) clevis hangers and a capped pipe cross member.
a. Isolate copper pipe from bearing on the cross member with an electrically-insulating material.
b. Where indicated, trapeze hangers shall be "Unistrut", or equal, double channel with drop rods and double nuts. Where pipes are indicated to be supported from the underside of trapeze hangers, provide "Unistrut", or equal, speed clamps.
2. Support horizontal cast iron pipe at every joint and sway brace to prevent shear.
3. Support horizontal copper tubing as follows:

NOMINAL PIPE SIZE	ROD DIA. (INCH)	MAX INT. (FT.)
1/2 to 3/4	3/8	5
1	3/8	6
1-1/4	3/8	6
1-1/2	3/8	8
2	3/8	8
2-1/2	1/2	9
3	1/2	10
3-1/2	1/2	11
4	5/8	12

4. Support vertical copper tubing at each story using a riser clamp.
5. Support horizontal steel piping as follows:

NOMINAL PIPE SIZE	ROD DIA. (INCH)	MAX INT. (FT.)
1/2 to 1-1/4	3/8	7
1-1/2	1/2	8
2	1/2	9
2-1/2	1/2	10
3	1/2	10
3-1/2	1/2	13
4	5/8	14
5	5/8	15
6	3/4	17

6. Support horizontal grooved steel piping as follows:

NOMINAL PIPE SIZE	ROD DIA (INCH)	MAX INT. (FT.)
Up to1-1/4	3/8	8
1-1/2 and 2	1/2	8
2-1/2 and 3	1/2	10
4 and 5	5/8	12

7. Support vertical steel piping at each story using a riser clamp. Support neoprene jointed piping at 5 foot intervals except where 10 foot lengths of pipe are used.
8. Support horizontal PVC & CPVC piping (Up to 100°F.) as follows:

NOMINAL PIPE SIZE	ROD DIA (INCH)	MAX INT. (INCH)
Up to 3	3/8	32
4	1/2	32

9. Support vertical plastic pipe sizes up to 1-1/2 inches at four foot intervals for exposed and concealed locations. Secure pipe to structure using a riser clamp.
10. Hangers for hot water piping services below 140° F may bear directly on the hangers.
11. Hangers for cold water piping services at 55° F and lower shall encompass and bear on the insulation covering.
12. Hanging from one pipe to another is prohibited.
13. Hanging piping/ tubing from ductwork or other equipment is prohibited.
14. Support pipe hangers from structure using appropriately secured attachments.
15. Provide means of preventing dissimilar metal contact such as plastic/ epoxy coated hangers.
16. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.
17. Where structure is steel framed, support pipe hangers from beam clamps, attachments, and brackets bolted to steel joints or beams. Bolting to steel deck is prohibited.
18. Where structure is reinforced concrete, support pipe hangers from concrete as follows:
    a. Loads to 400 pounds: Light weight concrete inserts, Grinnell Figure 285, Elcen Figure 86, Fee and Mason Figure 2570.
    b. Loads to 400 to 1430 pounds: Universal concrete insert, Grinnell Figures 282, Elcen Figure 64, Fee and Mason Figure 2570.
    c. Set inserts in concrete forms, obtain approval of their locations in ample time to permit pouring of concrete as scheduled; provide reinforcing rods for pipe sizes over 3".
    d. In areas where concrete slab will form finished ceiling, take care to have inserts finish flush with concrete slab surface and to make a neat appearance.
    e. Where insert are drilled into concrete slab, contractor shall confirm locations of concrete rebar and avoid penetrations at these locations.

3.02 ANCHORS

A. Anchor pipes as required and where indicated on the Drawings. Use steel collars fitted with lugs and bolts. Attachment in a manner detrimental to the building structure is prohibited.

3.03 CONCRETE BASES AND HOUSEKEEPING PADS

A. Provide all concrete bases and housekeeping pads required for mechanical equipment, except where otherwise indicated. Set expansion bolts in bases for attachment of equipment and/or isolators.

B. Bases and pads shall be constructed of 3,000 pound, 28 day strength concrete. Each base and pad shall be attached to the building floor using two or more expansion bolts which shall be set before pouring so that bolt heads are concealed within the base. The form material shall have smooth surfaces and all surfaces shall be plumb and in line with the building structural work. Surfaces of bases and pads shall be finished sufficiently smooth to receive painting. All bases shall be 4" high or as otherwise indicated on the Drawings and of sufficient length and width to accommodate the equipment mounted thereon. Housekeeping pads shall be minimum 3" high. After bases and pads are poured, they shall set seven days before mounting equipment.

3.04 STEEL SUPPORTS

A. Provide all steel supports required for the mechanical equipment to be furnished under this Division, except where otherwise indicated.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers pipe coding and equipment labeling and applies to and forms a part of each section of the Division 22 specifications under which piping and equipment are installed.

B. Identification shall be in accordance with this and other applicable sections of these specifications and the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS and Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

1.02 SUBMITTALS

A. Submit and provide pipe markers and color banding for approval.

B. Submit valve lists for approval by the owner. Provide valve tags.

C. Submit and provide hydronic system valve and cabinet tags.

PART 2 PRODUCTS

2.01 PIPE MARKERS

A. Pipe markers shall be Seton Set Mark, Brady Perma-Code, or approved equal, one-piece preprinted pressure sensitive markers and tapes and shall be in accordance with ANSI A13.1-1981 Standard adopted by OSHA.

B. Green bands (backgrounds) are required for safe contents, yellow bands for hazardous contents, blue bands for low hazard contents and red bands for fire quenching contents.

C. The width of the color band or marker and the size of legend letters shall be as follows:

O.D. of Pipe and Covering	Marker Width	Legend Letter Size
3/4" to 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

D. Arrows shall be black with background color same as color banding. A single arrow shall indicate direction of flow and a double arrow shall indicate reversible flow.

E. Legends and background and letter colors:

Pipe Contents & Title	Background	Letters
Cold Water	Green	White
Condensate Drain	Green	White
Hot Water	Yellow	Black
Tempered Water	Green	White
Vent	Yellow	Black
Waste	Yellow	Black
Non-potable Water	Yellow	Black
Natural Gas	Yellow	Black

2.02 VALVE TAGS

A. Valve tags shall be Seton, Brady, or approved equal, 1-1/2" diameter, solid plastic with heat stamped identifying service and number. Background and letter colors for each service shall be the same as listed in paragraph E above. Valve tag fasteners shall be No. 6 brass bead chains, 4-1/2" in length, with locking link.

2.03 HOSE BIBBS AND WALL HYDRANT

A. All non-potable hose bibbs and wall hydrants shall be identified with permanent pre-manufactured engraved plastic tags securely attached to wall at hose bibb or wall hydrant location indicating water is “Non-potable Water – Not Fit for Consumption.”

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Plumbing equipment, including water heaters, thermostatic valves, enclosures, tanks, basins and valve actuators shall be identified by service name and number either with permanent pre-manufactured 2" wide engraved plastic tags or by stenciling with 2" high black letters on contrasting color background.

B. Identification locations naming/numbering format shall be as directed by the Owner's representative.

3.02 PIPE IDENTIFICATION

A. All new piping inside the building shall be identified with pipe markers after pipe has been installed.

B. Pipe markers shall be applied to pipes adjacent to both sides of partitions and above

ground floors, at branch takeoffs adjacent to valves, at connections to equipment and 30 feet on center for straight lengths of pipe.

C. At each color band location, a title showing the pipe contents and an arrow showing direction of flow shall be applied.

D. Where titles and color bands match color of pipe, provide white background (black where color is white) extending at least three (3) inches around all bands and title.

E. Titles and arrows shall be prominently displayed adjacent to color coding and shall be clearly visible from operating positions, especially those adjacent to control valves.

3.03 VALVE TAGGING

A. Permanent pre-manufactured valve tags shall be chained to all shut-off valves furnished under the Work, except to valves on heating piping at duct mounted and VAV heating coils, fin tube radiation and cabinet unit heaters, inside the enclosure of factory manufactured equipment and on plumbing fixture stops.

B. All valves shall be sequentially numbered. Each tag shall identify the service and sequence number.

C. Two (2) 8-1/2" x 11" typed schedules listing all tagged valves in the building shall be prepared. One list shall tabulate valves in numerical sequence and show valve location, service and area served. The second list shall tabulate room numbers in sequence and show valve number and valve function in each room.

END OF SECTION

SECTION 22 06 00

SCHEDULES FOR PLUMBING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of performing all labor and furnishing all material, supplies, fixtures and equipment including minor items obviously necessary for complete and functioning plumbing systems as specified herein and as shown on the Drawings.

B. Plumbing work shall be in accordance with the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS and Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

C. The Work shall consist of the following:
   1. Drain piping with connections to the outside air plenums and to drain pans under the air handling unit cooling coils.
   2. Piping insulation of existing water piping where indicated.
   3. Natural gas piping system including extension from the gas main, piping, isolation valves, pressure regulator and connections to the gas fired dehumidifiers.

1.02 RELATED SECTIONS

A. The following sections apply to and form a part of these Sections:
   1. Section 22 07 00 PLUMBING INSULATION
   2. Section 22 10 05 PLUMBING PIPING

1.03 RELATED WORK DESCRIBED ELSEWHERE

A. Trenching and Backfilling:
   1. Perform all trenching and backfilling required for plumbing underground piping installation in strict accordance with the provisions of Section 22 05 00.

B. Insulation:
   1. Cold and hot water piping shall be insulated as specified in Sections 22 07 00 - PLUMBING INSULATION.

1.04 STANDARDS

A. This Contractor shall comply with all requirements of the Minnesota Plumbing Codes and amendments.

B. All piping shall be installed in a neat and orderly manner.

1.05 SUBMITTALS

A. Comply with the provisions of Section 01 33 00 - SUBMITTALS.

B. Within 30 calendar days of Contract Award, submit a complete list of materials, fixtures and equipment proposed to be furnished and installed under this Section.

C. Submit shop drawings of the following:
   1. Insulation systems.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section of these Specifications covers piping insulation and applies to and forms a part of Division 22, Section 22 07 00 - PLUMBING INSULATION.

PART 2 PRODUCTS

2.01 PLUMBING PIPING INSULATION

A. All service cold, hot, tempered, non-potable water piping and condensate piping shall be insulated with one or two-piece molded glass fiber pipe insulation, 3 lb./ cu. ft. density with fire retardant, self-sealing, vapor barrier all-service jacket.

B. Insulation thickness shall be as follows:

1. Cold, non-potable, tempered, and condensate water piping:

Pipe Size	Insulation Thickness
Runouts up to 2" (up to 12 ft. long)	1/2"
1" and smaller	1/2"
1-1/4" and larger	1"

2. Hot water piping: (140° F. and less)

Pipe Size	Insulation Thickness
Runouts up to 2" (up to 12 ft. long)	1/2"
2" and smaller	1"
2-1/2" and larger	1"

C. Fittings on hot water piping shall be insulated with pre-cut fiberglass insulation covered with Proto, or approved equal, PVC fitting covers.

2.02 INSULATION JACKETING

A. All insulated water piping within 6 feet of finished floor to be jacketed with PVC

piping jacket. Jackets to be Manville-Zeston, Knauf-Proto, or equal, 15 mil thick off-white color. Connections to be made with brush on welding adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 PIPE INSULATION INSTALLATION

A. Application:
   1. Insulation shall be applied in accordance with the manufacturer's published recommendations, unless otherwise specified.

B. Insulation Protection Shields:
   1. Provide insulation protecting shields under the 1/3 periphery of the insulated 1-1/4" and larger piping at hanger bearing points. Shields shall be 9" long x 20 gauge for pipe sizes 3" and smaller and 12" long x 16 gauge for pipes 4" and larger.

C. Hot Piping with Glass Fiber Insulation:
   1. Pipe: Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Self-sealing laps shall be secured according to manufacturer's published recommendations. Open ends of pipe insulation shall be neatly stopped off and tapered down with insulating cement and covered with canvas embedded into a wet coat of fire retardant lagging adhesive.
   2. Fittings: All fittings shall be insulated with segments of pre-molded glass fiber pipe insulation or with compressed flexible glass fiber secured in place with18 gauge galvanized soft wire. Cover all fitting insulation with white plastic fitting covers.
   3. Valves, etc.: All valve bodies, strainers and flanges shall be insulated as specified for fittings.

D. Cold Piping with Glass Fiber Insulation:
   1. Pipe: Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21 feet on continuous runs of pipe. Self sealing laps shall be secured according to manufacturer's published recommendations.
   2. Insulation, vapor barrier and covering shall be continuous through all chilled water pipe supports and pipe sleeves. High density inserts, the same thickness as adjacent insulation, shall be installed at pipe supports where the density of the insulation is not sufficient to support the full pipe. Inserts shall be 180 degrees and not less than the length of the protection shields.
   3. Fittings: All fittings shall be insulated with molded fiberglass fittings or with

compressed flexible glass fiber with vapor barrier secured in place with 18 gauge galvanized soft wire. All thicknesses to be equal to that of adjoining pipe covering. Cover all fitting insulation with white plastic fitting covers.

4. Valves, etc.: All valve bodies, strainers and flanges shall be insulated as specified for fittings.

3.02 COATINGS

A. This Contractor shall be responsible for all thermal insulation.

B. All exposed pipe covering shall be coated shall be coated in accordance with the requirements of section 09 90 00.

3.03 INSULATION JACKETING

A. Apply PVC jacketing to all insulated water piping within 6 feet of finished floor.

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers plumbing piping and applies to and forms a part of Division 22, Section 22 10 05 - PLUMBING PIPING.

B. Plumbing piping shall be in accordance with this section of these specifications and the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS and Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

1.02 GENERAL REQUIREMENTS

A. Furnish and install pipe and fittings of type and material specified in this Section and as shown on the Drawings and required to connect all fixtures and equipment.

B. Make equipment connections with unions for quick easy disconnect and located to allow equipment removal without dismantling piping.

C. Furnish and install all valves required to isolate fixtures, equipment and segments of each piping system as specified in this Section and as shown on the Drawings.

1.03 COORDINATION

A. Coordinate plumbing piping with equipment, ductwork, piping and conduit to be provided by other trades.

PART 2 PRODUCTS

2.01 PIPES AND PIPE FITTINGS

A. Service Water:
   1. Underground:
      a. 2" and smaller sizes: ASTM B88 Type K, soft drawn seamless copper tubing. Joints will not be permitted in buried copper tubing.
   2. In building, above ground:
      a. 3" and larger sizes: ANSI B36.2 Schedule 40 galvanized steel and ANSI B16.3 malleable iron standard weight banded screwed fittings.
      b. 2-1/2" and smaller sizes: ASTM B88 Type L hard drawn seamless copper tubing and ANSI B16.22 wrought copper solder fittings joined using 95-5 solder. Short connections to fixtures and equipment may be ASTM B88 Type L soft drawn copper.

C. Natural Gas:

1. Inside building:
   a. 2" and smaller sizes: ASTM A53/ A53M black steel Schedule 40 pipe and ASME B16.3 standard weight, malleable iron screwed fittings. Shall not be used in return air plenums or concealed ceilings.
   b. 2” and smaller sizes in concealed spaces: ASTM B88 Type L hard drawn seamless copper tubing and ANSI B16.22 wrought copper solder fittings joined using Sil-Fos Silver brazing.
   c. 2-1/2" and larger sizes: ASTM A53/ A53M black steel Schedule 40 pipe and ASME B16.3 standard weight butt weld fittings.
2. Outside building, above ground:
   a. 2" and smaller: ASTM A53 galvanized steel, Schedule 40 pipe and ASTM A197 standard weight galvanized screwed fittings. Clean all exposed fittings and coat with zinc finish.
   b. 2-1/2" and larger: ASTM A53 black steel Schedule 40 pipe and ASME B16.3 standard weight butt weld fittings. Prime coat with rust resistant primer. Apply finished enamel coat as required by Section 09 90 00.
3. Outside building, underground:
   a. 2" and smaller sizes: ASTM B88, Type K soft copper, with brazed joints, having a minimum melting temperature of 1000° F.
   b. Polyethylene Pipe. Pipe shall be DriscoPlex™ 6500 PE 2708 (PE2406) polyethylene pipe, and shall be manufactured and tested in accordance with the latest published edition of ASTM D 2513.
      1) Materials used for the manufacture of polyethylene pipe and fittings shall be PE 2708 (PE2406) medium density polyethylene meeting cell classification 234373E per ASTM D 3350; and shall be Listed in PPI (Plastics Pipe Institute) TR-4 with standard grade HDB ratings of 1250 psi at 73°F, and 1000 psi at 140°F. All pipe and fittings materials shall be opaque yellow in color. Materials shall be stabilized against ultraviolet deterioration and shall be suitable for unprotected outdoor storage for at least four (4) years.
      2) Interchangeability of Pipe and Fittings. The same Manufacturer shall supply polyethylene pipe and heat fusion fittings. Pipe and fittings from different Manufacturers shall not be interchanged.
      3) Polyethylene Fittings. Polyethylene heat fusion fittings shall be manufactured and tested by the pipe manufacturer in accordance with ASTM D 2513 and D.O.T. requirements.
      4) Heat Fusion Joining. Butt, socket, and saddle fusion joints in polyethylene gas piping shall be made using procedures that have been qualified and approved by the Operator in accordance with Title 49, CFR, and Part 192.283.
      5) Joining by Other Means. Polyethylene gas pipe and fittings may be joined together or to other materials by transition

fittings, fully restrained mechanical couplings, or electrofusion. These devices shall be designed for joining polyethylene to another material and shall be approved by the Operator for use in his gas distribution system. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

6) When mechanical OD compression couplings are used, polyethylene gas pipe shall be reinforced with a stiffener in the pipe bore. Stiffeners shall be properly sized for the diameter and wall thickness of polyethylene pipe being joined. For service pipe connections, the stiffener length shall match the pipe end penetration depth into the coupling.

4. Casings:
   a. ASTM A53 Schedule 40 black steel, welded, three (3) sizes larger than encased gas pipe.

D. Drains (Condensate Drains):
   1. Inside building, above ground:
      a. ASTM B88 Type M hard drawn copper tubing and ANSI B16.22 wrought copper solder fittings joined using 95-5 solder.

2.02 UNIONS

A. Copper Tubing:
   1. 3" and smaller sizes: Soldered ground joint union, Chase 402, or equal.

B. Dielectric unions for connecting copper tubing to steel piping, tanks and equipment:
   1. 2" and smaller sizes: Steel body and nut with insulating gasket and copper connector, 250 PSI WOG, Epco Model FX, FB and EA, or equal.

C. Black Steel Piping:
   1. 2" and smaller sizes: Screwed malleable black iron ground joint union, brass to iron seat, 300 PSI WOG, Grinnell 463, Stockham 694, or equal.
   2. 2-1/2" and larger sizes: Welding neck or slip-on forged black steel bolts, 150 PSI, Grinnell 1901 and 1921, or equal.

D. Galvanized Steel Piping:
   1. 2" and smaller sizes: Screwed galvanized malleable iron ground joint union, brass or iron seat, 300 PSI WOG, Grinnell 463, Stockham 694, or equal.
   2. 2-1/2" and larger sizes: Flanged, threaded, galvanized cast iron union, 175 PSI WOG, gasket and carbon steel bolts, Grinnell 487, Stockham 489, or equal.

E. PVC and CPVC Piping:
   1. Normal impact Schedule 80 PVC and CPVC socket type, EPDM O-ring.

2.03 VALVES

A. Valves shall be Apollo, Nibco-Scott, Kitz, Milwaukee, Watts, Crane, or Stockham. The specified manufacturer's name and number for identification of types, quality and construction.

B. Service Water Piping:
   1. Shut-off-4" and larger: Butterfly valve, 150 PSI WOG, iron body, renewable EPT seat and seal, bronze or ductile iron disc, stainless steel shaft, lever operator, Kitz 81E, wafer type except lug tap type at equipment.
   2. Shut-off - 3" and smaller: Solder end ball valve, 300 PSI WOG, bronze full port two-piece body, stainless steel ball, extended stem to allow for insulation, lever handle, Teflon seats and seal, Kitz 59, Nibco S-585, Apollo 77-200 Series, or equal. Stainless steel for stainless steel piping systems.
   3. Shut-off - Wall Hydrant Supplies: Solder end, stop and waste valve, 150 PSI Series, or equal.
   4. Check - 2" and smaller: Screwed lift check, 300 PSI WOG, bronze body and trim, 300° F composition disc, Kitz 36, or equal.
   5. Check - 2-1/2" and 3": Screwed swing check, 200 PSI WOG, bronze body, regrinding seat, renewable disc, Stockham B342, Crane 36, or equal.
   6. Check - 4": Flanged swing check, 200 PSI WOG iron body bronze trim, Kitz 78, or equal.
   7. Drain Valves: Solder or screwed, 200 PSI WOG, bronze angle, 250° F composition disc, garden hose adapter, 1/2" size, Nibco S-311 or T-311, Crane 2, or equal.

C. Natural Gas Piping:
   1. Shut-off: Screwed end ball valve, UL/CGA Listed, 600 PSI WOG, bronze two-piece body, chromium-plated ball, lever handle, Teflon seats and seal, Legend Series T-1002, or equal.
      a. Shut-off valves installed in a portion of a piping system operating above 0.5 PSIG shall comply with ASME B16.33.
      b. Shut-off valves installed in a portion of a piping system operating at 0.5 PSIG or less shall comply with ANSI Z21.15 or ASME B16.33.

D. PVC and CPVC Piping:
   1. Shut-off: Solvent weld ball valve, 100 PSI WOG, normal impact PVC or CPVC, Hayward or Chemtrol.
   2. Check – 2” and smaller: Union ball check valve, PVC or CPVC body, Vitron seals, Hayward or Chemtrol.

PART 3 EXECUTION

3.01 EXCAVATING AND BACKFILLING

A. Excavate and backfill inside the building as required to install underground piping. Excavating and backfilling shall be as specified in Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

3.02 SERVICE PIPING INSTALLATIONS

A. All service piping shall be prepared, sleeved and installed as specified in Section 22 01 60 - PLUMBING PIPING PROCEDURES.

B. Support piping as specified in Section 22 05 40 - SUPPORTS AND ANCHORS - PLUMBING.

C. Gas Piping:
1. Threaded pipe and fittings are prohibited within concealed ceiling spaces.
2. Provide dirt pocket, shut-off cock and union in branch connection to equipment.
3. For each branch main, install a manual shut-off valve where indicated on the Drawings.
4. Provide dirt pocket and union in branch pipe to each group of gas outlets.

3.03 PRESSURE TESTS

A. All plumbing piping shall be pressure tested before insulating or concealing and connecting to fixtures and equipment as specified below and in Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

B. Water Piping:
1. Test service cold, non-potable, tempered and hot water piping tight under 120 PSIG hydrostatic pressure for a period of two (2) hours with no drop in pressure.

C. Natural Gas Piping:
1. Air test piping at 25 PSIG for 30 minutes with no drop in pressure.

3.04 CONNECTIONS TO MISCELLANEOUS EQUIPMENT

A. Make all service and drain connections to all equipment, whether furnished under this or other Sections or by the Owner, including piping and shut-off valves on branches to and from each item of equipment from the service mains or branches.
1. This equipment will be unpacked, assembled and set by others.
2. Included in this work are connections including valves, unions, supplies, traps and drains for connections to air handling units and drain pans.

B. Make allowances for variations in service and drain connections and locations as required for the equipment actually furnished.

C. Fixtures and equipment furnished under other Sections, by Others or by Owner:
1. Air handling units (condensate drain).
2. Dehumidifiers (gas, condensate drain).

D. Cooling Coil Drains:
1. Pipe trapped condensate drain:
a. From each air conditioning unit cooling coil drain.
2. Trap size shall be line size.
3. The diameter of the drain pipes shall be equal to or greater than the exit diameter of the drain seal device. The drain pipe shall be as direct as possible to the condensate disposal area and shall have the least possible number of elbows.
4. The drain pipe shall slope away from the drain seal at no less than 1/8"/ ft.
5. Drain lines shall be constructed of Type M copper tubing or Schedule 40 PVC

or steel piping.

6. Drain pipe supports shall be fastened in place and at intervals that ensure a uniform slop is maintained.

E. Pipe drain from outside air plenum and ducts that are not pitched to drain through their respective wall louver and are not provided with an area drain.

3.05 DISINFECTING

A. Disinfect water piping system in accordance with Minnesota Rules, part 4715.2250. Test the plumbing system in accordance with Minnesota Rules, part 4715.2820.

B. Treat the piping with chlorine and flush with clean water. Open and close all affected valves during the disinfecting period. Repeat as necessary to pass required bacteriological tests.

3.06 FIRESTOPPING

A. Firestop all pipe and tubing penetrations of masonry walls, rated partitions and above grade floors as specified in Section 22 01 60 - PLUMBING PIPING PROCEDURES.

END OF SECTION

SECTION 22 10 06

PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers plumbing specialties and applies to and forms a part of Division 22.

B. Plumbing specialties shall be in accordance with this section of these specifications and the requirements of Section 22 01 20 - PLUMBING GENERAL PROVISIONS and Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING.

1.02 GENERAL

A. Furnish and install plumbing specialties of type and material specified in this section and where shown on the Drawings.

1.03 RELATED SECTIONS

A. Section 22 06 00 - SCHEDULES FOR PLUMBING.

B. Section 22 07 00 - PLUMBING INSULATION.

C. Section 22 10 05 - PLUMBING PIPING.

1.04 REFERENCES

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).

D. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1019).

E. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.05 SUBMITTALS

A. See Section 01 33 30 - Supplemental Procedures, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

PART 2 PRODUCTS

2.01 GAS PRESSURE REGULATORS

A. Gas pressure regulators for gas service into each unit shall be Maxitrol or Fischer Series S202, 10 PSI inlet to 7" W.C. gas pressure regulator. Confirm with manufacturer for capacities as listed on the equipment schedules.

B. Vent all regulators individually, full size to building exterior. Terminate with hooded, screened outlet at least 12" above grade and 4 feet from any opening into the building.

C. Exterior regulators to be provided with a vent protector.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.02 GAS PRESSURE REGULATOR INSTALLATION

A. Gas regulating valves shall be selected for gas pressure and capacities as indicated in the Contract Documents. Furnish and install regulating valves required to maintain proper pressure to appliances and heating equipment.

B. Vent regulators to outside in black steel pipe and terminate with screened 90 degrees vent ell turned down. Model 325-3 regulator with vent limiting device installed in horizontal position need not be vented to outside.

C. Extend vent piping with turned down ell on regulators installed outside.

END OF SECTION

SECTION 23 01 20

HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL CONDITIONS

A. This section applies to and forms a part of each of the Sections of Division 23 and together with each Section, is subject to the following requirements:
   1. Instructions to Bidders
   2. General Conditions
   3. Supplementary General Conditions
   4. Division 01: General Requirements

1.02 RELATED SECTIONS

A. Section 01 30 00 - Administrative Requirements

1.03 INCLUDED SECTIONS

A. Section 23 01 55 - HVAC Site Conditions

B. Section 23 01 60 - HVAC Piping Procedures

C. Section 23 01 70 - HVAC Submittals

1.04 SCOPE OF WORK

A. The Work under this Division of the Specifications consists of furnishing all construction engineering, supervision, labor, equipment, fixtures, materials, all incidentals, related items and appurtenances, and performing all operations necessary to complete the installation of Work in strict accordance with these Specifications and Drawings.

B. All work shall be finished, tested and ready for operation and use.

C. The term "provide" shall mean "furnish and install complete and ready for use".

1.05 DISCREPANCIES OR OMISSIONS FROM SPECIFICATIONS OR DRAWINGS

A. Notify the Engineer of any discrepancies in, or omissions from the Specifications or Drawings. The Owner's Construction Representative will not be responsible for any oral instructions or modifications of the Specifications or Drawings. Written interpretations will be made only by Addenda. Discrepancies discovered during construction shall immediately be called to the attention of the Construction Representative for decision.

1.06 DRAWINGS

A. The Drawings indicate the extent and general layout of the Mechanical systems

intended for the building. Furnish offsets, fittings, valves and accessories as required but not shown because of the scale of the Drawings.

B. In general, the Mechanical Drawings are drawn to scale as indicated, however, do not scale the Mechanical Drawings. Refer to the Architectural Drawings for dimensions, details of construction, locations of partitions, walls, suspended ceilings, ceiling heights and other pertinent information. Architects Drawings shall not take precedence over field measurements.

C. Coordinate Work with the work of other trades. Make reasonable modifications in layout to avoid conflict with the work of other trades and for proper execution of the Work at no additional cost to the Owner.

D. All Drawings and Specifications shall be considered in bidding. The Drawings and Specifications are complimentary, and what is called for in either shall be as binding as though called for in both.

1.07 SUBSTITUTION REQUESTS

A. Refer to Section 01 30 00 - Administrative Requirements, for proper procedures on product and equipment substitutions.

1.08 INSPECTION OF SITE

A. Contractor shall inspect the site of the proposed Work and note the conditions under which the Work is to be performed.

1.09 PERMITS AND FEES

A. Contractor shall obtain all permits required for the performance of the Mechanical Work and shall submit complete certified Drawings and Specifications with the permit application to the authority having jurisdiction.

B. Contractor shall pay for all sales tax, fees, licenses, permits, charges for connection to outside services, use of property for storage of materials and other costs pertaining to the Mechanical Work.

C. Contractor shall coordinate and request all inspections and approvals as required. Contractor shall notify the Owner's Construction Representative of date and time of all coordinated inspections and shall submit certificates of inspection and final approval of the inspection authority.

1.10 APPLICABLE CODES AND STANDARDS

A. Construction shall be in conformance with the latest amended edition of the State Building Code, including requirements of other codes, standards and regulations adopted by reference as a part thereof. Contractor shall comply with any requirements of the Drawings and Specifications that exceed the State Building Code requirements.

B. All materials, equipment and their installation shall conform to the applicable sections of the following current Codes for the State of Minnesota:
   1. International Building Code, IBC 2012.

2. International Mechanical Code, IMC 2012.
3. Uniform Plumbing Code, UPC 2012.
    a. Minnesota State Plumbing Code Amendments
4. International Fire Code, IFC 2012.

1.11 WORKMANSHIP

A. All the Work shall be performed in a craftsmanship manner by workmen thoroughly trained and experienced in the Work they are to perform.

B. Refer to Specification Section 23 01 55 - HVAC Site Conditions and Section 23 01 60 - HVAC Piping Procedures for further direction.

1.12 ACCIDENT PREVENTION

A. Comply with the "Safety and Engineering Practices" set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America and with all applicable state and local safety laws, regulations and ordinances as well as the Owner's established safety rules.

B. Provide and properly maintain warning signs and lights, barricades, railings and other safeguards for the protection of workmen and others on, about, or adjacent to the work as required by the conditions and progress of the Work.

1.13 SITE AND BUILDING CLEANLINESS

A. During construction, provide for orderly storage and removal of all construction debris, cartons, packing cases and other such items in a manner to reduce fire and accident hazards.

B. Contractor shall clean the working area each day and shall remove all trash and waste materials, and shall maintain the Site in a neat and orderly condition throughout the construction period.

C. Contractor shall daily, or as it becomes apparent, pick up all garbage, litter, debris and other materials attributable to the Work or the activities of Contractor's employees, Sub-Contractors and suppliers that accumulates on the property in the vicinity of the Site.

1.14 WORK SCHEDULE

A. Examine the Drawings and Specifications to determine the extent and details of the Work to be performed.

B. Submit a construction work schedule for approval to the General Contractor.

C. The schedule must be suitable to all parties concerned.

D. The schedule shall be a guide to construction operations and progress shall conform, as nearly as possible to the schedule. Notify the General Contractor at least one week in advance of any changes to the schedule.

E. Be responsible for scheduling and arranging all Mechanical work for the orderly progress of the project.

1.15 COORDINATION OF WORK

A. Coordinate the Mechanical Work with the General Contractor and other Sub-Contractors.

B. Inform the General Contractor at least twenty-four (24) hours in advance of any service interruption or disruption to construction operations and estimate the duration of interruption or disruption. Do not proceed until the General Contractor has been fully informed and has granted his approval.

1.16 RECORD DRAWINGS

A. Contractor shall maintain one set of Drawings at the job site for use as a record copy. Each change order or other revisions, deletions, or additions, shall be clearly marked and noted by colored marker. Where any material, ductwork, piping or system component is installed different from what is shown on the Construction Documents, record such differences clearly and neatly. This record set of Drawings shall be submitted to the Owner's Construction Representative upon completion of the project.

1.17 SHOP DRAWINGS

A. Submit Shop Drawings for all materials and equipment in accordance with General Requirements Section 01 33 00 - Submittal Procedures.

B. All cuts have complete dimensions, ratings, installation requirements, etc.

C. Shop Drawings will not be accepted for review by the Architect/ Engineer until after they have been checked and approved by the Contractor as evidenced by his approval stamp and signature.

D. Where the Specifications state "or equal" or "or approved equal", manufacturers other than those listed may be substituted in accordance with Section 01 25 00 - Substitution Procedures.

1.18 OPERATION AND MAINTENANCE MANUALS

A. Submit two (2) copies of Operation and Maintenance Manuals for all HVAC systems and equipment in accordance with General Requirements Section 01 78 23 - Operation and Maintenance and Section 23 01 70 - HVAC Submittals.

1.19 COMPLETION

A. The Work shall be completed for service on the date stipulated in the Contract.

B. Correlate and finish the Work so that the affected areas and systems will be adjusted, cleaned and placed in proper working order at the time of the substantial completion observation.

C. Prior to final inspection, thoroughly clean the surfaces of all floor drains, fixtures and equipment furnished and installed under this Work. Refer to Section 23 01 70 - HVAC Submittals for further direction.

1.20 WARRANTIES

A. Submit two (2) copies of the Warranty Manual in accordance with Section 01 78 00 - Closeout Submittals and Section 23 01 70 - HVAC Submittals.

B. Refer to technical sections for extended warranties on equipment where stipulated.

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

SECTION 23 01 30

HVAC REMODELING PROVISIONS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers plumbing remodeling provisions and applies to and forms a part of each of the following Sections of Division 23:
   1. Section 23 07 00 - HVAC INSULATION
   2. Section 23 30 00 - HVAC AIR DISTRIBUTION
   3. Section 23 70 00 - CENTRAL HVAC EQUIPMENT
   4. Section 23 80 00 - DECENTRALIZED HVAC EQUIPMENT
   5. Section 23 90 00 – HVAC CONTROLS AND INSTRUMENTATION

B. HVAC remodeling shall be in accordance with this and other applicable Sections of these Specifications and the requirements of Section 23 01 20 – HVAC General Provisions.

1.02 DISCOVERY OF ASBESTOS

A. During the course of Work, if the Contractor observes the existence of asbestos pipe insulation, the Contractor shall promptly notify the Owner and Architect/ Engineer in writing and by telephone. Owner shall consult with the Architect/ Engineer regarding appropriate procedure to be taken, and the Contractor shall not perform any work pertinent to the asbestos material.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 FIXTURES AND EQUIPMENT TO BE REMOVED

A. Remove only the existing fixtures and equipment indicated on the Drawings to be removed. All other existing fixtures and equipment shall remain as is.

B. The Owner shall retain the right to keep certain fixtures and equipment that are removed. The Mechanical Contractor shall remove from the premises and properly and legally dispose of those fixtures and equipment the Owner chooses not to keep and all piping to be removed under the Work.

3.02 REMODELING CONDITIONS

A. Only where indicated on the Drawings are existing services to be removed, relocated or connected under Division 23. All other existing services shall remain as is.

B. Work that interrupts any service, including cutting into existing lines for new connections, shall be performed so as to minimize interruption of service and disruption to building operations. Anticipate work during abnormal hours. These off-hours labor costs shall not result in additional cost.

C. Schedule with the Owner two (2) weeks in advance of any shut off necessary, time of shut-off and estimated duration. Only after the Owner has been fully informed, and has agreed to the scheduled shut-offs, can the Work prompting the shut-off then proceed.

D. Connections to and relocation of existing piping/ductwork systems, which of necessity must provide continuous uninterrupted service, shall be accomplished in the least possible time. Work shall be scheduled so as to minimize the down time for the respective systems involved. This will require that all interconnecting portions of these systems shall be installed as complete as practicable prior to actual shutdown for final connections.

E. Locate existing piping/ductwork and make connections where required and/ or where shown on the Drawings. Do not cut into an existing service without first ascertaining to the satisfaction of the Owner that the pipe involved is the correct service.

F. At locations where new piping connects to existing, Contractor to verify existing conditions and be responsible for all alterations for such connections.

G. General HVAC Demolition Work Includes as follows:
   1. The demolition, removal and capping of existing heating elements and equipment and the demolition, removal and capping of existing heating piping.
   2. The demolition, removal and/ or relocation of air handling equipment, diffusers, registers and grilles and the removal of existing ductwork.
   3. The demolition and removal of all existing controls in all rooms and areas where new HVAC controls are required.

END OF SECTION

SECTION 23 01 55

HVAC SITE CONDITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waste Management Procedures

B. Cleaning and Protection.

C. Final Cleaning.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Methods of trash/ waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

C. Regulatory Requirements: The Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and Local requirements, pertaining to legal disposal of all construction and demolition waste materials.

3.02 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/ rubbish from site periodically and dispose off-site; do not burn or bury.

3.03 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual Specification Sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.04 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Provide new filters for all new equipment installed under this contract.

E. Provide an extra set of filters for all new equipment installed under this contract. Coordinate with the Owner for placement.

F. Clean debris from roofs, gutters, and drainage systems.

G. Remove waste, surplus materials, trash/ rubbish, and construction facilities from the site; dispose of in a legal manner; do not burn or bury.

H. Prior to final inspection, thoroughly clean surfaces of all floor drains, fixtures and equipment furnished and installed under this Work. Remove all stickers, rust, stains and other foreign matter or discoloration.

END OF SECTION

SECTION 23 01 60

HVAC PIPING PROCEDURES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers pipes, pipe fittings, valves and unions and applies to and forms a part of each of the following sections of Division 23:
   1. Section 23 20 00 - HVAC Piping and Pumps

B. Pipes, pipe fittings, valves and unions shall be in accordance with this and other applicable Sections of these Specifications and the requirements stated in Section 23 01 20 - HVAC General Provisions, Section 23 05 00 - Common Work Results for HVAC.

PART 2 PRODUCTS

2.01 PIPE, PIPE FITTINGS, VALVES AND UNIONS

A. HVAC pipe, pipe fittings, valves and unions are Specified in the following Sections:
   1. Section 23 21 13 - Hydronic Piping

PART 3 EXECUTION

3.01 ABOVE GROUND PIPING INSTALLATION

A. General:
   1. Install piping, valves and specialties indicated and as sized on the Drawings and supported as specified in Section 23 20 00 - HVAC Piping and Pumps.
   2. Locate piping as dimensioned, locate piping by scaling the Drawings.
   3. Coordinate piping locations with the work of Other Trades.
   4. All piping shall be installed parallel or perpendicular to adjacent walls and partitions, unless otherwise shown. All risers shall be plumb.
   5. Under no circumstances shall any pipe connection be made by punching a hole in the pipe and inserting a branch take-off.

B. Clearances:
   1. Provide clearance around each pipe to accommodate the specified insulation thickness and jacketing and to permit its free movement due to thermal expansion.

C. Preparing and Protecting Pipe:
   1. All piping shall be blown out with compressed air or otherwise cleaned internally immediately prior to installation into the pipe line.
   2. Cap or cover all open piping during erection to prevent entry of foreign material.

D. Pipe Termination for Future:
   1. Cap terminated ends of pipe mains and branches where indicated for future extension.
   2. Provide flanges or screwed unions at all connections to equipment.

E. Changes in Pipe Sizes:
   1. Increasers may be concentric.
   2. Reducers shall be eccentric:
      a. Flat on top for water.

F. Branch Take-Offs:
   1. Service water branch take-offs shall be off the top of the mains and at a 90° angle, unless otherwise shown.

G. Equipment Piping:
   1. All branch piping for connections to equipment shall consist of at least two elbows to ensure proper alignment and to eliminate pipe stresses on the equipment.
   2. Cap or cover all open piping during erection to prevent entry of foreign material.

H. Piping to Automatic Control Valves:
   1. Piping to automatic control valves shall be run line size as close as possible to valve connections. Install eccentric reducers at valve inlets and concentric increasers at valve outlets. Provide unions or flanges for easy removal of automatic control valves. Strainers ahead of control valves shall be line size.

I. Piping to Pumps:
   1. Piping to pumps shall be run line size as close as possible to pump connections. Pump shut-off valves shall be line size. Provide eccentric reducer, flat on top, at pump suction to reduce from line size to pump suction connection size. Provide concentric increaser at pump discharge to increase from pump discharge connection to line size. Long radius reducing elbows may be substituted for reducers and increasers specified above if radius of turn is in the vertical plane.

J. Pipe Anchors:
   1. Provide pipe anchors where shown on the Drawings and where they are otherwise needed to prevent excessive movement of piping and/ or excessive strain on piping and equipment connections.

K. Spring Hangers:
   1. Provide spring hangers where shown on the Drawings to prevent excessive forces from being transmitted to building structure.

L. Piping Near Electrical Panels:
   1. Where it is not possible to avoid installing pipe joints or valves in piping within 3'-6" in horizontal direction from electrical panels or equipment, provide drip pan, sized to afford protection and constructed of properly supported galvanized sheet metal.

3.02 CUTTING AND THREADING

A. Pipes 2" and smaller shall be cut, threaded and reamed with appropriate sharp tools.

B. Pipe shall be accurately cut to measurement. Springing or forcing of piping resulting from error in measurement is not acceptable.

C. Clean and remove all metal chips, cutting oil and other foreign material from both inside and outside of pipe before making up joints.

D. Where welding is required, remove cuttings oils with cleaning solvents.

3.03 SCREWED CONNECTIONS

A. Threads for screwed connections shall be ANSI Standard tapered pipe threads B2.1.

B. Remove fins and burrs from pipe and fitting before making up joint.

C. Screwed connections shall be made using approved pipe thread compound or sealant.

D. Obtain full thread engagement in fittings as described in ANSI B2.1. Backing off threaded joints for alignment shall not be permitted.

E. Whenever a threaded joint is separated, remove old compound or sealant remaining on all threads before applying new.

3.04 WELDED CONNECTIONS

A. Standard seamless butt weld elbows, tees and reducers shall be used with all welded pipe. Weldolets, Thredolets, or Socolets may be used on pipe sizes 4" and larger where pipe reduction is two (2) sizes or more.

3.05 FLANGED CONNECTIONS

A. Clearance between flanged faces shall be such that joints can be gasketed and bolted tight without producing strain on the piping system.

B. Connections shall be made with faces parallel and bores concentric.

3.06 SOLDERED CONNECTIONS

A. All soldered type joints shall be made with materials specified for the respective service. The amount of solder and flux used per connection shall be the minimum required to assure a tight joint. All soldered pipe ends shall be reamed with appropriate sharp tools prior to soldering.

3.07 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be used when joining piping of dissimilar metals such as copper to steel, cast iron, or malleable iron.

B. Connections shall be made with dielectric screwed unions or with flanges having non-conducting gasket, washers and bolt inserts.

C. Underground utility services entering buildings shall have dielectric connections installed on the outlet side of the first shut-off valve.

3.08 PLACEMENT OF VALVES

A. Furnish and install shut-off valves at the following locations:
   1. Each branch line take-off from main supply pipe or header.
   2. At all end of line equipment.
   3. Ahead of each control valve.
   4. Each branch line take-off from main supply pipe or header indicated for future extension or connection. Cap outlet side of shut-off valve.
   5. On strainer blow-down piping.

B. Furnish and install drain valves at the low points of each water piping system for drainage.

C. Furnish and install designated valves at other locations indicated on the Drawings.

3.09 PIPE SLEEVES

A. Furnish and set pipe sleeves where pipes and tubes pass through walls, partitions, floors and roof.
   1. Sleeves in masonry walls and floor, in fire rated gyp board partitions, and in masonry or steel deck roofs shall be zinc coated steel pipe.
   2. Sleeves in non-fire rated gyp board partitions shall be zinc-coated sheet steel.
   3. Sleeves shall be at least two (2) nominal pipe sizes larger that the through-going pipe or tube. For insulated pipes and tubes, the sleeve shall be large enough to accommodate the Specified insulation thickness allowing at least 1/4" annular space between the insulation and the sleeve.
   4. Each pipe and tube shall be individually sleeved.
   5. Floor sleeves shall extend 2" above the finished floor.
   6. Roof sleeves shall extend from 4" below to 12" above the roof deck and shall be furnished with welded attachment brackets. Furnish and install a weather skirt for each roof sleeve.
   7. For below grade wall sleeves, the opening between the pipe and sleeve shall be sealed with a modular wall seal. Installation shall be in accordance with the manufacturer's instructions.

3.10 FIRESTOPPING

A. Pipe Penetrations:
   1. Provide approved through wall/ floor penetrations where pipes and tubing

pass through rated walls and floors. Holes shall be a minimum of 3/4" greater in inside diameter than the external diameter of pipe and insulation passing through.

2. Space between pipe, tubing, or insulation and the sleeve or hole shall be not less than 3/4". Seal the annular space between the pipe or tubing and the sleeve with approved brand fire barrier caulk or putty. Firmly pack the space between the piping and the sleeve with a mineral wool insulation and caulk both ends of the penetration watertight with elastic cement.
3. Contractor shall provide to the Engineer and Code Official, two (2) copies each of intended through-penetration firestop system for each floor and wall pipe penetration. Include UL system number for proposed system including F and T rating, detailed drawing and list of components, installation procedure and manufacturer.

3.11 ESCUTCHEON PLATES

A. Furnish and install chrome plated escutcheon plates at floor, wall, roof and ceiling penetrations by un-insulated pipe and tubing in finished areas. Escutcheon plates shall completely cover penetration holes and any spalling of the wall, shall be flush with adjoining surfaces and shall be secured in place.

3.12 CLEANING AND FLUSHING OF PIPING SYSTEMS

A. Thoroughly flush all piping systems using a trisodium phosphate liquid cleaner, Robbins Chemical, or approved equal. For copper tubing, use a solution of one pound of cleaner per 50 gallons of water. For ferrous pipe, use a solution of 2 to 3 percent cleaner in water. Notify the Owner's Construction Representative of the time and date the piping is to be flushed to permit the Representative's visual observation.

B. After piping systems have been in continuous use for two (2) weeks, remove, clean and replace screens in pipeline strainers and traps.

3.13 PRESSURE TESTS

A. General:
   1. All piping systems shall be tested after erection and before concealing or covering and connecting to fixtures and equipment. The Mechanical Contractor shall arrange and pay for all tests of Mechanical Systems as required by Code and as Specified. Any materials or workmanship found faulty shall be immediately replaced or repaired and sections or systems retested.
   2. Provide all gauges, tools, pumps, gas, air or other equipment required for testing.
   3. Tests shall be made in the presence of the appropriate inspectors and/ or the Owner's Construction Representative.
   4. Any damage resulting from leakage of piping during the testing or guarantee periods shall be repaired at the expense of the Mechanical Contractor.

B. All piping shall prove absolutely tight under required tests.

C. Remedy all defects disclosed as the result of the tests. Repeat as necessary until test results are acceptable.

D. Certificates shall be furnished to the Architect/ Engineer that tests have been satisfactorily completed.

END OF SECTION

SECTION 23 01 70

HVAC SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operation and Maintenance Data.

B. Warranties and bonds.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal procedures: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 77 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

B. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with the Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion,

prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure,
incorporating manufacturer's instructions.

3.02 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

D. Provide servicing and lubrication schedule, and list of lubricants required.

E. Include manufacturer's printed operation and maintenance instructions.

F. Include Sequence of Operation by controls manufacturer.

G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

H. Provide control diagrams by controls manufacturer as installed.

I. Include test and balancing reports.

J. Additional Requirements: As specified in individual product specification sections.

3.03 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual. Including step-by-step instructions for operating the equipment.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment. At the beginning of each section, the equipment supplier's name, address and phone number shall be provided.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems, in order, under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Contractors, Subcontractors and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended

cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data. All data must clearly show model numbers, sizes and capacities of the equipment installed.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties and bonds.
   e. Factory/ Facility start-up reports.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of, Consultants, Sub consultants and names of responsible parties; schedule of products and systems, indexed to content of the volume.

L. Operation and Maintenance Manuals shall be submitted to the Engineer for approval prior to final observation of the Work. The Engineer will forward approved Manuals to the Owner's Construction Representative.

3.04 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with the Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-executive submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in Operation and Maintenance manuals, indexed separately on a Table of Contents.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of Table of Contents of the Project Manual, with each item identified with the number and title of the Specification Section in which specified, and the name of the product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

J. The Mechanical Contractor shall guarantee all workmanship and material against defects for at least one year from the date of Owner acceptance. Mechanical Contractor shall repair or replace any defects in Mechanical workmanship, materials, fixtures and equipment that appear or cause trouble of any kind, within the one year period, without any cost to the Owner.

K. Refer to technical sections for extended warranties on equipment where stipulated.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers basic materials and methods and applies to and forms a part of each of the Sections of Division 23.

B. The Work shall be in accordance with this and other applicable Sections of these Specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS.

1.02 RELATED SECTIONS

A. The following Sections apply to and form a part of these Sections:
   1. Section 23 05 13 Common Motor Requirements for HVAC Equipment
   2. Section 23 05 14 Common Electrical Requirements for HVAC Equipment
   3. Section 23 05 53 Identification for HVAC Piping and Equipment
   4. Section 23 05 93 Testing, Adjusting, and Balancing for HVAC

1.03 QUALITY ASSURANCE

A. The physical and chemical properties of all materials, design, performance characteristics and methods of construction of all equipment shall be in accordance with applicable current editions of the following Standards, references and guidelines:
   1. Underwriters Laboratories, Inc. (UL).
   2. National Fire Protection Association Standards (NFPA).
   3. American Society for Testing and Materials (ASTM).
   4. American Society of Mechanical Engineers (ASME).
   5. American Water/ Works Association (AWWA).
   6. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE).
   7. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).
   8. Air Movement and Control Association (AMCA).
   9. Air Conditioning and Refrigeration Institute (ARI).
   10. National Environmental Balancing Bureau (NEBB).
   11. American Association of Balancing Contractors (AABC).
   12. Plumbing and Drainage Institute (PDI).
   13. American Society of Plumbing Engineers (ASPE).
   14. American Gas Association (AGA).
   15. American National Standards .

16. National Electrical Manufacturers Association (NEMA).
17. Institute of Electrical and Electronic Engineers (IEEE).
18. Cast Iron Soil Pipe Institute (CISPI).
19. Plastic Pipe and Fittings Associations (PPFA).

1.04 DESIGN BASIS

A. The design and the physical sizes of equipment shown to scale on the Drawings are based on the manufacturers and model numbers of equipment scheduled on the Drawings. The Scheduled equipment establishes the quality basis and performance required. The Drawings were prepared to show the service connections, minimum clearances and accommodations required for the scheduled equipment.

B. If the Contractor elects to substitute equipment specified as "or equal" or "or approved equal", or to substitute equipment by other manufacturers where the manufacturer's name is added by addendum as "approved equal manufacturer", he/ she shall be responsible for the space requirements, configuration changes in connections, bases, supports, vibration isolation, structural members, openings in structure and its relationship to other equipment and services that may be affected by its use. Contractor shall submit scale drawings to the Engineer to show how the substituted equipment will be accommodated including manufacturer's recommended clearances and servicing provisions.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 RECEIPT, HANDLING AND STORAGE

A. Contractor shall be responsible for receiving delivery of the Mechanical materials, fixtures and/ or equipment.

B. Provide personnel to meet all delivery trucks, inspect the equipment and sign for the delivery, unload the trucks and move the equipment to locations agreed upon in advance. Uncrate the equipment and properly dispose of all crating materials off-site.

C. The Owner will not provide equipment, labor or handling assistance for this Work.

D. If the materials, fixtures and/ or equipment must be stored on-site prior to installation, the Contractor shall move the material, fixtures and/ or equipment to the location designated and provide temporary protection against weather and physical damage as directed by the Owner's Construction Representative.

3.02 EQUIPMENT INSTALLATIONS

A. Provide all necessary rigging, scaffolding, tools, tackle, labor, etc. necessary for the

complete installation of the Mechanical equipment.

B. Adapt the Work to the job conditions and install the Work so that beams, joists and light fixtures, etc. have clearance with Mechanical items. Adjust risers and avoid light fixtures. Raise or lower work to permit the passing of ductwork of the work of other trades, all as required or as job conditions dictate, without additional cost to the Owner.

C. All equipment shall be installed and connected with the best engineering practices and in accordance with the manufacturer's instructions and recommendations. Ductwork, piping, electrical connections, valves and appurtenances recommended by the manufacturer or as required for proper operation shall be furnished and install to complete the installation.

D. All equipment shall be installed and located to facilitate accessibility for maintenance and/ or replacement.

3.03 EXCAVATING AND BACKFILLING

A. Excavate and backfill as required to install underground piping, pipe conduits and/or ductwork. All the Work shall be carefully protected from injury due to frost, water or other causes and any work damaged shall be promptly and properly repaired. All underground work shall be inspected and approved prior to backfilling.

B. Backfill around underground pipe conduits and/ or ductwork shall be done with sand or gravel, free from perishable material and excessive amounts of clay. If the natural earth material is of granular structure, as specified above, no additional material will be required. All buried services shall have a uniform bearing and shall be placed on undisturbed soil or compacted fill.

C. Backfill up to 2'-0" of cover over piping shall be placed by hand and tamped, being careful not to damage the Work. Backfill above this point shall be placed and compacted to not less than 95% within building limits of maximum density given by ASTM D698-70T (Standard Proctor Density).

D. Any dewatering required to install Mechanical Work shall be the responsibility of the installing Contractor.

3.04 WELDING

A. All welding shall be performed by certified welders. Certification shall be for the type of work being performed and shall be accomplished in accordance with ASME "Qualification Standard for Welding Procedures, Welders and Welding Operations."

B. Contractor shall submit copies of the welder's certification to the General Contractor's construction superintendent prior to any welds to be made by any welder.

C. All welds shall be stronger than the parent metal. A minimum of two (2) passes shall be used on all arc welded joints.

3.05 CUTTING AND PATCHING

A. Do all cutting and patching necessary for the installation of the Mechanical Work, except where otherwise indicated. All cutting shall be done in a manner directed by the General Contractor. Patching shall match adjacent surfaces.

B. Do not cut structural members.

C. Core drill all openings up to 10 inches in diameter.

3.06 ACCESSIBILITY

A. Advise the General Contractor of spaces and clearances required to accommodate the Mechanical Work. Locate all equipment which must be serviced, operated or maintained in fully accessible positions.

B. Floor, wall and ceiling access panels as required to service valves, controls, dampers, fire dampers and equipment will be provided under the general construction work.

C. Coordinate required locations with the General Contractor.

3.07 PAINTING

A. Mechanical Contractor shall touch-up the surface marring on all pre-finished Mechanical equipment to match existing factory finish.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.02 RELATED SECTIONS

A. Section 26 27 17 - Equipment Wiring.

B. Section 26 24 19 - Motor-Control Centers.

1.03 REFERENCES

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

PART 2 PRODUCTS

2.01 MOTORS

A. Furnish electric motors as required for each motor driven unit. All motors shall conform with applicable NEMA, IEEE and ANSI Standards and shall bear the manufacturer's nameplate indicating the operating characteristics.

1. Motors shall be General Electric, Marathon, Westinghouse, Gould, or approved equal.
2. All motors shall be provided with ball or roller bearings complete with grease cups. Motors shall be mounted on sliding cast iron bases as required.
3. Each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the specified speed including all V-Belt and/ or drive and coupling losses. Where V-Belt drives are employed, the motor horsepower nameplate ratings shall not be less than 107 percent of the driven unit brake horsepower requirements.
4. All centrifugal pump motors shall be sized so as to be non-overloading throughout the flow range of the required pump impeller size.
5. Each motor shall have a minimum 1.15 service factor rating or as scheduled in this Section of the Specifications.
6. Motors shall be rated for continuous duty at 100 percent of rated capacity.

Temperature rise shall be based on an ambient temperature of 40° C.

7. Single phase motors shall be wound for 120 volts or 230 volts as specified, 60 cycle alternating current. Generally, motors 1/2 horsepower and under shall be single phase. All such motors shall have integral thermal overload protection.
8. Motors 3/4 horsepower and larger shall be polyphase motors wound for 460 volt, 60 cycle, 3 phase alternating current.
9. All motors 1 horsepower and larger, furnished separately or as part of equipment provided on this project, shall be high efficiency type NEMA Design B. The NEMA Nominal Efficiency Rating as stamped on the motor nameplate shall meet or exceed the efficiency as defined and listed in the latest edition of IEEE Standard 112 and NEMA MGI-12.53 a., b.
10. Motors operated from variable frequency drives (VFD's) shall be suitable for VFD application and shall include a thermal switch in the windings with leads brought into the motor junction box.

B. The horsepower of each motor Specified, Scheduled or indicated on the Drawings is the basis for the electrical feeder size indicated on the electrical drawings. If the actual horsepower for any equipment proposed to be furnished differs from that which was Specified or shown on the Drawings, the difference shall be referred to the General Contractor for coordinating electrical changes prior to installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. All motor starters will be furnished under Division 26 - ELECTRICAL, unless otherwise specified.

END OF SECTION

SECTION 23 05 14

COMMON ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers electrical work and equipment and applies to and forms a part of each of the following Sections of Division 23:
   1. Section 23 30 00 - HVAC AIR DISTRIBUTION
   2. Section 23 70 00 - CENTRAL HVAC EQUIPMENT
   5. Section 23 80 00 - DECENTRALIZED HVAC EQUIPMENT
   6. Section 23 90 00 – HVAC CONTROLS AND INSTRUMENTATION

1.02 ELECTRICAL WORK

A. All motor starters, starting switches, disconnects and variable frequency drives (VFD) will be furnished and installed under Division 26 - ELECTRICAL unless specified or as an integral part of the equipment being installed under Division 23.

B. All electrical power wiring will be furnished and installed under Division 26 - ELECTRICAL unless specifically described as a part of the installation under Division 23.

C. Electrical control wiring furnished and installed under Division 23 shall conform to the requirements of Division 26 - ELECTRICAL.

1.03 TESTING AGENCY CERTIFICATION

A. All Electrical equipment furnished under this Section shall be labeled by a testing agency that is recognized by the State Board of Electricity.

B. The equipment shall be constructed in accordance with the testing agency standard(s) that applies to the approved label.

C. The testing agency label shall apply to the completed assembly. Equipment that utilizes labeled components but does not have a label for the completed assembly is not acceptable.

D. The following testing agency labels are acceptable:
   1. Underwriter's Laboratories (UL):
      a. UL508 - Industrial Control Equipment
   2. Others as approved by the State Board of Electricity.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 23 05 40

SUPPORTS AND ANCHORS – HVAC EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers supports and anchors and applies to and forms a part of each of the following Sections of Division 23.
   1. Section 23 21 13 – Hydronic Piping.
   2. Section 23 21 14 – Hydronic Specialties.
   3. Section 23 70 00 – Central HVAC Equipment
   4. Section 23 80 00 – Decentralized HVAC Equipment

B. Supports and anchors shall be in accordance with this and other applicable Sections of these Specifications and the requirements of Section 23 01 20 – HVAC GENERAL PROVISIONS and Section 23 01 60 - HVAC PIPING PROCEDURES.

C. Install pipe hangers and supports as Specified in this Section and/ or as indicated on the Drawings, conforming to Manufacturer's Standardization Society Standards SP58 and SP69.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Support piping from structure with adjustable hangers:
   1. For cast iron, steel and plastic piping 2" and smaller: Anvil Fig. 269, PHD Fig. 180, Mason Fig. 202, Elcen Fig. 202, B-Line Fig. B3172 or equal.
   2. For cast iron pipe 3" size and for steel and plastic piping 2-1/2" and larger: Anvil Fig. 260, PHD Fig. 450, Mason Fig. 239, Elcen Fig. 12, B-Line Fig. B3100.
   3. For cast iron piping 4" and larger: Anvil Fig. 590, Mason, Elcen, B-Line Fig. 3100 or equal.
   4. For copper tubing 2" and smaller: Anvil Fig. CT-269, B-Line Fig. B3172CT.
   5. For copper tubing 2-1/2" and larger: Anvil Fig. CT-65, B-Line Fig. 3104CT.

B. Pipe Clamps
   1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3140 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or Trapeze Hanger
   1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
   2. Mount pipes to trapeze hanger with 2 piece straps sized for outside diameter of pipe, B-Line B2000 Series.
   3. For pipes subjected to axial movement:
      a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated pipes.
      b. Strut mounted pipe guide, B-Line B2417.

D. Wall Supports
   1. Metal pipes 4 inch and smaller:
      a. Carbon steel hook, B-Line B3191.
      b. Carbon steel J-hanger, B-Line B3690.

E. Floor Supports
   1. Hot metal piping under 6 inch and all cold metal piping:
      a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.
   2. Hot metal piping 6 inch and larger:
      a. (Adjustable) Roller stand with base plate, B-Line B3117SL (or B3118SL).
      b. Adjustable roller support and steel support sized for elevation, B-Line B3124.

F. Vertical Supports (Riser Clamps)
   1. Metal piping:
      a. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373.

G. Copper Tubing Supports
   1. Hangers shall be sized to fit copper tubing outside diameters.
      a. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
      b. Malleable iron ring hanger, B-Line B3198RCT or hinged ring hanger B3198HCT.
      c. Malleable iron split-ring hanger with eye socket, B-Line B3173CT with B3222.
      d. Adjustable steel clevis hanger, B-Line B3104CT.
   2. For supporting vertical runs use epoxy painted or plastic coated riser clamps, B-Line B3373CT or B3373CTC.
   3. For supporting copper tube or strut use epoxy painted pipe straps sized for copper tubing, B-Line B2000 series, or plastic inserted vibration isolation clamps, B-Line BVT series.

H. Continuous Plastic Pipe Supports
   1. V-Bottom clevis hanger with galvanized 18-gauge continuous support

channel, B-Line B3106 and B3106V, to form a continuous support system for plastic pipe or flexible tubing.

I. Supplementary Structural Supports
   1. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 Steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to the Engineer for approval. Use clamps and fittings designed for use with the strut system.

2.02 UPPER ATTACHMENTS

A. Beam Clamps
   1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
   2. C-Clamps shall have locknuts and cup point set screws, B-Line B351L, or B3036L. Top flange C-Clamps shall be used when attaching a hanger rod to the top flange of structural shapes, B-Line B3034 or B3033. Refer to manufacturers recommendations for setscrew torque. Retaining straps shall be used to maintain the clamps position on the beam where required.
   3. Center loaded beam clamps shall be used where specified. Steel clamps shall be B-Line B3050, or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be B-Line B3054 or B3291-B3297 Series as required to fit beams.

B. Concrete Inserts
   1. Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
   2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.

2.03 ACCESSORIES

A. Hanger Rods shall be threaded at both ends, or be continuously threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.

C. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum

thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.

2.04 FINISHES

A. Indoor Finishes
   1. Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper(R). Additional PVC coating of the epoxy painted hanger shall be used where necessary.
   2. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish, B-Line Dura-Green(R).
   3. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green(R).

B. Outdoor and Corrosive Area Finishes
   1. Hangers and struts located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
   2. Hangers and strut located in corrosive areas shall be type 304 stainless steel with stainless steel hardware.
      a. Hangers in the Filter Rooms. Isolation of dissimilar metals shall be provided.

PART 3 EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

A. Insulated pipe supports should be provided at hanger, support, and guide locations on pipe requiring insulation. The insert should consist of either Hydrous Calcium Silicate or Polyisocyanurate Foam insulation (Urethane) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) or galvanized steel jacket and installed during the installation of the piping system.

B. Locate hangers and supports at changes in direction and at concentrated loads. Hanger design shall permit vertical adjustment and lateral movement to allow pipe expansion.
   1. Three (3) or more pipes may be supported on trapeze hangers using two (2) clevis hangers and a capped pipe cross member.
      a. Isolate copper pipe from bearing on the cross member with an electrically-insulating material.
      b. Where indicated, trapeze hangers shall be "Unistrut", or equal, double channel with drop rods and double nuts. Where pipes are indicated to be supported from the underside of trapeze hangers, provide

"Unistrut", or equal, speed clamps.

2. Support horizontal cast iron pipe at every joint and sway brace to prevent shear.
3. Support horizontal copper tubing as follows:

NOMINAL PIPE SIZE	ROD DIA. (INCH)	MAX INT. (FT.)
1/2 to 3/4	3/8	5
1	3/8	6
1-1/4	3/8	6
1-1/2	3/8	8
2	3/8	8
2-1/2	1/2	9
3	1/2	10
3-1/2	1/2	11
4	5/8	12

4. Support vertical copper tubing at each story using a riser clamp.
5. Support horizontal steel piping as follows:

NOMINAL PIPE SIZE	ROD DIA. (INCH)	MAX INT. (FT.)
1/2 to 1-1/4	3/8	7
1-1/2	1/2	8
2	1/2	9
2-1/2	1/2	10
3	1/2	10
3-1/2	1/2	13
4	5/8	14
5	5/8	15
6	3/4	17

6. Support horizontal grooved steel piping as follows:

NOMINAL PIPE SIZE	ROD DIA (INCH)	MAX INT. (FT.)
Up to1-1/4	3/8	8
1-1/2 and 2	1/2	8
2-1/2 and 3	1/2	10
4 and 5	5/8	12

7. Support vertical steel piping at each story using a riser clamp. Support

neoprene jointed piping at 5 foot intervals except where 10 foot lengths of pipe are used.

8. Support horizontal PVC & CPVC piping (Up to 100°F.) as follows:

NOMINAL PIPE SIZE	ROD DIA (INCH)	MAX INT. (INCH)
Up to 3	3/8	32
4	1/2	32

9. Support vertical plastic pipe sizes up to 1-1/2 inches at four foot intervals for exposed and concealed locations. Secure pipe to structure using a riser clamp.
10. Hangers for hot water piping services below 140° F may bear directly on the hangers.
11. Hangers for cold water piping services at 55° F and lower shall encompass and bear on the insulation covering.
12. Hanging from one pipe to another is prohibited.
13. Hanging piping/ tubing from ductwork or other equipment is prohibited.
14. Support pipe hangers from structure using appropriately secured attachments.
15. Provide means of preventing dissimilar metal contact such as plastic/ epoxy coated hangers.
16. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.
17. Where structure is steel framed, support pipe hangers from beam clamps, attachments, and brackets bolted to steel joints or beams. Bolting to steel deck is prohibited.
18. Where structure is reinforced concrete, support pipe hangers from concrete as follows:
    a. Loads to 400 pounds: Light weight concrete inserts, Grinnell Figure 285, Elcen Figure 86, Mason Figure 2570.
    b. Loads to 400 to 1430 pounds: Universal concrete insert, Grinnell Figures 282, Elcen Figure 64, Mason Figure 2570.
    c. Set inserts in concrete forms, obtain approval of their locations in ample time to permit pouring of concrete as scheduled; provide reinforcing rods for pipe sizes over 3".
    d. In areas where concrete slab will form finished ceiling, take care to have inserts finish flush with concrete slab surface and to make a neat appearance.
    e. Where insert are drilled into concrete slab, contractor shall confirm locations of concrete rebar and avoid penetrations at these locations.

3.02 ANCHORS

A. Anchor pipes as required and where indicated on the Drawings. Use steel collars fitted with lugs and bolts. Attachment in a manner detrimental to the building structure is prohibited.

3.03 CONCRETE BASES AND HOUSEKEEPING PADS

A. Provide all concrete bases and housekeeping pads required for mechanical equipment, except where otherwise indicated. Set expansion bolts in bases for attachment of equipment and/or isolators.

B. Bases and pads shall be constructed of 3,000 pound, 28 day strength concrete. Each base and pad shall be attached to the building floor using two or more expansion bolts which shall be set before pouring so that bolt heads are concealed within the base. The form material shall have smooth surfaces and all surfaces shall be plumb and in line with the building structural work. Surfaces of bases and pads shall be finished sufficiently smooth to receive painting. All bases shall be 4" high or as otherwise indicated on the Drawings and of sufficient length and width to accommodate the equipment mounted thereon. Housekeeping pads shall be minimum 3" high. After bases and pads are poured, they shall set seven days before mounting equipment.

3.04 STEEL SUPPORTS

A. Provide all steel supports required for the mechanical equipment to be furnished under this Division, except where otherwise indicated.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers pipe coding and equipment labeling and applies to and forms a part of each section of the Division 23 specifications under which piping and equipment are installed.

B. Identification shall be in accordance with this and other applicable sections of these specifications and the requirements of Section 23 01 20 – HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 SUBMITTALS

A. Submit and provide pipe markers and color banding for approval.

B. Submit valve lists for approval by the owner. Provide valve tags.

C. Submit and provide markers and tags for HVAC equipment.

PART 2 PRODUCTS

2.01 PIPE MARKERS

A. Pipe markers shall be Seton Set Mark, Brady Perma-Code, or approved equal, one-piece preprinted pressure sensitive markers and tapes and shall be in accordance with ANSI A13.1-1981 Standard adopted by OSHA.

B. Green bands (backgrounds) are required for safe contents, yellow bands for hazardous contents, blue bands for low hazard contents and red bands for fire quenching contents.

C. The width of the color band or marker and the size of legend letters shall be as follows:

O.D. of Pipe and Covering	Marker Width	Legend Letter Size
3/4" to 1-1/4”	8”	1/2"
1-1/2" to 2"	8"	3/4"

2-1/2" to 6"	12"	1-1/4"

D. Arrows shall be black with background color same as color banding. A single arrow shall indicate direction of flow and a double arrow shall indicate reversible flow.

E. Legends and background and letter colors:

Pipe Contents & Title	Back-ground	Letters
Heating Supply	Yellow	Black
Heating Return	Yellow	Black
Cooling Supply	Yellow	Black
Cooling Return	Yellow	Black
Refrigerant Liquid	Yellow	Black
Refrigerant Suction	Yellow	Black

2.02 VALVE TAGS

A. Valve tags shall be Seton, Brady, or approved equal, 1-1/2" diameter, solid plastic with heat stamped identifying service and number. Background and letter colors for each service shall be the same as listed in paragraph E above. Valve tag fasteners shall be No. 6 brass bead chains, 4-1/2" in length, with locking link.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

A. Air handling units, fans, air conditioners, unit heaters, condensing units, make-up air units, boilers, and pumps shall be identified by service name and number either with permanent pre-manufactured 2" wide engraved plastic tags or by stenciling with 2" high black letters on contrasting color background.

B. Identification locations shall be as directed by the Owner's representative.

3.02 PIPE IDENTIFICATION

A. All new piping inside the building shall be identified with pipe markers after pipe has been installed.

B. Pipe markers shall be applied to pipes adjacent to both sides of partitions and above ground floors, at branch takeoffs adjacent to valves, at connections to equipment and 30 feet on center for straight lengths of pipe.

C. At each color band location, a title showing the pipe contents and an arrow showing direction of flow shall be applied.

D. Where titles and color bands match color of pipe, provide white background (black where color is white) extending at least three (3) inches around all bands and title.

E. Titles and arrows shall be prominently displayed adjacent to color coding and shall be clearly visible from operating positions, especially those adjacent to control valves.

END OF SECTION

SECTION 23 05 90

BASIC RESULTS FOR TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of testing, adjusting and balancing the heating, ventilating and air conditioning (HVAC) systems as specified within this Section and as shown on the Drawings.

B. Testing, adjusting and balancing work shall be done in accordance with the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS.

C. The Mechanical Contractor shall retain the services of an independent certified Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) testing and balance firm specializing in balancing HVAC systems, to test, adjust and balance all of the air moving systems and hydronic heating and cooling systems installed under Division 23. The test and balance firm is subject to the approval of the Owner's Construction Representative. All work by this firm shall be done under the direct supervision of a qualified heating and ventilating engineer. If requested, the tests shall be conducted in the presence of an authorized representative of the Owner.

D. Adjusting and balancing shall not begin until systems are complete, temporary filters and strainers are removed and permanent filters installed and piping systems are cleaned, flushed and chemically treated.

E. In addition to demonstrating that the systems are capable of achieving design load point flows, the certified test and balance shall demonstrate that the automatic control systems respond properly to load variations.

F. Test and balance firm shall include an extended warranty of 90 days, after completion of testing and balancing, during which time the Owner's Construction Representative may request a re-check, or re-setting of any outlet, supply air fan, return air fan or exhaust fan as listed in test report. The firm shall make any tests he may require during this period of time at no additional costs.

1.02 RELATED SECTIONS

A. The following sections apply to and form a part of these Sections:
   1. Section 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.03 STANDARDS

A. Adjusting and balancing shall be performed in accordance with the latest Standards of the National Environmental Balancing Bureau (NEBB), or approved equal, and as specified in the Contract Documents.

1.04 SUBMITTALS

A. Comply with the provisions of Section 01 33 00 - SUBMITTALS.

B. The name of the certified test and balance firm, including the name and registration number of the certified test and balance supervisor, shall be submitted for approval within 30 days after project Contract award. The selected certified test and balance firm shall submit the following:
   1. Detailed Procedures.
   2. Agenda.
   3. Report Forms.
   4. National project performance guaranty/ Quality assurance program, or approved equal.

C. An approved copy of each of the above shall be returned to the certified test and balance firm before adjusting and balancing is begun.

D. Upon completion of the Work, the test and balance firm shall compile the test data and prepare and submit four (4) bound copies of the complete Test and Balance Report to the Mechanical Contractor whom shall forward three (3) copies to the Owner's Construction Representative for evaluation and approval.

1.05 INSTRUMENTATION

A. The certified test and balance firm shall provide air system adjusting and balancing instrumentation such as pitot tubes, inclined gauge or U-tube manometers, magnehelic gauges, velometer, direct reading hood, tachometer or rpm counter, insertion thermometers, clamp-on ammeter for motor voltage and ampere readings and other instruments required to completely analyze and balance the HVAC systems. Instrumentation shall be accurately calibrated and checked before usage.

1.06 CONDITIONS

A. The certified test and balance firm shall be accorded and provided the following:
   1. Cooperation of temperature control and electrical contractors.
   2. Reasonable time to complete the adjusting and balancing prior to the required completion date.
   3. Completely operable systems.
   4. The right to adjust the systems.
   5. Access to system components.
   6. Master keys if the building is occupied.
   7. Secure storage space for tools and instruments.

1.07 CONTRACTOR RESPONSIBILITIES

A. The installing contractor shall be responsible for start-up and operation of systems during the adjusting and balancing process. Start-up shall include the following:
   1. All equipment operable in safe and normal condition.
   2. Temperature control systems installed complete and operable.
   3. Proper thermal overload protection in place for electrical equipment.
   4. For air systems:

a. Final filters clean and in place.
b. Duct systems and air handling units clean of debris.
c. Correct fan rotation.
d. Fire, smoke, and volume dampers in place and open.
e. Access doors closed and duct end caps in place.
f. All outlets installed and connected.

5. For hydronic systems:
   a. Flushed, filled and vented.
   b. All strainers cleaned and appropriate screens replaced.
   c. Service and balance valves open.

1.08 GENERAL ADJUSTING AND BALANCING PROCEDURES

A. The certified test and balance firm shall coordinate with the Owner and the installing Contractor to perform the work in a manner to meet the project schedule.

B. The certified adjusting and balancing firm shall leave all systems components in proper working order, including:
   1. Replace belt guards.
   2. Close access doors.
   3. Close doors to electrical switch boxes.
   4. Restore thermostats to specified setting.

C. Recorded data shall represent a true, actually measured, or observed condition.

D. Any abnormal conditions in the mechanical systems or conditions which prevent a proper adjusting and balancing process shall be reported to the Owner's Construction Representative.

E. If for any reason, a system cannot be properly balanced, that fact shall be reported to the Engineer and Owner's Construction Representative.

F. Should additional balancing devices be required, the certified test and balance firm shall so notify the installing contractor.

G. If it is determined by the certified test and balance firm that drive changes are required, the installing Contractor shall obtain and install all necessary new components.

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air systems testing, adjusting and balancing and applies to and forms a part of Division 23, Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

B. Air systems testing, adjusting and balancing shall be in accordance with this Section of these Specifications and the requirements of Section 23 05 90 - BASIC RESULTS FOR HVAC TESTING, ADJUSTING, AND BALANCING.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 HYDRONIC SYSTEMS ADJUSTING AND BALANCING PROCEDURES

A. Complete air balance before balancing the hydronic systems.

B. Prepare the hydronic systems for balancing in the following manner:
1. Open all valves to full open position. Set coil valves to full coil flow.
2. Have Contractor remove and clean all strainers.
3. Examine water in system and determine if system has been flushed.
4. Check pump rotation.
5. Check expansion tanks to determine they are not air bound and the system is completely full of water.
6. Check all air vents at high points of water systems and determine all are installed and operating freely.
7. Set all temperature controls so all coils are calling for full heating.
8. Check and set operating temperatures of boilers and chillers to design requirements.
9. Set pumps to deliver the required gallons per minute.
10. Balance the flow through each coil.
11. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
12. After adjustments to coils are made, recheck settings at the pumps, boilers and chillers and readjust if required.

C. Balance the flow rate at each flow measuring station installed in the following hydronic systems.
   1. Heating system.

D. Utilize a flow meter matched to the installed flow measuring stations.

E. Record and check the following items at each heating and cooling coil:
   1. Inlet water temperatures.
   2. Leaving water temperatures.
   3. Pump operating suction and discharge pressure and corresponding total dynamic head.
   4. List all mechanical specifications of pumps.
   5. Rated and actual running amperage of pump motor.
   6. Water metering device readings.

F. Permanently mark the settings of all valves so that the settings can be restored. Set and lock memory stops.

G. Tag each flow measuring station with a permanent tag marked to show the design flow rate in GPM and the corresponding design pressure drop.

3.02 AIR SYSTEMS ADJUSTING AND BALANCING PROCEDURES

A. Preparation for adjusting and balancing air systems:
   1. Adjusting and balancing shall not begin until the certified test and balance firm has verified that start-up procedures have been performed as required in the procedural standards of NEBB, or approved equal.
   2. Measure the amperes of all fan motors before adjusting and balancing is started and take proper steps to correct and report any overloads.
   3. Discontinue adjusting and balancing if any conditions are observed that are hazardous to the air system and report the conditions before proceeding further.
   4. Verify all outlets for compliance with design requirements and report any variations before starting the adjusting and balancing process.

B. Supply and Return Fans:
   1. Set the RPM of the fans to provide design total CFM within acceptable limits as indicated in the NEBB, or approved equal, national standards and/ or required static pressure to operate the system.
   2. Fan speeds shall not exceed the maximum allowable as scheduled and as established by the fan manufacturer.
   3. The final setting of the fan RPM shall not result in overloading the fan motor in any mode of operation. Dampers shall be modulated, and the amperes of the supply, return and exhaust fan motors shall be measured to ensure that no motor overload can occur. The amperes shall be measured in the full cooling, heating and economizer modes to determine the maximum brake horsepower.
   4. After adjusting and balancing, the following values shall be recorded:
      a. Fan RPM.

b. Motor voltage and amperes.
c. Entering static pressure.
d. Leaving static pressure.
e. When applicable, final fan settings shall be based on rated wet cooling coil resistance.
f. Final RPM of the supply and return fans, in systems having mixed air dampers, shall be set to provide the required minimum outside air CFM with the system in a logical non-modulating mode.
g. When project conditions permit, static pressure shall be measured as follows:
    1) Static pressure leaving the fan shall be taken as far downstream from the fan as is practical, but shall be up-stream of any duct restrictions such as duct turns.
    2) No reading shall be taken directly at the fan outlet or through the flexible connection.
    3) Static pressure entering a single inlet fan shall be measured in the inlet duct up-stream of any flexible connection and down-stream of any duct restrictions.
    4) Pressure entering a double inlet fan shall be measured through the wall of the plenum which houses the fan.
h. In all cases, the readings shall be taken so as to represent as true a value as possible. True value is actual measured static pressure.

C. Supply Air Outlets and Return/ Exhaust Air Inlets:
1. Quantities shall be measured according to NEBB, or approved equal, procedural standards. The systems shall be balanced so that the total supply air quantity into and out of each space shall be within ± 5% of the design airflows.
2. Each outlet and inlet within the same space shall be adjusted to design quantities. Final quantities shall be obtained without generating noise levels in excess of the design parameters listed in the Construction Documents.
3. The pattern for adjustable outlets shall be adjusted for proper distribution without drafts.
4. If any outlet or inlet conditions are detected that will not allow proper balancing to be performed, the condition shall be reported to the Owner's Construction Representative and the Engineer.
5. Under final balanced conditions, measure and record the static pressure entering and leaving each filter bank.

D. Coils and Other Devices:
1. Under final balanced conditions, measure and record the static pressure entering and leaving each coil bank.
2. The certified adjusting and balancing firm shall measure and record static pressures entering and leaving other devices not normally found in a system such as sound traps and heat recovery equipment.

E. Automatic Temperature Control Dampers:

1. Verify temperature control dampers for proper shut-off when driven closed by the controller. Dampers shall also be verified to be in the same position as indicated by the controller. Corrections shall be referred to the installing Contractor for remedial action.

F. Mixed Air Control:
   1. Manual balancing dampers shall be restricted as necessary so the system supplies and returns essentially the same CFM in any mode of modulation.
      a. Test mixed air plenums for possible stratification. If freeze-up or other serious problems are likely, the condition shall be reported at once.
      b. Set the minimum outside air quantity to the required value. If this air flow quantity cannot be properly measured, the temperature method shall be used.

END OF SECTION

SECTION 23 06 00

SCHEDULES FOR HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of performing all labor and furnishing all material, supplies and equipment including minor items obviously necessary for complete and functioning heating, ventilating and air conditioning (HVAC) systems as specified herein and as shown on the Drawings.

B. Heating, ventilating and air conditioning work shall be in accordance with the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

C. The Work shall consist of the following:
1. **Variable air volume (VAV) ventilation systems** for the various spaces including factory air handling units with outside air intake duct, air filters, heating and/or cooling coils, supply and exhaust air fans, Variable air volume boxes, supply and exhaust air ductwork, supply and exhaust air registers.
2. **Heating hot water system** for the including, circulating pumps, air separator, expansion tanks, unit heaters, finned tube radiation, supply and return piping, valves and appurtenances.
3. **Constant air volume (CAV) ventilation systems** for the various spaces including factory air handling units with outside air intake duct, energy recovery ventilator, air filters, heating and/or cooling coils, supply and exhaust air fans, supply and exhaust air ductwork, supply and exhaust air registers.
4. **Dehumidification systems** for the building including factory desiccant dehumidifier, supply and return air ductwork and supply air registers.
5. **Ventilation/ exhaust system** for various spaces including air intakes and outlets, supply fans and exhaust fans.
6. **Testing and balancing** all air systems.
7. **Testing and balancing** all hydronic water systems.
8. **Temperature control systems** for all new HVAC systems.
9. **Cleaning and flushing** all hydronic piping systems.
10. **Water treatment** for all hydronic piping systems.

1.02 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:
1. 23 20 00 HVAC PIPING AND PUMPS
2. 23 30 00 HVAC AIR DISTRIBUTION
3. 23 70 00 CENTRAL HVAC EQUIPMENT
4. 23 80 00 DECENTRALIZED HVAC EQUIPMENT
5. 23 90 00 HVAC CONTROLS AND INSTRUMENTATION

1.03 RELATED WORK DESCRIBED ELSEWHERE

A. Insulation:
   1. Ductwork and piping shall be insulated as specified in 23 07 00 - HVAC INSULATION.

1.04 SUBMITTALS

A. Comply with the provisions of Section 01 33 00 - SUBMITTALS.

B. Within 30 calendar days of Contract Award, submit a complete list of materials, fixtures and equipment proposed to be furnished and installed under this Section.

C. Submit shop drawings of the following:
   1. HW Unit Heaters.
   2. HW Finned tube radiation.
   3. Pumps.
   4. Air Separator.
   5. Power roof ventilators.
   6. Upblast exhaust fans.
   7. Energy recovery ventilators.
   8. VAV control boxes.
   9. Diffusers, registers and grilles.
   10. Motorized dampers.
   11. Flow measuring devices.
   12. Custom air handling units.
   13. Custom Desiccant dehumidifiers.
   14. HVAC Temperature Control systems.
   15. Expansion Tank.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 INSTRUCTIONS

A. Upon completion and approval of the HVAC systems and installations, provide experienced personnel to instruct the Owner's designated operators on all details of operating and maintaining the HVAC systems and equipment.

B. Provide a minimum of 24 labor hours of instruction broken down into three (3) time periods within the first year of operation as requested by the Owner.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of performing labor and furnishing all materials for thermally insulating the plumbing work installed in each of the following sections of Division 23:

1. Section 23 20 00 HVAC PIPING AND PUMPS
2. Section 23 30 00 HVAC AIR DISTRIBUTION
3. Section 23 70 00 CENTRAL HVAC EQUIPMENT
4. Section 23 80 00 DECENTRALIZED HVAC EQUIPMENT

B. Insulation work shall be in accordance with the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS.

1.02 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:

1. Section 23 07 13 DUCT INSULATION
2. Section 23 07 16 HVAC EQUIPMENT INSULATION
3. Section 23 07 19 HVAC PIPING INSULATION

1.03 STANDARDS

A. All insulation work shall be performed by skilled, competent labor familiar with this type of work.

B. All insulation shall present a neat, finished and skillful appearance.

PART 2 PRODUCTS

2.01 GENERAL

A. Insulation shall be Owens-Corning, Schuller, Knauf, Armstrong, or approved equal.

B. All insulating materials shall have fire and smoke hazard ratings as tested as a composite product by procedure ASTM E-84, NFPA 255 and UL 723. Material shall not exceed a flame spread rating of 25 and a smoke developed rating of 50, including adhesives.

C. Insulation accessories, such as adhesives, mastics, cement, tapes and glass cloth shall have the same component rating as listed above.

PART 3 EXECUTION

3.01 PIPE INSULATION INSTALLATION

A. Apply insulation over clean, dry surfaces and butt adjoining sections firmly together.

B. Unless otherwise specified, insulated pipe supports shall be provided by the Mechanical Contractor and installed by the same during pipe support installation.

END OF SECTION

SECTION 23 07 13

DUCTWORK INSULATION

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section of these Specifications covers ductwork thermal insulation and applies to and forms a part of Division 23, Section 23 07 00 - MECHANICAL INSULATION.

PART 2 PRODUCTS

2.01 OUTSIDE AIR, COMBUSTION AIR AND EXHAUST AIR DUCT INSULATION

A. All outside air, combustion air and exhaust air ducts within ten feet of the wall or roof penetration shall be externally insulated with rigid fiber glass board, 2" thick, 3 lb./ cu. ft. density having vapor barrier jacket of foil-scrim-kraft (FSK) with 2" tab.

2.02 EXTERIOR AIR DUCT INSULATION

A. Ducts in Exterior Locations:

1. All supply and return air ducts in exterior locations shall be insulated with semi-rigid fiber glass board, 2" thick, 3 lb./ cu. ft. density, having vapor barrier jacket of foil-scrim-kraft (FSK) with 2" tab.

2.03 DUCTWORK JACKETING

A. All exterior ductwork shall be weatherproofed with Pabco aluminum jacketing. The jacketing is to be manufactured from aluminum alloy conforming to ASTM B-209 designation with clear stucco embossed finish. All jacketing shall have an integrally bonded moisture barrier over the entire surface in contact with the insulation. A thickness of 0.032" is to be used. All seams and joints shall be sealed weather and water tight.

2.04 AIR CONDITIONED DUCT INSULATION

A. Ducts in Exposed Locations:

1. All air conditioned air ducts in exposed locations shall be insulated with semi-rigid fiberglass board, 1" thick, 3 lb./cu. ft. density, having vapor barrier jacket of foil-scrim-kraft (FSK) with 2" tab.

B. Ducts in Concealed Locations:

1. All air conditioned air ducts in concealed locations shall be insulated with fiberglass blanket, 1-1/2" thick, 1 lb./cu. ft. density, having vapor barrier jacket of foil-scrim-kraft (FSK) with 2" tab.

PART 3 EXECUTION

3.01 DUCTWORK THERMAL INSULATION INSTALLATION

A. Application:
   1. Insulation shall be applied in accordance with the manufacturer's published recommendations, unless otherwise specified.

B. Outside, Combustion Air and Exhaust Air Duct Insulation:
   1. Apply insulation to all outside air intake louvers to the end of the duct sleeve.
      a. All fresh air and combustion air ductwork from wall/roof penetration to connection at system or duct termination.
      b. All exhaust air ductwork within 10 feet of wall or roof penetration.
   2. Secure insulation to metal with welded pins and mechanical fasteners on not over 18" centers leaving no voids at edges. Seal all butt joints with 3" wide joint sealing tape and seal all corner joints with 4" tape. Seal over pin clips with tape patches.

C. Exterior Duct Insulation:
   1. Apply insulation to all exterior air ducts.
   2. Secure insulation to metal with welded pins and mechanical fasteners on not over 18" centers leaving no voids at edges. Seal all butt joints with 3" wide joint sealing tape and seal all corner joints with 4" tape. Seal over pin clips with tape patches.

D. Ductwork Jacketing:
   1. Apply aluminum weatherproofed jacketing to all exposed exterior insulated ductwork and where indicated on the Drawings.

E. Exposed Air Conditioned Ducts Insulation:
   1. Apply insulation to all air ducts exposed in non-air conditioned mechanical rooms and unfinished spaces.
   2. Secure insulation to metal with welded pins and mechanical fasteners on not over 18" centers leaving no voids at edges. Seal all butt joints with 3" wide joint sealing tape and seal all corner joints with 4" tape. Seal over pin clips with tape patches.

F. Concealed Air Conditioned Ducts Insulation:
   1. Apply insulation to all main air ducts located in ceiling spaces from the fan-coil units, make-up air units and air handling units to the ends of the duct mains.
   2. Secure insulation to metal with strips of insulation adhesive leaving no voids at the edges. Further, secure the bottom side insulation on ducts over 24" wide with welded pins and mechanical fasteners not over 18" centers. Lap joints 2", seal with lap adhesive and staple 6" on center. Seal over staples and fasteners with matching tape patches.

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section of these Specifications covers equipment thermal insulation and applies to and forms a part of Division 23, Section 23 07 00 - MECHANICAL INSULATION.

PART 2 PRODUCTS

2.01 HOT VESSEL INSULATION

A. Air separators in heating hot water systems shall be insulated with rigid fiber glass board, plain, 3" thick, 3 lb./ cu. ft. density.

PART 3 EXECUTION

3.01 INSULATION INSTALLATION

A. Application:
1. Insulation shall be equipped in accordance with the manufacturer's published recommendations, unless otherwise specified.

B. Hot Vessel Insulation:
1. Cut, score and miter the insulation to fit the contour of the vessel without voids between adjoining boards. Secure with 1/2" wide by 0.015" galvanized steel bands or 18-gauge galvanized steel wire on 12" centers. Apply 1" hex mesh, galvanized wire and trowel with a heavy coat of mineral fiber cement. When dry, cover with glass cloth and size with two (2) coats of Foster's 30-36, or equal, mastic.

3.02 COATINGS

A. This Contractor shall be responsible for all coatings on thermal insulation.

B. Insulation on all equipment in equipment rooms shall be coated with two (2) coats of Glidden's Model 1060-1200 "Prep and Prime" vapor barrier, interior, water-based primer-sealer. The second coat shall be tinted with a color to be selected by the Owner's Construction Representative.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section of these Specifications covers piping insulation and applies to and forms a part of Division 22, Section 23 07 00 - HVAC INSULATION.

PART 2 PRODUCTS

2.01 HEATING PIPING INSULATION

A. All hot water heating supply and return piping shall be insulated with one or two piece molded glass fiber pipe insulation, 3 lb./ cu. ft. density, with self-sealing all-service jacket.

B. Insulation thickness shall be as follows:

Pipe Size	Insulation Thickness
Runouts up to 2" (up to 12 ft. long)	1/2"
2" and smaller	1-1/2"
2-1/2" and larger	1-1/2"

C. Fittings shall be insulated with pre-cut fiberglass pipe insulation covered with Proto, or approved equal, PVC fitting covers.

2.02 COOLING PIPING INSULATION

A. All cooling supply and return water piping shall be insulated with one or two-piece molded glass fiber pipe insulation, 3 lb./ cu. ft. density with fire retardant, self-sealing, vapor barrier all-service jacket.

B. Insulation thickness shall be as follows:

Pipe Size	Insulation Thickness
Runouts up to 2" (up to 12 ft. long)	1/2"
2" and smaller	1-1/2"
2-1/2" and larger	1-1/2"

C. Fittings shall be insulated with pre-cut fiberglass insulation covered with Proto, or approved equal, PVC fitting covers.

2.03 INSULATION JACKETING

A. All insulated piping within 6 feet of finished floor to be jacketed with PVC piping jacket. Jackets to be Manville-Zeston, Knauf-Proto, or equal, 15 mil thick off-white color. Connections to be made with brush on welding adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 PIPE INSULATION INSTALLATION

A. Application:

1. Insulation shall be applied in accordance with the manufacturer's published recommendations, unless otherwise specified.

B. Insulation Protection Shields:

1. Provide insulation protecting shields under the 1/3 periphery of the insulated 1-1/4" and larger piping at hanger bearing points. Shields shall be 9" long x 20 gauge for pipe sizes 3" and smaller and 12" long x 16 gauge for pipes 4" and larger.

C. Hot Piping with Glass Fiber Insulation:

1. Pipe: Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Self sealing laps shall be secured according to manufacturer's published recommendations. Open ends of pipe insulation shall be neatly stopped off and tapered down with insulating cement and covered with canvas embedded into a wet coat of fire retardant lagging adhesive.
2. Fittings: All fittings shall be insulated with segments of pre-molded glass fiber pipe insulation or with compressed flexible glass fiber secured in place with 18 gauge galvanized soft wire. Cover all fitting insulation with white plastic fitting covers.
3. Valves, etc.: All valve bodies, strainers and flanges shall be insulated as specified for fittings.

D. Cold Piping with Glass Fiber Insulation:

1. Pipe: Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips. Seal laps, pulling jacketing tight and smooth. Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21 feet on continuous runs of pipe. Self sealing laps shall be secured according to manufacturer's published recommendations.
2. Insulation, vapor barrier and covering shall be continuous through all chilled water pipe supports and pipe sleeves. High density inserts, the same thickness as adjacent insulation, shall be installed at pipe supports where the density of the insulation is not sufficient to support the full pipe. Inserts shall

be 180 degrees and not less than the length of the protection shields.

3. Fittings: All fittings shall be insulated with molded fiberglass fittings or with compressed flexible glass fiber with vapor barrier secured in place with 18 gauge galvanized soft wire. All thicknesses to be equal to that of adjoining pipe covering. Cover all fitting insulation with white plastic fitting covers.
4. Valves, etc.: All valve bodies, strainers and flanges shall be insulated as specified for fittings.

E. Cold Tubing with Foamed Tubing Insulation:
1. Insulation shall be continuous for the full length of the piping.
2. Insulation shall be slit insulation lengthwise and snapped over tubing. Fitting covers shall be fabricated from mitered cut tubular forms. Butt joints and seams shall be sealed with Armacel 520 Adhesive, coating both surfaces to be joined.

3.02 COATINGS

A. This Contractor shall be responsible for all coatings on thermal insulation.

B. All exposed pipe covering in equipment rooms shall be coated with two (2) coats of Glidden's model 1060-1200 "Prep and Prime" vapor barrier interior, water-based primer-sealer. The second coat shall be tinted with color to be selected by the Owner's Construction Representative.

C. An Armacel WB Armaflex weather-resistant protective finish shall be applied over all insulation surfaces on foamed tubing insulated piping located outside the building.

3.03 INSULATION JACKETING

A. Apply PVC jacketing to all insulated piping within 6 feet of finished floor.

END OF SECTION

SECTION 23 20 00

HVAC PIPING AND PUMPS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air distribution and applies to and forms a part of Division 23, Section 23 06 00 - SCHEDULES FOR HEATING, VENTILATING AND AIR CONDITIONING.

1.02 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of furnishing all piping, insulation and performing all labor to install all HVAC piping including minor items obviously necessary for complete and functioning air distribution systems.

1.03 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:
   1. 23 21 13 HYDRONIC PIPING
   2. 23 21 14 HYDRONIC SPECIALTIES
   3. 23 21 23 HYDRONIC PUMPS
   4. 23 21 30 HYDRONIC HEAT TRANSFER EQUIPMENT
   5. 23 25 00 HVAC WATER TREATMENT

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers hydronic piping and applies to and forms a part of Division 23, Section 23 20 00 - HVAC PIPING AND PUMPS.

B. Hydronic piping shall be in accordance with this Section of these Specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install pipe and fittings of type and material specified in this Section and as shown on the Drawings and as required to connect to all hydronic equipment.

B. Make equipment connections with unions for quick and easy disconnect and located to allow for equipment removal without dismantling the piping.

C. Furnish and install all valves required to isolate equipment and segments of each piping system as specified in this Section and as shown on the Drawings.

1.03 COORDINATION

A. Coordinate hydronic piping with equipment, ductwork, piping and conduit to be provided by other trades.

PART 2 PRODUCTS

2.01 PIPES AND PIPE FITTINGS

A. Heating and Cooling Supply and Return:
   1. Pipe 2" and smaller sizes: ASTM A106 Schedule 40 black steel. Banded black cast iron, 125 PSI screwed fittings.
   2. Pipe 2-1/2" and larger sizes: ASTM A-135 or A-53, Grade B Schedule 40 black steel. Fittings: Victaulic or approved equal full flow cast ductile iron conforming to ASTM A-536 or malleable iron conforming to ASTM A-47 with grooves designed to accept Victaulic grooved end couplings, painted with alkyd enamel.
   3. Pipe 2" and smaller sizes: Type L, hard drawn, seamless copper and wrought copper solder fittings joined using 95-5 solder.

2.02 UNIONS

A. Copper Tubing:
   1. 2" and smaller sizes: Soldered ground joint union, Chase 402, or equal.

B. Dielectric unions for connecting copper tubing to steel piping, tanks and equipment:
   1. 2" and smaller sizes: Steel body and nut with insulating gasket and copper connector, 250 PSI WOG, Epco Model FX, FB and EA, or equal.
   2. 2-1/2" and larger sizes: Flanged cast iron body with insulating gasket and copper connector, machine bolts, 175 PSI WOG, Epco Model GX and GA, or equal.

C. Black Steel Piping:
   1. 2" and smaller sizes: Screwed malleable black iron ground joint union, brass to iron seat, 300 PSI WOG, Anvil 463, Stockham 694, or approved equal.
   2. 2-1/2" and larger sizes: Welding neck or slip-on forged black steel flanges, with raised faces, 1/16" cross laminated gaskets and carbon steel bolts, 150 PSI Anvil 1901, 1921, or equal.

D. Grooved Piping:
   1. Couplings shall be Victaulic Style 77 or Central Grooved Piping Products, standard flexible grooved IPS coupling consisting of two piece ductile or malleable iron cast housing, Grade "E" EPDM rubber gasket of a central cavity, pressure-responsive design, with nuts, bolts, locking toggle or lugs to secure unit together. Couplings shall be coated with an alkyd enamel paint.

2.03 VALVES

A. Valves shall be Apollo, Nibco-Scott, Milwaukee, Hammond, Crane, Stockham, Powell, Jenkins, DeZurik, Anvil, Demco, and/ or Williams Hager. The specified manufacturer's name and number are for identification of types, quality and construction.
   1. Heating/Cooling supply and return:
      a. Shut-off Valve - 3" and smaller steel piping: Screwed end ball valve, 300 PSI WOG, bronze two-piece body, stainless steel ball, extended stem to allow for insulation, lever handle, Teflon seats and seal, Nibco S580, Apollo 70-100 Series, or equal.
      b. Shut-off Valve - 2" and smaller copper tubing: Solder end ball valve, 300 PSI WOG, bronze two-piece body, stainless steel ball, extended stem to allow for insulation, lever handle, Teflon seats and seal, Nibco S580, Apollo 70-200 Series, or equal.
      c. Shut-off Valve - 4" and larger: Ball valve, Class 125, cast iron body and retainer, split body, full port, stainless steel ball and stem, blow-out proof stem, PTFE seats and seals. Add stem extensions on insulated valves. Apollo 6P, or equal.
      d. Shut-off Valve - 2-1/2" and larger: Flange retained iron body butterfly valve, 150 PSI WOG, EPT seat and seal, bronze or ductile iron disc, stainless steel shaft, Anvil Series 8000, or

approved equal.

1) 2-1/2" through 8" size: 10-position leverlock handle.
2) 10" and larger sizes: Gear operation with life-time lubrication and gasket.

e. Check Valve - 2" and smaller: Screwed swing check, 400 PSI WOG, bronze body, regrinding seat, renewable disc, Crane 36, or equal.

f. Check Valve - 2-1/2" and larger: Flanged vertical non-slam check, 125 PSI WOG, semi-steel body, bronze trim, Williams Hager, or approved equal. Valve shall be full line size, not connection size.

g. Balancing Valve - 2" and smaller: Same as shut-off valve for 2" and smaller, except include an original balancing stop.

h. Balancing Valve - 2" and smaller: Screwed end ball valve, 300 PSI WOG, bronze body with brass ball, differential pressure read-out ports, calibrated nameplate, and memory stop indicator. B & G circuit setter, or approved equal.

i. Balancing Valve - 2-1/2" and larger: Flanged eccentric plug valve, 150 PSI WOG, semi-steel body, rubber faced plug, lever actuated, adjustable open position stop with locking device, DeZurik 118, or equal.

j. By-Pass Valve: Screwed eccentric plug valve, 175 PSI WOG, semi-steel body, bronze plug, DeZurik 118, or equal.

k. Air Vents: 1/2" Size, Try cock, 125 PSI, bronze body, short pattern, Crane 730, or equal.

l. Drain Valves: Screwed, 200 PSI WOG, bronze two-piece body, chromium-plated ball, lever handle with extended stem to allow for insulation, Teflon seats and seal, garden hose threads with cap and chain, 3/4" size, unless otherwise indicated, Apollo 78-100, or equal.

m. Temperature and pressure test fittings: "Pete's Plug", 1/4" MPT fitting, to receive either a temperature or pressure probe, solid brass, 1/8" O.D. fittings with Nordel valve core fitted with a gasket cap, rated at 1000 PSIG.

2. Grooved supply and return piping:

a. Shut-off Valve - 2-1/2" through 4" size: Victaulic Style 721, Shurjoint, Gruvlok or Anvil grooved-end ball valve designed for 600 PSI WOG bubble-tight working pressure, with cast ductile iron body with painted finish, forged carbon steel micro-finished nickel plated and polished ball, forged carbon steel nickel chrome plated stem, TFE seals, electro galvanized stem, nuts and washers, stamped carbon steel electro galvanized handle with plastic grips on 2-1/2" size and cast ductile iron handle with painted finish and steel pipe extension on 3" and 4" size.

b. Shut-off Valve - 6" and larger: Victaulic Series 700, Shurjoint, Gruvlok or Anvil grooved-end butterfly valves with triple-seal liner design for bubble-tight shut-off up to 200 PSI, cast ductile iron or malleable iron housing, Schedule 40 carbon steel pipe

body, Grade "E" EPDM molded synthetic rubber liner permanently bonded to valve body, type 416 stainless steel stem, and aluminum bronze disc.

PART 3 EXECUTION

3.01 PIPING INSTALLATIONS

A. All hydronic piping shall be prepared, sleeved, installed, cleaned and flushed as specified in Section 23 01 60 HVAC PIPING PROCEDURES and as specified below:

B. Support and anchor piping as specified in Section 23 05 40 - SUPPORTS AND ANCHORS.

C. Pitch piping 1/8" per 10 feet minimum for drainage and air elimination.

D. Venting:
1. Install manual key operated air vent valves at high points of piping in the direction of water flow.
2. On the high side of each heating and cooling coil furnish and install a 3/4" x 4" high air chamber with a reducer at the top from which a 1/8" copper tube shall be extended to a manual key operated air vent valve accessibly located.
3. Where indicated, and as necessary, provide automatic air vents, Braukmann Model EA-122, or approved equal. Install a shut-off valve or try cock ahead of each air vent except air vents having an integral shut-off valve.

E. Draining:
1. Install a manual drain valve at every low point of the piping system. Drain valves attached to piping 4" and larger shall be 2" size. Drain valves attached to piping 3" and smaller shall be 3/4" size.

F. Heat Exchanger Piping:
1. Piping to heat exchangers shall be arranged to permit convenient removal of heads and cleaning and cleaning and plate pulling without disturbing equipment shut-off valves and by the removal of a minimum amount of piping between shut-off valves and equipment. Provide additional flanges or unions as required to meet these objectives.

G. Coil Piping:
1. Piping to air handling unit coils shall be arranged to permit convenient removal of coils without disturbing equipment shut-off valves and by the removal of a minimum amount of piping between shut-off valves and equipment. Provide additional flanges or unions as required to meet these objectives.
2. On each side of all heating coils and where otherwise indicated on the Drawings, install a test fitting.

a. Supply the following to the Owner's Construction Representative:
   1) Pressure gauge adapters with 1/8" O.D. probe.
   2) Two (2) pressure gauges for the required range.
   3) Four (4) 5" stem, pocket testing thermometers, 25 to 125° F range.
   4) Four (4) 5" stem, pocket testing thermometers, 50 to 500° F range.

3.02 PRESSURE TESTS

A. All hydronic piping shall be pressure tested before insulating or concealing and connecting to equipment as specified below and in Section 23 05 00 COMMON WORK RESULTS FOR HVAC.

B. Heating Hot Water/Cooling Water Piping:
   1. Test heating hot water/ cooling water piping tight under 100 PSIG hydrostatic pressure or 1-1/2 times the normal operating pressure whichever is greater. The pressure shall be maintained for a period of four (4) hours with no drop in pressure.

3.03 CONNECTIONS TO EQUIPMENT FURNISHED UNDER OTHER SECTIONS

A. Make hydronic piping connections to the following equipment furnished and installed under Other Sections:
   1. Unit heaters.
   2. Air handling Units.
   3. Fan-Coil Units.
   4. Air Separator.
   5. Finned tube radiation.
   6. Pumps.

B. Install motorized valves furnished under Section 23 30 00 HVAC AIR DISTRIBUTION.

C. Coordinate with and install all wells and pressure taps required by the Temperature Control Sub-Contractor.

3.04 FIRESTOPPING

A. Firestop all pipe penetrations of masonry walls, rated partitions and above grade floors as specified in Section 23 01 60 HVAC PIPING PROCEDURES.

END OF SECTION

SECTION 23 21 14

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers hydronic specialties and applies to and forms a part of Division 23, Section 23 21 00 - HYDRONIC PIPING AND PUMPS.

B. Hydronic specialties shall be in accordance with this and other applicable sections of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC

1.02 GENERAL

A. Furnish and install hydronic specialties where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 AIR SEPARATORS

A. Air separator shall be Bell & Gossett Rolairtrol Model CRS, Spirovent, Taco, Armstrong, or approved equal, coalescing medium type air and dirt separator. The unit shall have flanged inlet and outlet connections. The unit shall have an internal stainless steel coalescing medium with 3/16” perforations having a free area not less than five times the cross-sectional area of the connecting pipe, and NPT vent and drain connections. Air separator shall be constructed in accordance with the ASME Code for unfired pressure vessels and for 125 PSIG working pressure at 350° F. Air separator shall be painted with one coat of air dry enamel.

B. Air separator capacities and sizes shall be as scheduled on the Drawings.

2.02 EXPANSION TANKS

A. Pre-Charged:

1. Expansion tanks shall be Bell & Gossett Series B, Taco, or approved equal, vertical or horizontal pre-charged steel shell with replaceable heavy duty Butyl rubber bladder, 0.302"-32 charging valve and 2-1/2" NPT system connections. Tanks shall be fitted with lifting rings and a floor mounting skirt, or saddles as applicable. Tanks must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped for 125 PSIG working pressure at 240° F.

a. Automatic air vent: Bell & Gossett No. 87, or equal, 1/2" FPT/3/4" MPT connection, rated for operating temperature to 240° F and 150 PSI pressure.
b. Automatic air vent: Bell & Gossett No. 67, or equal, 1/8" MPT connection rated for operating temperature to 240° F and 35 PSI operating pressure.
c. Automatic air vent: Bell & Gossett No. 7, or equal, 1/8" FPT connection, rated for operating temperature to 240° F and 75 PSI pressure.
d. Charging valve, .302"-32.

2.03 PRESSURE GAUGES

A. Ashcroft, Trerice, U.S. Gauge, or approved equal, compound gauges, 4-1/2" dial, T-handle cocks and 1% accuracy bronze bourdon tube and bronze movement, as applicable.

2.04 THERMOMETERS

A. Trerice, Weiss, or approved equal. Thermometers shall be adjustable angle, industrial, red reading mercury type with 9" scale, 2 degrees divisions and separable socket, as applicable.

2.05 STRAINERS

A. Furnish and install strainers where indicated on the Drawings.
1. In-Line:
a. Pipe 1-1/2" and Smaller: Screwed, Y strainer, 250 PSI, cast iron or semi-steel, stainless steel screen, Sarco IT, Mueller 11-FCB, Metro-Flex, Hoffman or equal.
b. Pipe 2" and Larger: Flanged Y strainer, 125 PSI, cast iron or semi-steel, stainless steel, Sarco CF-125, Mueller 758, Metra-Flex, Hoffman or equal, and 3/4" valve with hose adapter.
2. Screen Perforations for Hydronic Heating:
a. 1/32" for 2" and smaller sizes.
b. 3/64" for 2-1/2" and 3" sizes.

2.06 PRESSURE REDUCING VALVES

A. Pressure reducing valves, for makeup water to the hydronic systems, shall be Bell & Gossett No. 7, or approved equal, brass body, equipped with a removable strainer, low inlet pressure check valve and extra large diaphragm, 3/4" male NPT union inlet connection and 3/4" female NPT outlet connection, 25 to 60 PSIG adjustable range factory set at 45 PSIG.

2.07 PUMP SUCTION DIFFUSERS

A. Pump suction diffusers shall be Bell & Gossett, Taco, Titan, or approved equal, cast iron angle body with steel inlet flow straightening vanes and combination diffuser-strainer-orifice cylinder, start-up strainer, EPDM O-ring seal and bottom boss for positioning a pipe support. Suction diffusers shall be designed for 175 PSIG working pressure at 300F. The permanent cylinder strainer shall be stainless steel with 3/16" diameter openings having a free area no less than 5 times the cross-sectional area of the pump suction opening and shall be encased by a 16 mesh bronze start-up strainer. Body shall be tapped with a 1/4" NPT for a pressure gauge and NPT for a blow-down drain. Suction diffuser sizes 2-1/2" and larger shall have 125 PSI ANSI flanges on both inlet and outlet.

B. Pump suction diffusers shall be as required for system size.

2.08 TRIPLE DUTY VALVE

A. Triple duty valve shall be Bell & Gossett 3D or 3DS as required, Taco, Titan, or approved equal, designed to function as a non-slam check valve, throttling valve, shut-off valve and calibrated balancing valve. The valve shall be straight pattern, heavy duty cast iron constriction, designed for 175 PSI working pressure with 125 PSI ANSI flanged connections.
   1. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert, stainless steel stem, and chatter preventing stainless steel spring.
   2. Valve design shall permit repacking under full system pressure.
   3. Valve shall be equipped with brass readout valve having integral check valve for differential pressure balancing.

B. Triple duty valve Cv at the 100 percent stem rise position shall be as indicated or scheduled on the Drawings.

2.09 FLOW MEASURING STATIONS

A. Flow measuring stations shall be Gerand Engineering, or approved equal, utilizing the flow venturi principle.
   1. Style VS venturis, 1/2" through 2" size, shall be brass screwed.
   2. Style VW-B venturis, 2-1/2" size and larger, shall be butt welded to piping.
   3. Include meter hose nipples, valves, and disconnects with each venturi.
   4. Flow venturis shall be sized based upon a nominal 12" W.C. pressure drop at the scheduled flow rate.
   5. Venturis shall be furnished with chained metal tag showing location, size, model number, GPM and meter reading for GPM specified.
   6. Utilize a Model “M” meter for measuring flow at each station.

B. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.
   c. B & G Circuit Sentry.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg. F.

C. Flow measuring device flow rates shall be as indicated or scheduled on the Drawings.

PART 3 EXECUTION

3.01 AIR SEPARATOR INSTALLATION

A. The air separator shall be suitably supported in its piping system with clearance provided for removing the strainer. Provide a full sized 3-way valved bypass around strainers as required for blow down and maintenance.

B. Pipe the air vent on top of the sir separator.

C. Provide a pipe, offset, union and drain valve from the drain connection and extend the blow-down/ drain pipe to spill into the nearest floor drain.

3.02 PUMP SUCTION DIFFUSERS

A. Install a pump suction diffusers on each base mounted end suction pump.

B. Provide a pipe support fitted over the boss at the underside of the diffuser to the pump base including an adjustable support foot. Adjust the foot so the diffuser bears on the support without strain to the pump attachment.

3.03 TRIPLE DUTY VALVE INSTALLATION

A. Install a triple duty valve in the discharge from each base mounted end suction and in-line pump

3.04 PRESSURE GAUGE INSTALLATION

A. Install pipe mounted pressure gauge in the following locations:

1. Suction and discharge of each pump.

3.05 THERMOMETER INSTALLATION

A. Install pipe mounted thermometers in the following locations:

1. Hydronic heating supply and return.

2. Where indicated on the Drawings.

3.06 STRAINER INSTALLATION

A. Furnish and install strainers in the following locations:

1. Suction side of all pumps (except where a pump suction diffuser having a start-up strainer is installed).

B. Plug tapped blow-offs on 1-1/2" and smaller Y-strainers.

C. Furnish and install 3/4" blow-off pipe and shut-off valve on 2" and larger Y-strainers.

3.07 FLOW MEASURING DEVICE INSTALLATIONS

A. Install flow measuring stations in the following locations:

1. Main branch return pipe where indicated at the Drawings.

B. Locate flow measuring stations in straight pipe runs at least ten (10) pipe diameters downstream from and five (5) pipe diameters upstream from valves, elbows, tees and other flow disturbing fittings.

C. Install automatic flow-control valves in the following locations:

1. Branch heating hot water return pipe from each fan-coil unit, air handling unit, unit heater and cabinet unit heater.

D. Water balancing shall be as specified in Section 23 05 93.

END OF SECTION

SECTION 23 21 23

HVAC PUMPS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers HVAC pumps and applies to and forms a part of Division 23

B. HVAC pumps shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 and Section 23 01 30.

1.02 GENERAL

A. Furnish and install HVAC pumps where indicated on the Drawings and as specified in this Section.

B. Variable frequency drives (VFD) for variable speed pumps will be furnished, installed and connected to pump motors under Section 23 90 00.

C. Shop drawings of pumps shall include pump curves with operating point indicated.

PART 2 PRODUCTS

2.01 FLEXIBLE COUPLED END-SUCTION PUMPS

A. Pumps shall be Bell & Gossett, Taco, Armstrong, or approved equal, flexible-coupled, single stage design, end-suction, base mounted, complete with motor, drive and drive guard. Pumps shall be capable of being serviced without disturbing piping connections.
   1. Pump volute shall be Class 30 cast iron with integrally-cast pedestal support. The impeller shall be cast bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking cap screw.
   2. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat of at least 98 percent alumina oxide content, and carbon seal ring, suitable for continuous operation at 225°F . A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
   3. Pumps shall be rated for minimum of 175 PSI working pressure. Casings shall have gauge ports at nozzles and vent and drain ports at top and bottom of casing.
   4. Pump bearing housing assembly shall have heavy-duty regreaseable ball bearings, replaceable without disturbing piping connections and have foot support at coupling end.

5. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area.
6. Motor shall be premium efficiency and shall meet Section 23 05 13 specifications. Pump and motor shall be factory aligned.
7. A flexible-type coupler, capable of absorbing torsional vibration, shall be provided between the pump and motor and shall be equipped with a suitable coupling guard.
8. Each pump shall be factory tested.
9. Pump shall be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
10. Provide one (1) spare set of mechanical seals for each pump for post warranty replacement.
11. Each pump shall have a permanent tag or label fastened to the pump indicating manufacturer, Model No., GPM, pump head, impeller diameter, motor horsepower, voltage and amperage draw.

B. Pumps controlled by variable frequency drives shall be provided with maintenance free, circumferential, conductive micro fiber shaft grounding ring (AEGIS SGR) shall be installed on the AC motor to discharge shaft currents to ground.

C. Pump performance capacities and characteristics including motor shall be as scheduled on the Drawings.

PART 3 EXECUTION

3.01 PUMP INSTALLATION

A. Base Mounted Pumps:
1. Mount each base mounted pump on a concrete base. Base height shall be 4" high minimum or as indicated on the Drawings. Set expansion bolts in bases for attaching pumps.
2. Grout each pump bed plate to its concrete base.
3. Mechanical Contractor shall realign each pump after installation.
4. Install flexible pump connectors on the suction and discharge side of each pump.

END OF SECTION

SECTION 23 21 30

HYDRONIC HEAT TRANSFER EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers hydronic heat transfer equipment and applies to and forms a part of Division 23, Section 23 21 00 - HVAC PIPING AND PUMPS.

B. Hydronic heat transfer equipment shall be in accordance with this and other applicable sections of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORKS RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install hydronic heat transfer equipment where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 UNIT HEATERS

A. Unit heaters shall be Sterling, Trane, Modine, or approved equal, hot water heated. Units shall be of propeller type, horizontal with horizontal and vertical adjustable louvers or vertical with diffusion vanes as scheduled.
   1. Unit motor shall be suitable for 120 volt electrical service and shall have built-in overload protection and permanently lubricated bearings.
      a. Heresite coated in Chemical Rooms where indicated.
   2. Furnish each water heating unit with an adjustable remote mounting 120V thermostat.

B. Unit heater performance capacities and characteristics shall be as scheduled on the Drawings.

2.02 FINNED TUBE RADIATION

A. Finned tube radiation shall be Sterling, Vulcan, Dunham Bush, Standard, or approved equal, top outlet enclosure finned tube radiation including heating elements, bracket assemblies, enclosure with integral grille, vandal proof accessories. Enclosures shall extend from wall-to-wall unless otherwise indicated.

1. Enclosures shall be rigid with snap-lock or tongue and groove, without screws through the top or front, including continuous metal hanger and full backplate, underlap inside and outside corners, end pieces, joining pieces and 12" removable cover section at valves. Tops and fronts shall be constructed of die formed 18-gauge (unless otherwise noted on schedule) steel and backplates shall be 18-gauge. Enclosures shall be chemically phosphatized before priming with baked enamel finish.

2. Heating elements shall be copper with mechanically bonded square aluminum fins.

B. Finned tube radiation, enclosure type, performance capacities, general dimensions and characteristics shall be as indicated and scheduled on the Drawings.

C. Color of steel enclosures will be selected by the Owner/Architect. Submit color samples.

PART 3 EXECUTION

3.01 UNIT HEATER INSTALLATIONS

A. Support each unit heater securely from the structure. Maintain adequate standing clearance height beneath each unit.

3.02 INSTALLATIONS SPECIFIED UNDER OTHER SECTIONS

A. Motor starting switches, disconnects, and power wiring will be provided under Division 26, unless otherwise specified.

B. Control wiring for the unit heaters will be provided under Section 23 90 00 - HVAC Controls.

END OF SECTION

SECTION 23 25 00

HEATING SYSTEM WATER TREATMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers chemical water treatment and applies to and forms a part of Division 23, Section 23 21 00 – HVAC PIPING AND PUMPS.

B. Chemical water treatment shall be in accordance with this and other applicable sections of these specifications.

1.02 GENERAL

A. Furnish and install water treatment equipment and apply water treatment to all hydronic systems as specified in this Section.

B. Chemical Standards: Provide only chemical products which are acceptable under state and local pollution control regulations.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Submit manufacturer's technical product data, including the list of chemicals and consumption rates, rated capacities of selected equipment, water pressure drops, dimensions, required clearances, weights, specialties and accessories to be furnished and installation and start-up instructions.
   2. Submit piping diagrams prepared by the water treatment provider to indicate locations of recommended equipment, chemical feeds and other water treatment components, system connections and metering, check and isolating valves.

B. Maintenance Data:

   1. Submit maintenance data and parts list for all water treatment equipment, Operation and controls, including troubleshooting maintenance guide. Include this data, product data, shop drawings, and piping diagrams in the Maintenance manual in accordance with requirements of Section 01300.

1.04 EXTENDED MAINTENANCE SERVICES

A. Prior to final acceptance, submit three (3) copies of an Agreement for Continued Service and Maintenance for boiler water treatment system for possible Owner's acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing, including replacement of materials and equipment, for one-year period with option by Owner for renewal of Agreement.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 CHEMICAL WATER TREATMENT

A. Retain the services of a qualified chemical water treatment service organization to recommend the proper treatment for the heating hot water system.

B. Submit the water treatment consultant's recommendations on chemical water treatment, chemicals required, method of treatment, description of test equipment to be furnished, and a water analysis for approval prior to furnishing or implementing treatment. The proposed treatment shall maintain proper control of the water conditions to assure adequate corrosion protection, pH control and good heat transfer without damaging any of the component parts of the systems.

C. Provide all chemical feed equipment, valves, fittings, piping, supports, etc., required for convenient and proper introduction of chemicals into the systems. Feeder location and piping connections to each system shall be as recommended by the treatment consultant. Furnish all chemicals required to maintain proper solution conditions for one year of operation and provide the necessary testing equipment required to maintain the conditions.

D. Furnish all chemicals required to maintain proper solution conditions for one year of operation and provide the necessary testing equipment required to maintain the conditions.

E. Upon start-up of each system, after proper flushing and cleaning, implement the treatment and instruct the Owner's designated Representative in the proper care and maintenance of each system, including testing to maintain proper control.

END OF SECTION

SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air distribution and applies to and forms a part of Division 23, Section 23 06 00 - SCHEDULES FOR HEATING, VENTILATING AND AIR CONDITIONING.

1.02 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of furnishing ductwork, fans, air terminals, including minor items obviously necessary for complete and functioning air distribution systems.

1.03 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:
1. 23 31 00 HVAC DUCTS AND CASINGS
2. 23 33 00 AIR DUCT ACCESSORIES
3. 23 34 23 HVAC POWER VENTILATORS
4. 23 36 00 AIR TERMINAL UNITS

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section of these Specifications covers ductwork and applies to and forms a part of Division 23, Section 23 30 00 - AIR DISTRIBUTION.

B. Ductwork shall be in accordance with this Section and other applicable sections of these Specifications and also follow the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install ductwork of type and material specified in this Section and as shown on the Drawings and as required to connect to all air handling equipment, air terminals and air handling system components.

1.03 COORDINATION

A. Coordinate ductwork with equipment, piping and conduit to be provided by other trades.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.01 DUCT ARRANGEMENT

A. Except where otherwise required by conditions of installation, install all ductwork symmetrical and/ or parallel with lines of the structure. Work duct carefully into place without springing of forcing.

B. Drop and rise horizontal ducts only as necessary to clear piping, conduit, and floor and roof structures.

3.02 DUCTWORK

A. Sheet Metal and Aluminum:
   1. Provide all sheet metal and aluminum work in conjunction with the Project air handling systems.
   2. Ductwork shall be run as high as possible in all rooms to maintain proper

headroom. Wherever possible, ducts shall be run close to beams of floor slabs above and where two or more ducts cross each other, they must be arranged in such a manner as to maintain the greatest possible clearance underneath. Do not cover any electrical junction boxes. Coordinate with the other trades to avoid interference with pipe runs, etc.

3. Inform the Architect/ Engineer before proceeding with any concealed ductwork that will require a ceiling to be lowered or shaft to be increased in size, etc. Should it be found impractical to install any duct of the exact sizes given, a duct of different shape but having the same resistance shall be installed.
4. Provide offsets, elbows, and transformations in ductwork as required for a complete installation.
5. Construct rectangular ducts from zinc coated sheet steel in accordance with SMACNA duct construction standards for up to 2" w.c. static pressure including gauges and reinforcing.
    a. Ductwork in noted areas to be constructed of Type 3003 – H14 aluminum. Refer to Drawings.
6. Additional bracing where necessary shall be used and may be ordered by the Engineer wherever, in his opinion, such additional bracing is required.
7. All duct dimensions indicated on the Drawings are inside dimensions for the net free area.
8. All sides, including top and bottom of all ducts and plenums shall be constructed of sheet metal and no portion of the building construction, such as walls or slabs, shall be used as part of any duct or plenum, unless indicated for on the Drawings or otherwise specified.
9. Cross break sheet metal surfaces of rectangular ducts 18 inches through 60 inches in size.
10. Curved elbows shall have a centerline radius equal to 1.5 times the duct width.
11. Square turn elbows shall be fitted with turning vanes conforming to SMACNA standards. Vanes shall be double thickness, fastened to runners and adequately braced.
12. Duct branching shall be of the diverter type unless otherwise indicated.
13. Interconnect supply air ducts and supply air diffusers with flexible air ducts where indicated and to the extent allowed.
14. Tap-ins for flexible duct extensions to diffusers shall be radiused square-to-round with inlet openings which are 50% larger than branch duct size. Install a manual, adjustable, volume damper with position indicating and locking device in each branch tap-in.
15. Install air transfer ducts where indicated.
16. Dampers:
    a. Fit dampers and splitters in ducts with an arm outside of the duct, set in the same direction and plane of the damper and positioned by the quadrant or regulator. Blades shall not exceed 6" in width for ducts 24" and smaller and 8" in width for larger ducts.

b. Damper rods shall be 5/16" and shall be fitted with brass bracing on one end for dampers 14" and under. For rods 15" long and over, fit the rods with brass bearings on each side of the duct.
c. Stiffen all dampers where necessary to prevent noise. Any damper causing any noise shall be replaced with a new one or additional stiffeners added so as to eliminate the noise.

17. Seal longitudinal and transverse joints in all supply air ducts with 3M Sealer 800, or approved equal, in accordance with SMACNA Class C requirements to produce a leakage rate of not more than 5 percent.
18. Outside air, exhaust air or relief air ducts entering or leaving the building and passing over finished ceilings shall be soldered absolutely watertight for a developed horizontal distance of 15 feet from the wall or roof opening.
19. Where ductwork penetrates walls or floors of mechanical rooms and rated walls where a fire or combination fire/ smoke damper is not present, "hand" stuff the space between opening and duct with glasswool and then fire stop edges with a minimum 1" depth 3M brand fire barrier caulk, UL Classified.
20. In exposed locations, trim the full perimeter of ducts penetrating walls/ceilings/floors not required to be fire dampered with 1-1/2" x 1-1/2" sheet metal angles finishing flush to the wall/ceiling/floor.
21. Whenever ducts penetrate the roof, outer walls or waterproofing of any kind, furnish and install all base flashing and all necessary counterflashing and caulking.
22. Provide watertight plenum beneath roof mounted exhaust fans and seal joints watertight with an approved sealer.
23. Coordinate with the General Contractor the location and size of all openings for ductwork that pass through walls, floors and partitions and provide duct sleeves as required.
24. Blank off all inactive areas of wall louvers with double wall sheet metal panels internally insulated with 2", 3 lb./ cu. ft. density rigid insulation. Seal all joints watertight.

3.03 SPIRAL LOCK SEAM DUCT AND FITTINGS

A. Exposed supply air ducts and fittings shall be United Sheet Metal, or approved equal, spiral lock seam duct and fitting.
1. Pipe-to-pipe couplings shall be designed to slip fit into the adjoining duct ends and shall be reinforced by a rolled bead. Pipe-top fitting joints shall be designed so projecting collar of fitting will slip fit into the adjoining duct end.
2. All fittings shall have continuous welds along all seams. All divided flow fittings shall be manufactured as a separate fitting, not as a tap collar welded into spiral duct sections.
3. 90 degree elbows in diameters to 12 inches and 45 degree elbows up to 14 inches shall be two-section stamped elbows. All other elbows shall be

gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1-1/2 times the cross-sectional diameter.

4. Provide supply air openings in ducts and install collars for mounting linear slot diffusers. The entire perimeter of each collar shall be welded to the duct.
5. Galvanized surfaces damaged by welding shall be coated with corrosion resistant aluminum paint.
6. Ductwork in noted areas to be constructed of Type 3003 – H14 aluminum. Refer to Drawings.

3.04 DUCT HANGARS AND SUPPORTS

A. Securely attach all ductwork to the building construction in a manner to be free from vibration and swaying under operating conditions.

B. Hangers shall be galvanized strap hangers, bolted to the angle stiffeners or secured to the sides of the duct, adequately supported from the building structure with bolts, anchors, inserts and/ or clamps, as the condition requires.

C. Stays on vertical lines of ducts shall consist of galvanized steel straps anchored to the building structure at such points as are necessary for properly supporting them and maintaining alignment.

1. Where insert are drilled into concrete slab, contractor shall confirm locations of concrete rebar and avoid penetrations at these locations.

D. Trapeze all ductwork 36" and over in width using threaded rods and steel angles or Unistrut channels. Comply with SMACNA recommendations on loading, sizes and attachments. Hanger spacing shall not exceed 4'-0" centers.

E. Where vertical ducts pass through floors, securely fasten supporting angles on at least two (2) sides of the ducts with rivets, screws, or bolts and support the assembly on the adjoining floor construction in an approved manner. Angles shall be 2" x 2" x 1/8" black iron primed with zinc chromate.

F. Hanging one duct from another is prohibited.

G. All fastenings and hardware for galvanized ductwork and sheet metal work shall be cadmium plated steel.

1. All fastenings and hardware for aluminum ductwork shall be Type 316 stainless steel.
2. Isolation of dissimilar metal components shall be provided with a material such as neoprene sheeting or equivalent.

H. Hangers supporting stainless steel ductwork shall be 316 stainless steel strap hangers, bolted to the angle stiffeners or secured to the sides of the duct, adequately supported from the building structure with 316 stainless steel bolts, anchors, inserts and/or clamps, as the condition requires.

3.05 FLEXIBLE CONNECTIONS

A. Make duct connections to vibration isolated fan with fabric connections. Connections shall be not less than 6" wide. Allow 1" slack. Attach with bolted steel clamping bands and adhesive for airtight connection.

3.06 INSTALLATION OF DIFFUSERS, REGISTERS AND GRILLES

A. Coordinate mounting locations of diffusers, registers and grilles with the work of other trades.

B. Gasket and draw each device tightly to the surface to eliminate gaps and dirt streaking. Rigidly fasten ducts behind grilles, registers and diffusers.

C. Install sheet metal retainers inside spiral duct air outlet collars for concealed screw fastening of linear slot diffusers.

3.07 ACCESS PANELS

A. Fabricate and install duct access panels for access to duct mounted heating coils, D/X cooling coil, control dampers, backdraft dampers, fire dampers and control equipment. Panels shall be located and adequately sized for the purpose. Minimum panel size shall be 18" x 18" x 2" less than the duct size will permit.

B. For ducts required to be insulated, access panels shall be double wall construction with 1" of insulation fill.

C. Attach panels using zinc-plated cam latches, two (2) for sizes to 18" x 18" and four (4) for larger sizes. Seal edges with polyurethane foam.

D. Coordinate with the General Contractor the locations of ceiling access panels, in inaccessible ceilings, to be adjacent to duct access panels to allow for damper servicing.

3.08 FIRE DAMPER INSTALLATIONS

A. Mount each fire damper in a 16 gauge wall sleeve set in the wall independent of duct support and secured all around on both sides of the wall by means of 1-1/2" x 1-1/2" x 1/8" angles attached to the sleeve. Attach connecting duct work to the sleeve with S-slips.

3.09 INSTALLATIONS SPECIFIED UNDER OTHER SECTIONS

A. Masonry wall, floor and roof openings will be provided under the General Construction Work.

B. Drains from outside air ducts will be installed under Division 22.

C. Duct mounted smoke detectors will be furnished, installed and wired under Section 23 90 00, unless noted otherwise.

3.10 INSTALLATIONS OF EQUIPMENT PROVIDED UNDER OTHER SECTIONS

A. Install air control dampers furnished under Section 23 33 00.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers ductwork accessories and applies to and forms a part of Division 23, Section 23 33 00 - HVAC AIR DISTRIBUTION.

B. Ductwork accessories shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install ductwork accessories where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 FLEXIBLE CONNECTIONS

A. Flexible connections to vibration isolated fans shall be Ventglas, or equal, double neoprene coated, fire retardant fabric.

2.02 CONTROL DAMPERS

A. Control dampers shall be Ruskin CD50, Cesco, Arrow, Greenheck, Pottorff, or approved equal, frame mounted with rectangular opposed blades. Damper frame shall be 4" wide, extruded aluminum hat-shaped channel. Blades shall be extruded aluminum with maximum 6" spacing and maximum 48" in length. Linkage shall have brackets riveted to the blades with aluminum rod locked to the pivots. Bearings shall be Oilite Bronze. Axles shall be extended for motor actuator attachment. Dampers shall be suitable for velocities up to 2,000 FPM.

1. Dampers shall be low leakage construction with polyurethane blade and jamb seals.
2. Dampers shall be louver size or duct size as applicable or sized as scheduled on the Drawings.

2.03 FIRE DAMPERS

A. Fire dampers shall be Ruskin 1BD2 Type B, Greenheck, Prefco, Air Balance,

Pottorff, or approved equal, curtain type with galvanized steel blades in galvanized channel frame. Blades shall be accordion out-of-the-air stream in their open position. Blades shall be held open by fusible link rated at 165 degrees F. Dampers shall bear the UL label for 1-1/2 hour fire protection.

B. Fire damper sizes shall match duct sizes indicated on the Drawings.

2.04 AIR FLOW MEASURING STATION

A. Air flow measuring station (AFMS) shall be Tek-Air, IAQ-Tek, or approved equal. AFMS shall be complete with outdoor air probes, transducer and monitor. Monitor to provide analog outputs for airflow and temperature interface with BAS system.
   1. Airflow probes to be provided with mounting struts and brakets.
   2. AFMS shall be duct size as applicable or sized as scheduled on the Drawings. Verify exact duct size.

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers power ventilators and applies to and forms a part of Division 23, Section 23 30 00 - HVAC AIR DISTRIBUTION.

B. Power ventilators shall be in accordance with this and other applicable sections of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL REQUIREMENTS

A. Furnish and install power ventilators where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 POWER ROOF VENTILATOR

A. Power roof ventilators shall be Greenheck, Twin City Fan, or Loren Cook, centrifugal roof exhausters, AMCMA certified. Ventilators shall have backward curved blade fan, motor mounting base, detachable hood, discharge baffles, bird screen, vibration isolation, safety disconnect switch and internal wiring post. All exposed parts of units shall be finished with a baked enamel paint, color as selected by the Architect. Steel supporting parts and other internal steel framework shall be prime coated.

1. Variable pitch V-belt or direct drive as scheduled.
    a. Direct drive motors to be DC electronic communication type (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Motors are permanently lubricated, heavy duty ball bearing type. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed. Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

2. Single-phase motors shall be capacitor start with built-in overload protection.

3. Lubrication and belts shall be suitable for low temperature operation.

4. Furnish control damper with blade edge and jamb seals and electric damper actuators as scheduled.

5. Furnish multi-blade backdraft damper with edge seals as scheduled.

6. Furnish a curb adaptor and extended base with side access panel.

7. Power roof ventilators shall be Heresite coated as scheduled.

B. Power roof ventilator performance capacities and characteristics shall be as scheduled on the Drawings.

2.02 UPBLAST ROOF VENTILATOR

A. Upblast roof ventilator shall be Greenheck, Twin City Fan, or Loren Cook, AMCA certified.

1. Fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Wind bands shall have a rolled bead for added strength and shall be joined to curb caps with a welded seam. Housing shall have internal grease trough and drain fitting for kitchen hood exhaust.

2. 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.

3. Motor shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors shall be mounted on vibration isolators, out of the airstream. Outside air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motor shall be readily accessible for maintenance.

4. Drive frame assembly shall be constructed of heavy gauge steel and mounted on vibration isolators.

5. Precision ground and polished fan shaft shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.

6. 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 curb cap to the motor compartment for ease of electrical wiring.

7. Fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

8. Variable pitch V-belt drive or direct drive as scheduled.

   a. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   b. Belts shall be suitable for low temperature operation.

9. Furnish a matching factory made extended roof curb base and curb adaptor constructed of galvanized steel. Curb height shall be as required for minimum 40" fan discharge height above roof.

B. Upblast roof ventilator performance capacity and characteristics shall be as scheduled on the Drawings.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Install equipment in accordance with the manufacturer’s recommendations.
   1. Mount the power roof ventilators on existing roof curbs. Provide and roof curb adaptor as required. Coordinate mounting locations level and align each unit.

END OF SECTION

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air terminal units and applies to and forms a part of Division 23, Section 23 30 00 - HVAC AIR DISTRIBUTION.

B. Air terminal units shall be in accordance with this Section of these Specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL REQUIREMENTS

A. Furnish and install air terminal units where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 VARIABLE AIR VOLUME (VAV) REHEAT CONTROL UNITS

A. Variable air volume reheat control units shall be Price, Titus, Trane, Envirotec, or approved equal, single duct pressure independent DDC actuated heating-cooling unit for variable air volume cooling air supply and minimum air volume heating air supply including primary air damper, and hot water heating coil.

1. Unit Casings: 22 gauge welded zinc-coated steel, internally lined with 3/4", 1-1/2 pound dual density insulation with treated surface to prevent erosion. Insulation shall meet NFPA 90A requirements. All exposed insulation edges shall be coated with NFPA 90A approved sealant. Hanger holes.

2. DDC Actuators: The DDC damper actuator and control module will be furnished under Section 23 90 00 and shall be mounted by VAV terminal unit manufacturer at his cost, as directed by the Temperature Control Sub-Contractor.

3. Leak Rating: Volume regulator and casing leak rate of not more than 4 percent of unit nominal CFM at 3 inch inlet static pressure.

4. Hot Water Coil: One-row or two-row as scheduled, aluminum plate type fins bonded to 5/8" seamless copper tubes, same end female sweat connections, leak tested at 300 PSIG air under water.

5. Unit shall include a removable access panel at the upstream side of the heating coil.

6. Sound levels transmitted via the downstream duct shall not exceed NC-35 at 1.0 SP for VAV boxes, including the effects of any integral sound attenuator, for a maximum of 10 feet of acoustical duct lining. No allowance is permitted for more than 10 feet of downstream lined duct. Sound levels radiated by the casing of a VAV box completely exposed shall not exceed NC-32 at 1.0" SP. All of the specified NC values are based on 10 dB room absorption re 1 microwatt. Shop drawings shall substantiate conformance with this specification based on tests according to ISO Standard 5219, ISO Standard 3741 and ARI-ADC Standard 880. The intent of this specification is to achieve actual sound levels in rooms served, not exceeding NC-35 with VAV boxes concealed above ceilings. Acoustical lining shall conform to NFPA-90A.

B. VAV reheat control unit performance capacities, minimum air volumes and characteristics shall be as scheduled on the Drawings.

C. VAV units will be DDC controlled by temperature sensors provided under Section 23 98 50.

2.02 DIFFUSERS, REGISTERS AND GRILLES

A. Diffusers, registers and grilles shall be Price, or approved equal, Titus, Nailor, Tuttle & Bailey, or Price as scheduled within this section.

B. All registers shall be provided with opposed blade volume control dampers, key operated.

C. Where indicated on the Drawings, individually adjustable deflecting vanes shall be provided to control air volume and deflect the supply air for even distribution through supply grille, register or diffuser.

D. Schedule:
1. SR - Supply registers - for sidewall and exposed duct installations: Model 620DAL, register with 1-1/4" margin, double deflection, adjustable, vertical face and horizontal rear vanes, 3/4" vane spacing, opposed blade dampers, aluminum construction.
2. RG - Return grille - for wall or exposed duct installations: Model 630,

register with 1-1/4" margin, 45 degree deflected horizontal face vanes, 3/4" vane spacing, opposed blade dampers, aluminum construction.

E. Finishes:
   1. Ceiling diffusers, registers and grilles shall have off-white baked enamel finish.
   2. Other grilles and registers shall have prime coat finish.

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 23 70 00

CENTRAL HVAC EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air distribution and applies to and forms a part of Division 23, Section 23 06 00 - SCHEDULES FOR HEATING, VENTILATING AND AIR CONDITIONING.

1.02 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of furnishing all heat recovery ventilators and make-up air units and performing all labor to install all heat recovery ventilators and make-up air units including minor items obviously necessary for complete and functioning HVAC systems.

1.03 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:

1. 23 73 30 AIR-TO-AIR ENERGY RECOVERY VENTILATORS
2. 23 74 00 PACKAGED AIR HANDLING UNITS

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

SECTION 23 73 30

AIR-TO-AIR ENERGY RECOVERY VENTILATORS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers packaged make-up air units and applies to and forms a part of Division 23, Section 23 70 00 - CENTRAL HVAC EQUIPMENT.

B. Packaged air-to-air energy recovery ventilator units shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install packaged air-to-air energy recovery ventilator units where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 ENERGY RECOVERY VENTILATORS

A. Energy Recovery Ventilators shall be packaged static plate enthalpic energy recovery ventilator as manufactured by Renew Aire or Conserv.

B. Units shall be installed as recommended by manufacturer and be equipped with duct connection points for room air and fresh air. Units shall be provided with duct connection points for ducts to and from the outside, allowing ducts to be installed in a straight or angle configuration. Unit shall be installed in a horizontal orientation. Manufacturer to provide mounting accessories, where indicated, for floor, wall or ceiling mounting of unit.

C. Energy Transfer Performance: Element shall be rated by manufacturer using method described in ASHRAE Standard 84-1991 Procedure for Testing Air-to-Air Heat Exchangers. Energy transfer shall be as shown on Schedule.

D. Sensible and Latent Transfer: Shall be capable of transferring both sensible and latent energy between air streams. Latent energy transfer shall be accomplished by direct transfer of water vapor.

E. Construction: Fixed-plate energy-exchange element. Energy-exchange module shall be of fixed-plate cross-flow construction, with no moving parts.

Insulation. Entire unit case shall be full insulated. Blower compartments shall be insulated with 1" fiberglass board acoustic/thermal insulation. All other compartments shall be insulated with 1" FSK high-density fiberglass board insulation. Case: Case shall be constructed of 20-gauge galvanized steel, with lapped and welded edges. Unit shall be finished with white, power coat paint, 65%-70% gloss, HB Pencil hardness, minimum one mil thickness.

No Drain: No condensate drains shall be allowed and unit shall be capable of operating in winter and summer conditions without generating condensate.

F. Air Flow Operation Range: Module shall be applicable for a range of ventilation air flow in each air stream without deposition of dust in the elements. Air flows shall be as shown on Schedule.

G. Maximum Allowable Pollutant Recapture: Water vapor transfer shall be through molecular transport by hydroscopic resin and shall not be accomplished by porous plate mechanisms. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix. Energy-transfer element shall be resistant to transfer of pollutants between air streams.

H. Frost-free Operation: Energy-transfer element shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10 F. and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function or performance of the element.

I. Smoke and Flame Characteristics: Manufacturer shall be able to provide evidence of independent testing of energy recovery element by certification facility, establishing its flame spread rating of 18, and its smoke generation rating of 22, meeting NFPA 90A and NFPA 90B requirements.

J. Blower Locations: (On Units with Blower Fans) Each blower shall be located in its respective airstream between the outside air and the energy recovery element, taking

advantage of the sound transmission reduction characteristic of the element to reduce noise generation in ventilated space.

1. Control: Each blower fan shall be separately controlled from independent starters and disconnect switches provided with the unit.

K. UL-Listing: Unit shall be UL-listed under Standard UL 1812 for Ducted Air-to-Air Heating Exchangers. Energy recovery ventilators shall be certified in accordance with ARI 1060 and listed as certified on ARI website.

L. Warranty: Lossnay element shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, or a period of ten years from the date of purchase.

Balance of module shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of one year from the date of purchase.

M. Pre-Filters: Filters shall be Farr type 30/30. Air filters shall be 2" thick, pleated, disposable type. Each filter will consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter media shall have an average efficiency of 25-30% on ASHRAE Test Standard.

The filter shall be listed by Underwriters Laboratories as Class 2. A bank of galvanized universal holding frames shall be arranged for upstream access. Provisions shall be made on the downstream side of the frames to prevent filter blowout.

1. Provide one (1) extra set of air filters for the unit.

PART 3 EXECUTION

3.01 ENERGY RECOVERY VENTILATOR UNIT INSTALLATION

A. Install equipment in strict accordance with manufacturer's recommendations.

B. Support units with vibration isolators and on structural steel stands as indicated on the Drawings. Install at height as recommended by manufacturer or as indicated on the Drawings.

C. Furnish Electrical Contractor with field wiring diagram and electrical data to permit power wiring connections to the unit.

D. Provide equipment check, test and commissioning by a factory trained and authorized service technician. Provide a copy of the start-up report to the Engineer.

This function must be performed by factory authorized personnel, and not by the installing contractor unless factory certified personnel are employed by the installing contractor.

E. Provide the Owner's operating personnel with instructions on proper use of the unit and controls.

F. Warranty - Equipment shall have a two (2) year warranty for furnishing parts of the unit which become defective in normal operation except for perishable items such as belts and filters. This warranty shall become valid one (1) year from the date of Owner's acceptance only when the start-up is performed by a Factory Authorized Service Technician.

END OF SECTION

SECTION 23 74 00

PACKAGED AIR HANDLING UNITS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers packaged air handling units and applies to and forms a part of Division 23, Section 23 70 00 - CENTRAL HVAC EQUIPMENT.

B. Packaged air handling units shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install packaged air handling units where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 PACKAGED MODULAR AIR HANDLING UNITS

A. Air handling units shall be Johnson Controls, Trane, Daikin, or approved equal, horizontal mounted, complete with filters, coil sections with hot water heating coils, drain pan, centrifugal fan, V-belt drive, motor, adjustable motor mounts, sheaves and belts as applicable. Unit shall be factory assembled and tested in accordance with ARI 430 and ARI 260. The unit will comply with NFPA 90a and be UL Listed.

1. Unit Casings:
    a. Units shall be constructed of a complete frame with removable side panels. Removal of side panels must not affect the structural integrity of each module.
    b. Units shall have an insulated with 2 inch, fiberglass fire resistant and odorless glass fiber material, R13.
    c. Units to conform to ASHRAE Standard 111, Class 6 for casing leakage of no more than 1% of design airflow at 1.25 times the design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches W.G. in negative pressure sections.
2. Units shall ship fully assembled (within freight limitations or as required to transport units into the building). AHU-1 shall be configured to fit through a 72” wide x 80” high opening. Contractor to coordinate shipping splits.
3. Water Coils:

a. Coils shall be manufactured by the same company as the supplier of the Air Handling unit. Coils shall be designed with aluminum plate fins and copper tubes.
b. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the unit casing to be accessible for service and can be removed from the unit either through the side or top. Capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410.
c. All coils shall be enclosed in a coil section. Coil headers and U-bends shall not be exposed.
d. Hydronic heating coils shall have a supply header to ensure distribution of fluid to each tube of coil. Coils shall be proof tested to 300 PSIG and leak tested to 450 PSIG air pressure under water.

4. Drain Pan:
   a. Drain pan shall be noncorrosive and doubled sloped. The drain pan will be constructed of stainless steel. There shall be a drain connection at the lowest point of the drain pan.

6. Filters:
   a. Throwaway: Filters shall be of the throwaway type and shall have 2-inch thick pleated fiberglass media contained in a rigid frame. Filters shall have a rigid supporting maze across both the entering and leaving faces of the media. Filters shall be sized so as not to exceed scheduled face velocities. Medium capacity 2" pleated throwaway filters having a minimum efficiency of 30 percent as determined by ASHRAE Standard 52-76.
   b. Provide one (1) extra set of filter media for each unit.

7. Fans:
   a. Fans shall be double width, double inlet, multi-blade type as manufactured by the unit manufacturer. Fans shall be forward curve (FC). (AHU-3 only). (Fan for AHU-1 to be plenum fan.)
   b. Supply fan performance shall be certified as complying with ARI Standard 430. Centrifugal fans shall be dynamically balanced at the factory as a complete fan assembly (fan wheel, motor, drive and belts). Fan shaft shall not pass through their first critical speed at any cataloged rpm.
   c. Fans shall be equipped with self-aligning, anti-friction pillow block bearings with a minimum life of L-50 200,000 hours. Bearings shall be equipped with grease lines allowing for lubrication from one side of the fan.
   d. Fan and motor assembly shall be internally isolated from unit casing with spring isolators, furnished and installed by unit manufacturer.

8. Motors:
   a. Motors shall be mounted integral to an isolated fan assembly furnished by the unit manufacturer. Motors shall be mounted inside the unit casing. Motor mounts shall be adjustable to permit drive belt tensioning.

b. Motors shall be premium efficiency open drip-proof with permanently sealed ball bearings or inverter duty as Scheduled.

9. Drives:
   a. Drive shall be variable pitch, suitable for adjustment within five percent of specified rpm.
   b. Drive shall be selected at 1.5 service factor.
   c. Belt speed shall be between 1,000 and 5,000 feet per minute.
   d. Center line distance shall not exceed three (3) times the sum of the sheave diameters and should not be less than the diameter of the larger sheave.
   e. The area of the belt contact on the smaller sheave shall not be less than 120 degrees.
10. Factory-installed motor wire termination enclosures:
   a. Any welds shall be properly finished with no rough edges. Enclosures shall house circuit breaker disconnects, bypass circuitry, Drive-OFF-Bypass switches and control transformers. Each air handling unit shall be provided with a NEMA rated disconnect switch that shall disconnect the source of power to the unit. Disconnects shall have an external disconnect located on the outside of the access door.
   b. Power wiring to fan motor shall be routed to an externally mounted enclosure for interface by Division 26 contractor in accordance with Division 26 specifications and NEC requirements.
   c. Air Handling Unit, AHU-1 fan motor shall be controlled by a remotely mounted VFD furnished and installed by the Temperature Control contractor.
11. Factory Wiring of Accessories:
   a. Units with factory-mounted accessories shall also include power wiring from the unit mounted disconnect to the accessories, transformers and devices.
   b. Provide all sections of each AHU complete with a marine light and guard, controlled by a lighted switch.
   c. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6’ in length may be contained in FMC.
   d. The AHU manufacturer shall provide one single-point power connection for all accessories and the temperature control transformer/interface on each AHU. Manufacturer shall coordinate this temperature control power interface with the Temperature Control Contractor. All temperature control devices to be furnished and installed by the Temperature Control Contractor.
12. Dampers
   a. All dampers shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil

design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

b. Outside, Return and Exhaust air dampers: Parallel blade dampers shall be provided to prevent infiltration of unconditioned air into the building when unit is not in operation. 2-position or modulating actuator to be furnished, installed, and wired by 23 90 00.

c. Heat coil face & bypass dampers: (AHU-3) Opposed blade dampers shall be provided on the outdoor air side for regulation of supply air. Modulating actuator to be furnished, installed, and wired by 23 90 00.

B. Air handling unit performance capacities and characteristics shall be as scheduled on the Drawings.

C. The air handling units shall be put into operation under the direct supervision of the manufacturer's factory-trained service engineer and his services shall be paid for by the Mechanical Contractor. The service engineer shall check the calibration and control settings and shall verify the proper operation of all safety and operating controls. He shall instruct the Owner's designated Representative on the operation of the unit and its control system.

PART 3 EXECUTION

3.01 INSTALLATION OF AIR HANDLING UNITS

A. Arrange to have the manufacturer's service engineer check the installations and controls for proper operation.

B. Units which are shipped in multiple sections shall be assembled on the jobsite by the installing contractor. Assembly includes caulking all seams weathertight and extending electrical power and network control wires to the terminal provided. Reconnect the motor and control wiring between sections to create a complete and operable installation per manufacturer's recommendations.

C. Support air handling units with vibration isolators and on structural steel stands as indicated on the Drawings. Install at height as recommended by manufacturer or as indicated on the Drawings.

D. Heating hot water and cooling water piping connections to the units will be provided under Section 23 21 13.

E. Furnish Electrical Contractor with field wiring diagram and electrical data to permit power wiring connections to the unit.

F. Provide equipment check, test and commissioning by a factory trained and authorized service technician. Provide a copy of the start-up report to the Engineer. This function must be performed by factory authorized personnel, and not by the installing contractor unless factory certified personnel are employed by the installing contractor.

G. Provide the Owner's operating personnel with instructions on proper use of the make-up air unit and controls.

H. Warranty - Equipment shall have a two (2) year warranty for furnishing parts of the unit which become defective in normal operation except for perishable items such as belts and filters. This warranty shall become valid one (1) year from the date of Owner's acceptance only when the start-up is performed by a Factory Authorized Service Technician.

3.02 INSTALLATIONS SPECIFIED UNDER OTHER SECTIONS

A. Motor starting switch, disconnect and power wiring to make-up air units will be provided under Division 26, unless otherwise specified.

END OF SECTION

SECTION 23 80 00

DECENTRALIZED HVAC EQUIPMENT

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers air distribution and applies to and forms a part of Division 23, Section 23 06 00 - SCHEDULES FOR HEATING, VENTILATING AND AIR CONDITIONING.

1.02 SCOPE OF WORK

A. The Work required under this Section of the Specifications consists of furnishing and installing all HVAC equipment including units which may or may not connect to primary, mechanical HVAC heating or cooling systems. Such equipment may have controls furnished by the HVAC Contractor and be balanced and tested by the HVAC Contractor.

1.03 RELATED SECTIONS

A. The following sections apply to and form a part of this Section:

1. 23 82 10 DEHUMIDIFIERS

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

SECTION 23 82 10

DEHUMIDIFIERS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers dehumidifiers and applies to and forms a part of Division 23, Section 23 80 00 - DECENTRALIZED HVAC EQUIPMENT.

B. Dehumidifiers shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS and Section 23 05 00 - COMMON WORK RESULTS FOR HVAC.

1.02 GENERAL

A. Furnish and install custom fabricated desiccant type dehumidifiers where indicated on the Drawings and as specified in this Section.

PART 2 PRODUCTS

2.01 DEHUMIDIFIER/VENTILATION UNIT (D-1)

A. Provide Dehumidifier/Ventilation Unit (D-1) with this specification, drawing details and the corresponding Schedule of Performance and Schedule Notes.

B. The system shall be shop manufactured and assembled by Munters Series DDS. Arrangement of all units shall be as shown on the Drawings. Performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, and 100% run tested to check operation, fan and blower rotation and control sequence (if applicable) before leaving the factory.

C. Dehumidifier/Ventilation Unit shall be bid in accordance with the following direction:

1. Munters shall be included as the Base Bid.

2. Other Approved Manufactures: Other Manufacturers shall be listed as an add or deduct to the Base Bid to include the costs associated with project redesigns such as project electrical upgrades, structural upgrades, increase in project utility usage. Alternate manufactures not approved in writing shall not be considered equal and the pricing of these units shall not be included in the bid.

D. Pre-Approval: To gain approval, alternate manufacturers shall provide to the Engineer the following information at least fourteen (14) days prior to the bid date:

1. Certified factory drawings detailing that overall dimensions and weights of proposed equipment. Identify proposed equipment exceeding those shown on plans, note such differences and proposed resolution.

2. Schedule of Performance showing compliance with Delivered Air Temps, Moisture Levels and Power Usage.

3. Certified Performance Submittals of the unit and a line-by-line comparison of proposed equipment specification versus this specification with highlights of how the proposed equipment meets or exceeds this specification.

4. If applicable: Provide DDC control sequence of proposed equipment, provide temperature sensor location, and wiring diagram.

5. Provide list of equipment installation locations within the Duluth area with contact information.

E. HOUSING

1. Unit Base: Unit base shall be bolted steel construction with formed 12 gauge galvanized steel channels around the outside perimeter and reinforced with galvanized steel cross members bolted on centers not exceeding 31 inches. Base shall have a minimum of four lifting brackets bolted in place.

2. Unit Casing:

a. The unit casing shall be constructed using a double wall panel and frame system for torsional rigidity. This includes walls, floors and ceilings. This system shall not contain any through metal. The unit casing shall also meet the following criteria based on ASTM E84-90 (Standard Test Method for Surface Burning of Building Materials), flame spread = 25, smoke index = 50.

b. The frame system components shall be constructed of fiberglass reinforced plastic (FRP) pultruded members. Horizontal frame members shall be supported along their length by intermediate supports and internal partitions. Through metal systems shall not be allowed. To avoid condensation, heat loss or loss of cooling capacity, each panel shall be 2 inches thick and constructed such that there are no through metal connections between the exterior surface and the interior surface. The exterior casing shall be 22-gauge corrosion resistant galvalume. The interior casing shall be 22-gauge galvanized steel. Manufacturers not providing exterior galvalume construction must provide painted galvanized exterior panels. Painted coating must

be corrosion resistant exceeding ANSI 2000 hour salt spray standards. Panels shall be foam injected into individual panels with a density of 2-1/2 lb/ft^3. The heat transfer rate through casing walls shall be less than 0.0625 Btu/sq. ft./°F equivalent to an R-value of 14. This construction shall be suitable for a 50°F difference as tested between process air dry bulb temperature and the dew point of the air surrounding the plenum. The unit casing shall be manufactured as an air and vapor tight system. There shall be a gasket system which seals the panels to the structure. Fixed panels shall be provided with flat closed cell neoprene and be sealed in place with FDA approved silicon. Doors and plug panels shall be provided with polyvinyl chloride seals.

3. Access Doors and Plug Panels:
   a. Access doors or plug panel doors will be provided as indicated on the drawings. Doors shall be rigid double wall construction and shall use heavy-duty hinges with lockable latches on each door. Doors shall be a minimum of 30.5" in width and be the full height unit plenum. Doors shall be of the same construction as panels. Hinges shall be installed by locating hinges no more than 36 inches on center from hinge to hinge. Door latches shall be capable of being fully tightened against gasket surfaces. All major components such as coils, filters, blowers, etc., within the air handling structure shall be easily removable through access panels without dismantling plenums or distributing ductwork. Equipment that requires disassembly of components rather than access through removable or hinged panels shall not be acceptable. The unit casing shall include access panels for inspection and for any maintenance required by the operating and maintenance manual. Panels without gaskets shall not be acceptable.

4. Weather Protection:
   a. The dehumidification system shall be capable of continuous outdoor operation. The air inlets shall be protected from flowing water by mist eliminators or connected duct work. Consequently, all access panels shall be weather tight, as shall all joints between casing and electrical conduits and between the unit casing and any components mounted in separate enclosures.
   b. For outdoor units a roof shall be fabricated using a capped standing seam style construction. Outside air inlets shall be provided with mist eliminating architectural louvers and rain hoods. Mist eliminating louver shall be an extruded aluminum construction utilizing a 2" vertical blade with a 2 phase separation chamber per blade. Frame shall be no less than 2 3/8" deep and arranged with bottom front drainage. Standard AMCA testing shall show beginning of water penetration to be not less than 930 FPM. The pressure drop through

the louver shall not be not more than 0.125". Louvers shall bear the AMCA Seal and have its ratings certified to comply with AMCA Publication 511.

F. DESICCANT WHEEL

The desiccant wheel media shall be a monolithic, extended-surface contact medium, fabricated entirely of inert, inorganic binders and glass fibers formed into narrow passages in the direction of airflow. The wheel shall be non-toxic. It shall also meet the following requirements:

The process and reactivation air streams shall be separated by air seals and internal partitions so that the humid reactivation air does not mix with the dry process air. Suppliers who do not also manufacturer the active desiccant dehumidification wheel must provide a 5 year parts and labor warranty for the wheel. Manufacturers must provide the desiccant dehumidification capacity without exceeding a gas usage specified. Manufacturers exceeding gas usage specification must provide a deduct of $ 2000 per therm. Acceptable manufacturers must be able to procure replacement if required within 24 hours or provide a spare stock for each unit size. The proposed equipment shall meet the following minimum requirements:

1. Wheel Face Seals; The dehumidifier shall have full-face seals on both the process air entering and the process air leaving sides of the wheel. These shall seal the entire perimeter of both air streams as they enter and leave the wheel. Partial seals shall not be acceptable. The seals shall be the silicone rubber bulb-type, with a protective strip of low-friction, abrasive-resistant surface to extend seal life and reduce the force needed to turn the desiccant wheel. Neither wiper-type seals nor brush-type nor any non-contact-type seal shall be acceptable. The seals shall be documented to have a minimum working life of 25,000 hours of normal operation.

2. Materials; The glass fibers which form the support matrix shall be made from uniform continuous strands larger than five microns in diameter which are nonrespirable and are not considered a possible health risk by the International Agency for Research on Cancer (IARC).

3. Flame spread and smoke generation; The wheel shall be tested according to ASTM E84-90 (Standard Test Method for Surface Burning of Building Materials) and shall achieve the following results:
   a. Flame spread index = 0
   b. Smoke developed index = 10

4. Desiccant impregnation; The desiccant shall be evenly impregnated

throughout the structure for predictable, consistent performance and for maximum wheel life. Coatings applied on top of the contact medium shall not be acceptable unless the manufacturer can provide independent life tests demonstrating less than a 5% decline in desiccant capacity over a five year period of normal operation.

5. Desiccant type; The desiccant impregnated into the contact medium shall be:

   a. Titanium-reinforced silica gel. The Honeycombe® desiccant wheel shall be a fabricated extended surface contact media with a multitude of small passages parallel to the airflow. The rotary structure shall be a monolithic composite consisting of inert silicates with microscopic pores designed to remove water in a vapor phase. The desiccant shall be hydrothermally -stabilized silica gel reinforced with titanium for maximum strength and stability over time. The fabricated structure shall be smooth and continuous having a depth of 400 or 200 millimeters, as specified in unit schedule, in the direction of airflow without interruptions or sandwich layers which restrict air flow or create a leakage path at joining surfaces. Nominal face velocity shall not exceed 800 fpm. The Honeycombe® wheel shall be manufactured in the United States. The manufacturer shall provide documentation to establish that:

   b. The desiccant retains more than 90% of its original capacity after ten years of continuous operation in clean air, with inlet air conditions up to an including 100% relative humidity.

   c. The wheel as impregnated with silica gel is capable of withstanding five complete water immersion cleaning cycles while retaining more than 95% of its original adsorption capacity.

G. DESICCANT WHEEL SUPPORT AND DRIVE ASSEMBLY

Desiccant wheels less than 86” in diameter shall be a single piece for fast removal and simple handling. The desiccant wheel shall be supported by four rollers at the base of the unit so the wheel can be easily removed by lifting it over the rollers using the drive belt. Center-axle support or any arrangement which requires disassembly of the support structure for wheel removal shall not be acceptable. In addition, the wheel drive assembly shall provide:

1. Rotation speed; To avoid excessive heat carryover from reactivation to the process air, the wheel rotation speed shall not exceed 16 rph while achieving the required moisture removal rate at the specified conditions.

2. Drive belt; The drive belt shall be the flat, toothed type, with aramid fiber reinforcement.

3. Drive motor; The drive motor shall be fractional horsepower and rated for continuous duty for a period of 20,000 hours under the load conditions imposed by the drive assembly.
4. Rotation detection; The drive assembly shall be equipped with a rotation detection circuit which shuts down the dehumidifier and signals the operator through an indicating light on the control cabinet if the wheel is not rotating.

H. REACTIVATION CIRCUIT

The reactivation circuit shall conform in all respects to the current National Electrical Code.

1. Direct-fired natural gas reactivation:
   a. The direct-fired raw gas burner shall have a rust-resistant cast iron air-fuel manifold and stainless steel air mixing plates. The burner assembly shall be mounted inside a housing constructed of G-90 hot dipped galvanized steel. The housing shall be welded and equipped with internal insulation of fibrous glass with a minimum thickness of 1 inch.
   b. Burners with less than 401 MBH input capacity shall be equipped with a single-stage combination gas valve. The complete pilot ignition system has been A.G.A. design certified to A.N.S.I. Standard Z21.7A-1985 "Automatic Intermittent Pilot Ignition Systems for Field Installation.". Gas valves and ignition control units also are A.G.A. design certified (separately) to applicable A.N.S.I. standards.

      The butterfly valve utilized for gas flow control is a UL recognized component. The actuator provided to modulate the valve is powered by a UL listed Class 2 cover mounted transformer.
   c. Burners with 401 MBH and greater input capacity shall be equipped with a general-purpose ANSI-standard gas train with redundant fluid power valves rated for duty at the specified gas supply pressures.
   d. Reactivation energy shall be automatically matched to dehumidification requirements by means of a modulating gas valve with proportional electric valve actuator. The valve/actuator assembly shall be connected to a temperature sensor/controller mounted in the discharge of the reactivation air stream.

I. FILTERS

1. Reactivation Filter; The unit shall include a disposable pleated filter with 25% to 30% minimum efficiency with 90% to 92% arrestance minimum as rated by ASHRAE Test Standard 52-76.
2. Standard Medium Efficiency Filters; The unit shall include removable filters

at the inlet of both process and reactivation air streams. These filters shall be mounted on sliding racks and accessible through access panels. All supply air is filtered through filters of 25% to 30% minimum efficiency with 90% to 92% arrestance minimum as rated by ASHRAE Test Standard 52-76. Filters are disposable 2" deep, pleated disposable type with non-woven media held in place by a welded wire grid. Filters are held in aluminum channels top and bottom with spacers and back-up plates to minimize bypass. Filter channels are welded and sealed in place to eliminate air bypass.

J. FANS

General Requirements:

1. Blowers provide the specified air volume(s) through the system with adequate static pressure to overcome duct and distribution losses specified. Blowers are of the non-overloading, backward inclined, air foil blade type for air volumes greater than 1000 scfm. Blowers are direct or belt drive provided fan speed does not exceed 80% of the fan shaft critical speed. Access shall be provided on both sides of the supply blower for inspection and servicing. All fans shall be rated in accordance with AMCA Standard 210. Fan motors shall be TEFC, high efficiency type with Class B insulation and a 1.15 service factor

2. Balancing; Fans shall be balanced after assembly and after coating at the speed the unit is scheduled to operate. Fans are balanced such that the maximum displacement in any plane does not exceed 1.5 mils for fans operating at or below 2000 rpm or 1.0 mils for fans operating above 2000 rpm.

3. Belt Drive Fans; For fan motors of 10 hp and smaller, the belt-drive shall be selected for 120% of rated capacity. For fans driven by motors larger than 10 hp, the drive shall be selected for 150% of rated capacity. All belt-driven fans shall be equipped with:

   a. Motors mounted on slide rails or bases and belt tension is adjustable without repositioning of belt guard.

   b. Fan assemblies mounted on a rigid structural steel base supported at not less than 4 points by rubber-in-shear or spring type vibration isolators. Overall isolation efficiency is not less than 95% at the design fan speed.

   c. Fan and base assembly shall be equipped with not less than 3 tie down bolts for stability during shipment to prevent damage.

4. Direct Drive Fans; Direct drive blowers are 1725 or 3450 RPM. Direct drive blowers are mounted on vibration pads or rubber-in-shear type vibration isolators. Overall isolation efficiency is not less than 95% at the design blower speed.

5. Fan Motors; Fan motors shall be the totally-enclosed fan-cooled (TEFC),

high-efficiency type with Class B insulation and shall be selected for a service factor of 1.15.

K. INDIRECT FIRED POST HEATER

1. Heater shall conform to ANSI Z83.9. Unit shall be suitable for operation on natural gas as specified. Unit shall be of downblast or horizontal configuration. Unit shall have an input rating of 400 MBH on high firing rate and 200 MBH on low firing rate. Where input is greater than 400 MBH multiple heaters shall be used. It shall contain tube type heated exchangers, flue gas collector with vent fan, in shot burners, and controls for high and low fire. Unit shall be un-housed and fit within the unit housing envelop dimensions.

2. Burners shall be die formed in shot type with adjustable air shutters. Burners must be individually removable for cleaning or service. Entire burner assembly must be easily removable as an assembly.

3. Unit shall have a powered venting system consisting of a collection box, direct drive vent fan and ana air proving switch. The collection box shall be made of the same material as the heat exchanger bulkhead plate and shall be removable. The venting fan bearings shall have a minimum L10 bearing life of 24000 hrs. The vent fan shall exhaust the flue gas horizontally out the side of the unit. The unit fan shall operate on 120/1/60 and not exceed 2 FLA.

4. Tubes shall be permanently attached to a bulkhead plate to form an airtight seal between combustion byproducts and heated air system. Heat exchanger shall be 2constructed of 18 gauge aluminized tubes with 14 gauge aluminized steel bulkhead plate. Heat exchanger shall be rated for a minimum lifespan of 100,000 cycles.

5. Gas train shall utilize components certified by AGA. Gas train shall consist of a 24 VAC two stage combination valve (manual on-off, automatic safety shutoff, regulation to handle 0.5 psig input pressue and adjustable pilot valve). The combination valve shall be rated at a flow of 400 MBH. The valve shall feed inshot burners through a manifold with screw in brass orifices sized for either natural gas or propane, as required by unit schedule. The flame controllers shall be solid state module that operates on 24 VAC. It shall have a built in spark ignitor and flame sensor with 100% gas shutoff. The pilot shall be ignited during each cycle of operation. After the pilot is proven, the main burner valve shall open. Pilot and main burners shall be extinguished during the off cycle. The thermal disc type high temperature limit switch shall shut off main and pilot valves if an overheat occurs.

L. ELECTRICAL CONTROL CABINET

The electrical control cabinet shall be weather tight to NEMA 3R standards and shall include:

1. Wiring to comply with the current National Electrical Code with further fuse and wiring sizing to meet or exceed UL 508A Industrial Control Panel.

2. Wires shall be color-coded or numbered at both ends and all terminal block connection points shall be numbered. These markings shall correspond with the electrical diagram provided in the operating and maintenance manual.

3. Components shall be UL or CSA approved where possible.

4. Control System; The unit sequence of operations shall include separate indication for:
   a. Power on
   b. Unit running
   c. Desiccant wheel rotation fault
   d. Burner fault
   e. Motor overload

5. Operating and maintenance manual
   The control cabinet shall include a copy of the O & M manual, mounted in a separate compartment or pocket to allow access to critical information by maintenance personnel after installation.

6. Disconnecting Means; The unit shall be suitable for operation from a single 480 volt, 3 phase source. The unit shall include a NEMA rated disconnect switch that shall disconnect the source of power to the unit. The unit shall include a unit mounted weather-proof enclosure that shall house a fused 480:120 volt control power transformer, a 120:24 volt transformer, starters, all controls and all control switches for operation of the unit as defined herein. The control panel shall include a NEMA rated combination starter with phase failure protection and overloads to operate the motor(s) that are integral with the air handling unit. The control panel shall include gas, safety and related controls. The control panel shall be third party labeled in accordance with the requirements of the Minnesota State Board of Electricity.

M. ENTHALPY WHEEL HEAT EXCHANGER

The rotary air-to-air heat exchanger(s) shall be Model RT3 as manufactured by Munters. Suppliers who do not manufacture their own energy recovery wheels shall provide a five year parts and labor warranty for the wheel and carry stock sufficient to

ship replacements within 24 hours.

1. Wheel Matrix; Rotor shall be constructed of rotating honeycomb matrix consisting of a highly selective desiccant, permanently bonded to aluminum. The desiccant material shall be a molecular sieve with pore diameters ranging from 3A to 4A to minimize the carryover of undesirable gases. The corrugated media provides individual flutes to channel the airflow and the thus minimize cross contamination and ensure rated performance under all differential pressure conditions. The desiccant coating shall provide corrosion resistance against attack from office, laboratory, hospital, pharmaceutical chemicals, etc., and protection in coastal and marine environments.

2. Wheel Casing; The wheel frames shall consist of evenly spaced galvanized steel spokes, galvanized steel outer band, and a rigid center hub. The wheel construction shall allow for wheel alignment. The wheel seals shall be brush type and shall be easily adjustable. Brush seals shall be included to separate fresh air from exhaust air across entire surface of air entering side, air leaving side and outer band (all four planes). Additionally, the entire circumference of the rotor shall include brush seal to minimize air bypass. Cassettes shall be fabricated of heavy-duty, reinforced 16-gauge galvanized steel. Bearings shall be outboard-flanged ball bearing with concentric locking collars. Bearings shall be permanently sealed and lubricated for zero maintenance and long life. Drive system shall consist of a heavy-duty AC motor driving a self-adjusting, easily replaceable multi-link belt. Heat exchangers shall be tested in accordance with ASHRAE Standard 84-1991 and ARI Standard 1060.

3. Variable speed drive and controls for economizer mode shall be provided as scheduled

4. Variable speed drive and controls for frost prevention shall be provided as scheduled.

N. CONTROLS

The unit shall have DDC microprocessor control with a factory supplied program to ensure the required sequence of operation is performed. Units microprocessor shall be capable of communicating with a building management system (BMS) through Modbus, Lonworks or BACnet protocol. Control options include the ability for the AHU to determine stages of heating, cooling and dehumidification required to maintain space conditions when an “enable” command is given via the BMS, or direct control via commands issued from the BMS.

1. Refer to Specification Section 23 98 50 for additional information/description on system Sequence of Operation.

O. UNIT CAPACITY AND SYSTEM START-UP

1. Dehumidifier unit performance capacities and characteristics shall be as scheduled on the Drawings.

2. The Dehumidifier unit shall be put into operation under the direct supervision of the manufacturer's factory-trained service engineer and his services shall be paid for by the Mechanical Contractor. The service engineer shall check the calibration and control settings and shall verify the proper operation of all safety and operating controls both in the spring at the beginning of the dehumidification season and in the fall at the beginning of the heating season. He shall instruct the Owner's designated Representative on the operation of the unit and its control system.

3. Furnish, without additional cost to the Owner, the services of competent instructors, who shall fully instruct the Owner's designated representatives in the care, adjustment and operation of the unit.

4. An Operating and Maintenance Manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.

5. The total number of man-hours of instruction furnished shall be eight (8). Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 50% of time used for initial instructions and 50% of time used for follow-up instructions at the Owner's request, a minimum of four (4) weeks after the initial instructions.

2.02 DESICCANT DEHUMIDIFIER (D-2)

A. Dehumidifier shall be Munters HCD Series sorption type, fully automatic factory assembled package units, weather tight for indoor or outdoor use, complete with reactivation heated, roughing filters, process and reactivation fans and motors desiccant wheel and drive assembly, controls, including remote mounted humidistats, access panels and duct connections. The unit shall be NFPA 255-ASTM #84 compliant.

1. Dehumidifiers shall be a type proven in satisfactory operation for a minimum of ten (10) years.)

2. Dehumidifiers shall be of the non-cycling sorption type with a single desiccant rotary structure.

3. Unit shall be configured to fit through a 72"wide x 80" high opening.

B. Dehumidifier unit casing:

The unit casing shall be fabricated of strain-hardened aluminum with a minimum thickness of 0.125" for torsional rigidity and corrosion resistance. The casing shall be formed, welded and sealed as a single unified structure. Steel construction is not acceptable. Aluminum structures depending on screws for casing construction are not

acceptable. In addition, the unit casing shall include:

1. Insulation; To avoid either condensation, heat loss or loss of cooling capacity, the unit casing shall be insulated such that the heat transfer rate through casing walls is less than 0.27 Btu/sq. ft./°F if the wall separates air streams which differ in temperature by more than 25°F.

2. Wiring; All wiring between dehumidifier components shall comply with the current National Electrical Code (NEC). Wiring unprotected by flexible conduit shall not be acceptable.

3. Process and reactivation air flow gauges; To set and verify the specified air flow rates through the unit, the casing shall be equipped with differential pressure gauges which measure and display the pressure drop across the desiccant wheel. The dial of the gauges shall include a warning zone to indicate when the air flow is above the recommended operating range of the equipment.

4. Coating; The exterior of the unit casing and all surfaces of access panels shall be degreased and cleaned, then primed with one coat of industrial wash primer and finished with one coat of catalyzed polyurethane enamel. All pieces shall be painted individually prior to assembly to assure complete protection.

5. Maintenance access and inspection panels; The unit casing shall include access panels for inspection and for any maintenance required by the operating and maintenance manual. These panels shall be fastened by captive hardware permanently fixed to either the panel or the unit casing. The panels shall be airtight to the extent of not leaking more than 1% of the rated airflow when the interior of the casing is under 5" WC positive air pressure, nor more than 0.5% of the rated flow when the casing is under 5" WC of negative pressure. Panels without gaskets shall not be acceptable. Panels held in place by drill-screws shall not be acceptable. Equipment which requires disassembly of components rather than access through removable panels for any maintenance required by the operating and maintenance manual shall not be acceptable.

6. Filters; The unit casing shall include removable filters at the inlet of both process and reactivation air streams. These filters shall be mounted on sliding racks and accessible through panels equipped with fast-acting, captive hardware.

C. Electrical control cabinet:

The electrical control cabinet shall be weather tight to NEMA 4 standards and shall include:

1. Wiring to comply with the current National Electrical Code with further fuse and wiring sizing to meet or exceed UL 508A *Industrial Control Panel.*

2. The dehumidifier unit shall be suitable for operation from a single 480 volt, 3

phase source. The dehumidifier unit shall include a NEMA rated disconnect switch that shall disconnect the source of power to the unit. The disconnect switch shall be provided with "padlock-off" provisions. The dehumidifier unit shall include unit mounted enclosure that shall house a fused 480:120 volt control transformer, a 120:24 volt transformer and starters. The unit shall include a NEMA rated combination starter with phase failure protection and overloads to operate the motor(s) that are integral with the air handling unit.

3. Wires shall be color-coded or numbered at both ends and all terminal block connection points shall be numbered. These markings shall correspond with the electrical diagram provided in the operating and maintenance manual.

4. Components shall be UL or CSA approved where possible.

5. Programmable logic controller; The unit sequence of operations shall be controlled by a programmable logic controller which includes separate indication for:
   a. Power on.
   b. Unit running.
   c. Desiccant wheel rotation fault.
   d. Reactivation air overheat after heaters
   e. Reactivation air leaving below set point
   f. Motor overload

6. Operating and maintenance manual; The control cabinet shall include a copy of the O & M manual, mounted in a separate compartment or pocket to allow access to critical information by maintenance personnel after installation.

7. Run-hour meter; To allow for recording maintenance practices and to assist fault diagnosis, the cabinet shall have a run-hour meter mounted and visible from the exterior of the unit.

D. Reactivation circuit:

The reactivation circuit shall conform in all respects to the current National Electrical Code.

1. Direct-fired natural gas reactivation

   a. The direct-fired raw gas burner shall have a rust-resistant cast iron air-fuel manifold and stainless steel air mixing plates. The burner assembly shall be mounted inside a housing constructed of strain-hardened aluminum sheet of 0.125 inch thickness. The housing shall be welded and equipped with internal insulation of fibrous glass with a minimum thickness of 1 inch.

   b. Burners with less than 749 MBH input capacity shall be equipped with a single-stage combination gas valve. The complete pilot ignition system has been A.G.A. design certified to A.N.S.I. Standard Z21.7A-1985 "Automatic Intermittent Pilot Ignition Systems for Field Installation.". Gas valves and ignition control units also are A.G.A.

design certified (separately) to applicable A.N.S.I. standards.

The butterfly valve utilized for gas flow control is a UL recognized component. The actuator provided to modulate the valve is powered by a UL listed Class 2 cover mounted transformer.

c. Burners with 750 MBH and greater input capacity shall be equipped with a general-purpose ANSI-standard gas train with redundant fluid power valves rated for duty at the specified gas supply pressures.

d. Reactivation energy shall be automatically matched to dehumidification requirements by means of a modulating gas valve with proportional electric valve actuator. The valve/actuator assembly shall be connected to a temperature sensor/controller mounted in the discharge of the reactivation air stream.

E. Desiccant Wheel:

The desiccant wheel media shall be a monolithic, extended-surface contact medium, fabricated entirely of inert, inorganic binders and glass fibers formed into narrow passages in the direction of airflow. The wheel shall be bacteriostatic and non-toxic. It shall also meet the following requirements:

1. Materials; The glass fibers which form the support matrix shall be made from uniform continuous strands larger than five microns in diameter which are nonrespirable and are not considered a possible health risk by the International Agency for Research on Cancer (IARC).

2. Flame spread and smoke generation; The wheel shall be tested according to ASTM E84-90 (Standard Test Method for Surface Burning of Building Materials) and shall achieve the following results:

   a. Flame spread index = 0

   b. Smoke developed index = 10

3. Desiccant impregnation; The desiccant shall be evenly impregnated throughout the structure for predictable, consistent performance and for maximum wheel life. Coatings applied on top of the contact medium shall not be acceptable unless the manufacturer can provide independent life tests demonstrating less than a 5% decline in desiccant capacity over a five year period of normal operation.

4. Desiccant type; The desiccant impregnated into the contact medium shall be:

   a. Titanium-reinforced silica gel; The Honeycombe® desiccant wheel shall be a fabricated extended surface contact media with a multitude of small passages parallel to the airflow. The rotary structure shall be a monolithic composite consisting of inert silicates with microscopic pores designed to remove water in a vapor phase. The desiccant shall be hydrothermally-stabilized silica gel reinforced with titanium for maximum strength and stability over time. The fabricated structure

shall be smooth and continuous having a depth of 400 millimeters in the direction of airflow without interruptions or sandwich layers which restrict air flow or create a leakage path at joining surfaces. Nominal face velocity shall not exceed 600 fpm. The Honeycombe® wheel shall be manufactured in the United States. The manufacturer shall provide documentation to establish that:

1) The desiccant retains more than 90% of its original capacity after ten years of continuous operation in clean air, with inlet air conditions up to an including 100% relative humidity.

2) The wheel as impregnated with silica gel is capable of withstanding five complete water immersion cleaning cycles while retaining more than 95% of its original adsorption capacity.

F. Desiccant Wheel Support and Drive Assembly:

For wheels of 60" diameter and smaller, the wheel shall be a single piece for fast removal and simple handling. In the smaller case, the desiccant wheel shall be supported by four rollers at the base of the unit so the wheel can be easily removed for maintenance by lifting it over the rollers using the drive belt. Center-axle support or any arrangement which requires disassembly of the support structure for wheel removal shall not be acceptable. In addition, the wheel drive assembly shall provide:

1. Rotation speed; To avoid excessive heat carryover from reactivation to the process air, the wheel rotation speed shall not exceed 10 rph while achieving the required moisture removal rate at the specified conditions.

2. Drive belt; The drive belt shall be the flat, toothed type, with aramid fiber reinforcement.

3. Drive motor; The drive motor shall be fractional horsepower and rated for continuous duty for a period of 20,000 hours under the load conditions imposed by the drive assembly.

4. Rotation detection; The drive assembly shall be equipped with a rotation detection circuit which shuts down the dehumidifier and signals the operator through an indicating light on the control cabinet if the wheel is not rotating.

G. Air seals and internal air leakage:

The process and reactivation air streams shall be separated by air seals and internal partitions so that the humid reactivation air does not mix with the dry process air. The proposed equipment shall meet the following minimum requirements:

1. Wheel face seals; For units with desiccant wheels under 61" in diameter, the dehumidifier shall have full-face seals on both the process air entering and the process air leaving sides of the wheel. These shall seal the entire perimeter of

both air streams as they enter and leave the wheel. Partial seals shall not be acceptable. The seals shall be the silicone rubber bulb-type, with a protective strip of low-friction, abrasive-resistant tape to extend seal life and reduce the force needed to turn the desiccant wheel. Neither wiper-type seals nor brush-type nor any non-contact-type seal shall be acceptable. The seals shall be documented to have a minimum working life of 25,000 hours of normal operation.

2. Total casing air leakage; The unit shall not allow leakage to exceed the greater of the following values:

   a. One percent of the process air flow.

H. Process and reactivation air fans:

Process and reactivation air fans shall be the single-inlet, single-width, centrifugal-type.

1. Fan wheel type; Fans driven by motors of 2 hp and below shall be the direct-drive, forward-curve centrifugal type. Fans driven by motors of 3 hp through 7.5 hp shall be backward-inclined, direct-drive centrifugal type. Fans driven by motors of 7.5 hp and larger shall be the backward-inclined, belt-driven centrifugal type.

2. Balancing; Fans shall be balanced after assembly and after coating at the speed the unit is scheduled to operate. Fans shall be balanced such that the maximum displacement in any plane is less than 1.0 mils, peak to peak.

3. Belt-driven fans; For fan motors of 10 hp and smaller, the belt-drive shall be selected for 120% of rated capacity. For fans driven by motors larger than 10 hp, the drive shall be selected for 150% of rated capacity. All belt-driven fans shall be equipped with:

   a. Removable belt guards with openings to allow tachometer readings at both fan and motor shafts. Guards shall also be constructed to allow visual inspection of the belts without removing the guard.

   b. Vibration isolators, with a minimum efficiency of 95%.

4. Fan motors; Fan motors shall be the totally-enclosed, fan-cooled, high-efficiency type and shall be selected for a service factor of 1.15.

I. Moisture removal capacity control:

The dehumidifier shall operate automatically, in response to the control system supplied by the manufacturer as follows:

1. Process air face & bypass modulation:

   The volume of process air passing through the dehumidifier shall be modulated by means of electric motor-driven dampers which cover the

process air inlet and the bypass air inlet to the dehumidifier casing. The bypass air duct shall be included inside the dehumidifier casing such that no additional external ductwork need be added to the unit to achieve control. The bypass duct shall be equipped with an orifice plate to balance the pressure drop of the bypass to equal that of the desiccant wheel at full flow.

a. Dampers; Dampers shall be opposed-blade type, with galvanized steel frames, stainless steel end-seals, elastomeric blade edge seals and oil-impregnated blade shaft bushings.

b. Damper frames and casing; The damper frames shall be fastened and sealed to eliminate air bypass around the damper assembly. The operator(s) and connecting linkages shall be mounted in a separate compartments sealed from the supply air stream and from the ambient environment. The compartment shall be equipped with an access panel for ease of adjustment and servicing without the need to disturb the supply air flow.

c. Damper actuators; Damper actuators shall be the proportional type with spring return on power loss. They shall operate in response to a continuous signal input signal.

d. Responsibility for the control system shall be divided as follows:

1) Dehumidifier manufacturer; Provide the dehumidifier complete with dampers and motors mounted, wired and tested in the factory prior to shipment. The manufacturer shall provide the sensor/controller suitable for operation and control at the specified location and humidity control range.

2) Installing contractor; Install the humidity sensor in the location specified, and wire the sensor and controller to the dehumidifier. Reset the fixed-position bypass flow control damper such that pressure drop through the bypass equals the pressure drop through the desiccant wheel at the specified process air flow rate.

J. UNIT CAPACITY AND SYSTEM START-UP

1. Dehumidifier unit performance capacities and characteristics shall be as scheduled on the Drawings.

2. The Dehumidifier unit shall be put into operation under the direct supervision of the manufacturer's factory-trained service engineer and his services shall be paid for by the Mechanical Contractor. The service engineer shall check the calibration and control settings and shall verify the proper operation of all safety and operating controls both in the spring at the beginning of the dehumidification season and in the fall at the beginning of the heating season. He shall instruct the Owner's designated Representative on the operation of the unit and its control system.

3. Furnish, without additional cost to the Owner, the services of competent instructors, who shall fully instruct the Owner's designated representatives in the care, adjustment and operation of the unit.

4. An Operating and Maintenance Manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.

5. The total number of man-hours of instruction furnished shall be four (4). Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 50% of time used for initial instructions and 50% of time used for follow-up instructions at the Owner's request, a minimum of four (4) weeks after the initial instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install dehumidifier per manufacturer's installation instructions, where indicated on the Drawings.

1. Air flow; The air flow volume of the process and reactivation air streams shall be set so that the reading on the manometers on the unit matches the values outlined on the technical data sheet provided by the manufacturer.

B. Provide electrical and ductwork connections as indicated.
C. Pipe condensate drain from unit drain pan to nearest floor drain.
D. Wiring from unit to dehumidifer panel shall be by Division 26.
E. Gas piping to desiccant dehumidifier unit will be provided under Section 22 10 05
F. Ductwork to and from desiccant dehumidifier will be provided under Section 23 31 00
G. Arrange to have the manufacturer's service engineer check the installations and controls for proper operation.

3.03 SCHEDULES

A. Refer to Equipment Schedules on the Drawings for capacities and characteristics.

END OF SECTION

SECTION 23 92 00

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers Variable Frequency Drives (VFD's) and applies to and forms a part of Division 23, Section 23 90 00 - HVAC CONTROLS.

B. Variable Frequency Drives shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 - HVAC GENERAL PROVISIONS.

1.02 GENERAL

A. Furnish and install Variable Frequency Drives of type and characteristics specified in this Section and as required for sequences of control specified in Section 23 98 50 - SEQUENCE OF OPERATION.

PART 2 PRODUCTS

2.01 GENERAL

A. Manufacturers: Subject to compliance with requirements, provide motor starters and control stations of one of the following (for each type and rating of motor starter):
   1. Allen Bradley "Powerflex" or approved equal.

2.02 MOTOR STARTERS

A. Provide a separate variable frequency controller for each motor to be controlled unless specifically noted otherwise on drawings.

B. Each Motor shall be automatically controlled as described in the temperature control specifications. The variable frequency control shall provide stepless continuously variable speed of the connected motor.

C. Provide as components of the VFD the necessary contractors, protection devices, and control to achieve the operation described. Each drive unit shall conform to the following specifications.

D. Each converter unit shall convert input voltage to a sinusoidal adjustable frequency output voltage. Output shall be three phase sine coded adjustable voltage/frequency to provide stepless speed control of the installed squirrel cage induction AC motor throughout a continuous speed range 0 to 100% rated speed under variable load not exceeding the motor's full load rating. The converter shall have a diode bridge

rectifier section, with constant voltage output, filtered dc link and inverter section. The inverter output waveform shall be an average value, including harmonics, not exceeding 1.05 fundamental at all normal operating speeds. Unit shall be fully rated across the rated switching frequency. Maximum input current distortion shall not exceed values in Table 10.3 of IEEE 519 for 20 $<I_{sc}I_L<50$. Equipment which causes current distortions with DC offset is not acceptable.

E. The following protection features and control functions shall be provided:

1. Current limit protection of converter and connected motor to provide soft starting, acceleration and running current never exceeding 150% of motor rated amperes; and dynamic current limiting to the same value under any fault condition of inverter and/or motor. Limitation shall be of the type which reduces output voltage and frequency while limiting current with directly causing a shutdown.
2. Instantaneous over current trip for short circuit or overload condition.
3. Under-voltage and over-voltage for both line and output trip.
4. Over temperature trip.
5. Components shall be designed to withstand or control logic and auxiliaries shall be provided, to protect the converter unit from internal or external short circuits, internal or external open circuits, internal or external transients under any condition of load. Alphanumeric message shall be provided to indicate shutdown due to any of the preceding listed trip indicators. Control shall be provided for remote alarm.

   All shutdowns shall be orderly and protection shall be provided without component failure. Status indication lights shall be provided by the four segment digital display which indicates shutdown due to any of the preceding listed trip indicators. Control shall be provided for remote alarm.

   Except for overload, load short circuits, load open circuits and ground faults, drives shall automatically restart when conditions causing trips cease to be, overload, load short circuit, load open circuit, and ground faults shall require manual reset for restart.

F. The controller shall always automatically restart motor at low speed after return of power after any loss or upon being called upon to starter after any shutdown.

G. The drive shall be equipped with a line side voltage transient suppression network to protect drive components from voltage transients.

H. Signal and power circuits shall be isolated.

I. Drive logic shall be microprocessor based.

J. The capability of the control to withstand open and short circuits on its output terminals shall be documented by factory test. Variable speed control shall be tested at 1/4, 1/2, 3/4 and full load, with the motor connected. At full load with motor load

connected, control shall be tested for load short circuit by operating a contractor or switch wired for test purposes to place a short across the output. At full load with motor load connected, control shall be tested or load open circuit by operating a contractor or switch first to open all 3 phases to the load and secondly by opening only one phase to the load. Upon removal of short or open and after manual reset the control shall return to normal operation without component replacement.

K. The input power factor of the system including control and motor shall be not less than 0.95 lagging at full load, at speeds from 70 to 100% rated speed.

L. VFD shall contain the following controls and features:

1. Lighted power on indication
2. Reset for overload, short circuits, and open circuits
3. Manual speed adjust control
4. Maximum and minimum speed adjustment capability
5. Controlled speed range of 20.1, or greater
6. Overload capability of 120% for 60 seconds.
7. Process follower 4-20MA, 0-5VDC, or 0-10VDC input. Total speed signal shall follow an adjustable linear time ramp to provide accelerating and deceleration control
8. Minimum of three selectable output frequency ranges
9. Sixteen selectable volt/hertz patterns
10. Front-door mounted micro-processor-based unit with digital programming panel (HIM). Panel shall have programming keys and alpha-numeric display to allow operator to view and modify drive parameters, alarms, and operating conditions. Include a separate speed-potentiometer if speed adjustment capability is not built into programming unit. Unit shall be able to display output frequency, status, percent current, percent voltage, and percent response signal.
11. Input circuit breaker with through-door handle
12. Current limiting circuit
13. Coast and ramp to stop
14. Electronic reversing
15. Fault indicators
16. Fault contacts (1NO. INC)
17 A terminal strip for up to six customer safety interlocks and remote start-stop.
18. On loss of speed reference signal, the drive shall operate at a preset minimum speed.
19. The drive shall have an open-collector output signal to indicate when the drive's output is at maximum and minimum speed.
20. 3% line-side reactor, in addition to 3% VFD internal impedance.
21. Line-side main disconnecting means with external operating handle and padlock-off provisions.

M. The variable frequency drive shall have, as a minimum, the following protective features:

1. Ground fault protection.
2. An adjustable thermal motor overload relay, sized specifically for the motor(s) it is protecting.
3. Current limited stall prevention during acceleration, deceleration, and run conditions.
4. Automatic restart after momentary power loss or momentary over-voltage.
5. Start into a rotating motor.
6. Anti-windmill protection.
7. Fault indicators shall indicate the following fault conditions.
    a. Over-current while running.
    b. Over-current on output.
    c. Internal short circuit.
    d. Overload.
    e. Over-voltage during deceleration.
    f. Over-voltage due to power surge.
    g. Over temperature.
    h. Control function error.
    i. Ground fault.

N. The VFD shall have the following adjustments:
1. Acceleration - 0.1 to 200 seconds.
2. Deceleration - 0.1 to 200 seconds.
3. Volts/hertz adjustments.
4. Maximum frequency range.
5. Minimum frequency.
6. Maximum frequency.
7. Carrier frequency
8. Bias and gain adjustment for 4-20mA, O-5VDC, 0-10VDC follower (Can be direct or indirect acting).
9. Calibration adjustment for remote speed indicator (provided by others).

O. The variable frequency drive shall be designed to operate within the following environmental and service conditions.
1. Ambient service temperature: -10^{o}C to 40^{o}C.
2. Ambient storage temperature: -20^{o}C to 60^{o}C.
3. Humidity: non-condensing to 90%.
4. Altitude to 3300 feet.
5. Service factor: 1.1.
6. Input voltage: Three phase, 208/230 VAC $\pm$ 10% for 230 VAC series and 380/400/460 VAC $\pm$ 10% for 460 VAC series.
7. Input frequency: 60 Hertz + or - 3%.

P. Output from control shall be provided to alert supervisory controls to following conditions:
1. Control Off
2. Control Manual
3. Control or Motor Failure

Q. The VFD shall be designed to control connected motor.

2.03 ENCLOSURE:

A. The variable speed system which includes the speed control, circuit breaker, motor starters, etc., shall be all supplied by the manufacturer of the variable speed control package.

B. Drive components shall all be factory preassembled and prewired in a NEMA 2 wall mounted steel cabinet with hinged lockable door. Indicators and controls shall be mounted on the front of the unit.

C. The variable speed drive enclosures for motors shall be capable of being installed on wall as indicated in Mechanical Room.

D. The VFD enclosure shall come with a front mounted HIM (Human Machine Interface) VFD display.

PART 3 EXECUTION

3.01 INSTALLATION OF VARIABLE FREQUENCY CONTROL:

A. Install control where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements. Control shall not be installed without factory test.

B. The Contractor shall select overload protection in accordance with code for actual nameplate current of motor installed. Horsepower sizes noted on drawings are nominal. Contractor is responsible for ensuring VFD is rated for connected motor.

C. Coordinate with other work including motor and electrical wiring/cabling work, as necessary to interface installation of control with other work.

D. Tighten connectors and terminals including screws and bolts, in accordance with equipment manufacturer's recommendation.

3.02 ADJUSTING AND CLEANING

A. Inspect control's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch up scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Energize control and demonstrate functioning of equipment in accordance with requirements; where necessary correct malfunctioning units, and then retest to demonstrate compliance. Ensure that direction of rotation of motor fulfills requirements.

B. Contract sum shall include a minimum of two, 4-hour periods of start-up services at the installation site for inspection and adjustment of the drive equipment. Services shall be performed by an employee engineer of the manufacturer fully trained in the operation and maintenance of the specified equipment.

END OF SECTION

SECTION 23 98 50

HVAC SEQUENCES OF OPERATIONS

PART 1 GENERAL

1.01 APPLICABILITY

A. This Section covers the sequence of controls and applies to and forms a part of Division 23, Section 23 90 00 – HVAC CONTROLS.

B. The sequence of controls shall be in accordance with this section of these specifications and the requirements of Section 23 01 20 – HVAC GENERAL PROVISIONS.

1.02 GENERAL

A. Furnish and install controls which will affect the operational sequences described for heating, ventilating and air conditioning systems installed under Division 23.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.01 EQUIPMENT

A. The thermostats located on cold walls shall be mounted on an insulated backplates and piping penetrations through the wall are to be sealed airtight.

B. All thermostats and controllers shall be labeled as to the function and the temperature setpoint.

3.02 SEQUENCE OF OPERATIONS

A. CHEMICAL FEED AREA HEATING & VENTILATION SYSTEM:

Air Handling Unit AHU-3:

This is a single speed, 100 percent outside air, air handling unit with supply fan, heating water coil with 2-way heating valve, heating coil face and by-pass dampers.

The air handling unit shall be provided with a control panel with an ON-OFF system switch, blower, low temp alarm, general failure alarm and dirty filter lights and discharge

air temperature setpoint. The control panel will be mounted where indicated on the plans. Control sequence shall be as follows:

System switch in the "ON" position:

1. The air handling unit shall operate and run continuously unless shut-down by a safety feature. The discharge, fresh air, return air and exhaust air dampers shall fully open.

Whenever the unit is operating and the system is in the Winter mode.

2. The discharge air temperature setpoint shall be reset from the space temperature sensor. The discharge air duct thermostat shall modulate the heating coil face and by pass dampers in AHU-3 as required to maintain the temperature set point, 60 degrees. An outside air sensor shall modulate the 2-way heating valve water flow through the heating coil from no flow at 65 degrees ambient to full flow through the coil at 30 degrees ambient (adjustable).

Whenever the unit is operating and the system is in the Summer mode:

3. The system shall operate as indicated above except the flow though the heating coil will be off and no heating will be provided.

The air handling unit shall be provided with a low limit control that shall automatically shut the system down if the supply air temperature is less than 35 degrees, (adjustable) for more than 5 minutes (adjustable). An alarm shall be energized whenever the unit shuts down on low temperature. In addition to the low limit alarm a general air handling unit failure alarm shall also be provided.

All control devices mounted in the return air stream to be constructed of corrosion resistant stainless steel.

The discharge air controller, remote control panel, control wiring, duct-stat reset controller, contacts for exhaust fan EF-1, damper actuators, 2-way heating control and all other control devices required to operate as described shall be furnished and installed by T.C. contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be furnished and installed by Division 26.

Points Monitored:

1. DDC system graphic.
2. AHU fan status indication (each fan).
3. Damper position. (multiple locations)
4. Heating valve position.
5. Heating water supply temperature.
6. Heating water return temperature.

7. Space Temperature.
8. Space Temperature Setpoint.
9. Supply air temperature.
10. Outside air temperature.
11. Return air temperature.
12. Filter air pressure drop.
13. Alarms

B. ENERGY RECOVERY VENTILATOR VENTILATION SYSTEMS:

Energy recovery ventilator ERV-1, Exhaust fan EF-1 and motorized dampers in outside air ducts serving the unit, MD-10:

Exhaust Fan EF-1 shall be interlocked to and operate whenever it's respective air handling unit, AHU-3 is calling for operation, refer to AHU-3 sequence description above. The motorized dampers associated with ERV at the outside air duct shall be interlocked with the operation of AHU-3 and shall open when AHU-3 is operating and fully close when the AHU-3 fan is off.

All damper actuators, interlocks and control wiring to be furnished and installed by the T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic.
2. Exhaust Fan EF-1 fan status indication.
3. MD-10, Damper position.
4. Outside air temperature.
5. Return air temperature.
6. Supply air temperature (from ERV).
7. Filter air pressure drop (at ERV)
8. Alarm.

C. UNIT HEATERS:

Hot water heated unit heaters shall have continuous water flow and shall cycle fan off and on as called for from remote wall mounted thermostat. Thermostat locations are indicated on the Drawings. Thermostat set points to be 55 degrees.

The thermostats will be furnished, installed and wired by the T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power

wiring to be by Division 26.

D. FINNED TUBE RADIATION:

Finned tube radiation shall be provided with a 2-position heating water control valve which shall cycle as required to maintain space temperature from a remote wall mounted thermostat. Thermostat locations are indicated on the Drawings. Thermostat set points to be 65 degrees.

Furnish heating water control valve for installation.

The thermostats and control valve actuator to be furnished, installed and wired by the T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

E. MISCELLANEOUS VENTILATION SYSTEMS: (EF-5, EF-6)

Exhaust fans, associated motorized dampers at exhaust fans and intake dampers at intake louvers:

Furnish and install a manual ON-OFF System switch where indicated.

With system in the "ON" mode the exhaust fan shall operate and associated normally closed motorized dampers at exhaust fans and wall louvers shall open.

The manual system switch, all damper actuators, interlocks and control wiring to be furnished and installed by T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic. (Each exhaust system).
2. Exhaust fan status indication. (Each exhaust fan).
3. Motorized exhaust damper position. (several locations)
4. Motorized intake damper position. (several locations)
5. Alarm.

F. FUME HOOD VENTILATION SYSTEMS: (EF-7)

Exhaust fan, EF-7, associated motorized damper, MD-16 at exhaust fan:

Furnish and install a manual ON-OFF System switch where indicated.

With system in the "ON" mode the exhaust fan shall operate and associated normally closed motorized damper at exhaust fan shall open.

The manual system switch, all damper actuators, interlocks and control wiring to be furnished and installed by T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic.
2. Exhaust fan status indication.
3. Motorized exhaust damper position.
4. Alarm.

G. CHEMICAL ROOM VENTILATION SYSTEMS: (EF-2, EF-3, EF-4)

Exhaust fans, associated motorized dampers at exhaust fans and intake dampers at intake louvers:

Furnish and install a manual ON-OFF-AUTO System switch where indicated.

With system in the "ON" mode the exhaust fan shall operate and associated normally closed motorized dampers at exhaust fans and wall louvers shall open.

With system in the "AUTO" mode the exhaust fan shall operate and associated normally closed motorized dampers at exhaust fans and wall louvers shall open whenever either energized from an interlock with the space lights or when receiving a “Run” signal from the BAS.

The system switch, all damper actuators, interlocks and control wiring to be furnished and installed by T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic. (Each exhaust system).
2. Exhaust fan status indication. (Each exhaust fan).
3. Motorized exhaust damper position. (several locations)
4. Motorized intake damper position. (several locations)
5. Alarm.

H. RESTROOM VENTILATION SYSTEMS: (EF-8, EF-9)

Exhaust fans, associated motorized dampers at exhaust fans:

Furnish and install a manual ON-OFF-AUTO System switch where indicated.

With system in the "ON" mode the exhaust fan shall operate and associated normally closed motorized dampers at exhaust fans shall open.

With system in the "AUTO" mode the exhaust fan shall operate and associated normally closed motorized dampers at exhaust fans shall open whenever the facility is “Occupied” as dictated by the BAS signal.

The manual system switch, all damper actuators, interlocks and control wiring to be furnished and installed by T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic. (Each exhaust system).
2. Exhaust fan status indication. (Each exhaust fan).
3. Motorized exhaust damper position. (several locations)
4. Alarm.

I. VARIABLE AIR VOLUME BOX WITH REHEAT COIL:

Provide new electronic controls with new electronic controller, discharge air temperature sensor and space temperature sensor, damper actuator, 2-way heating control valves and control valve actuator for five (5) locations:

The VAV will be controlled off of space temperature. The VAV box mode will switch to cooling mode when the space temperature is one or more degrees above the cooling temperature set point for 10 minutes (adjustable). The VAV box mode will switch to heating mode when the space temperature is one or more degrees below the heating temperature set point for 10 minutes (adjustable). The Damper will modulate to maintain the airflow set-point.

In the cooling mode the airflow set-point will modulate between the cooling minimum and maximum limits to maintain the room temperature at set point and the reheat valve will be closed.

In the heating mode, the reheat valve will modulate from 0-100% as necessary to maintain/achieve set-point. The airflow set-point will modulate between the heating minimum and heating maximum limits. During unoccupied mode and one (adjustable) space(s) is calling for heat, the AHU-1 will be energized and run.

Space sensor for Lab, Zone 5 shall be provided with an exposed set-point adjustment and set-point indicator.

If space conditions cannot be met, provide alarm.

Points Monitored:

1. DDC system graphic room/area served.
2. Room temperature.
3. Room temperature set-point.
4. Airflow (CFM).
5. Discharge air temperature.
6. Reheat control valve position as percent open.
7. Alarms.

J. ADMINISTRATION AREA HEATING, VENTILATION & AIR CONDITIONING SYSTEM:

Air Handling Unit AHU-1:

This is a variable speed air handling unit with supply fan, cooling water coil with 2-way cooling valve, heating water coil with 2-way heating valve, return air and outside air dampers.

Install controller and controls for AHU-1; TCC to deliver unit wiring schematics to the AHU manufacturer so penetrations/conduit between sections are factory installed. Unit to have a variable speed supply fan with motorized dampers. Furnish and install remotely mounted VFD where indicated on the Drawings.

Devices and Operation:

1. Input Device: Electronic SAT, MAT, RAT temperature sensors. Electronic actuators for the 2-way chilled water control valve. Electronic actuator for the 2-way heating water control valve. Transmitter and airflow monitor.
2. Output Device: Electronic controller, damper actuators, air temperature/humidity sensors, control-valve actuators on control valves.
3. Provide control wiring between VAV's and AHU Controller.

Action:

1. Time Schedule: Start and stop supply fan. Signal alarm if fan fails to start as commanded.
   a) Duct static sensor will ramp the supply fan VFD to maintain a set supply duct pressure setpoint.
2. Safety Devices:
   b) Freeze Protection: Stop supply fan and close outdoor air damper and relief air dampers (MD-3 & 8) if discharge air temperature falls below 40°F; signal alarm. Freezestat will reset automatically. If the freezestat trips three times in 1 hour (adj.) the software lock-out the supply fan and will allow the operator to reset the system from the BAS workstation.
3. Morning Warm-up:

c) Start the unit fan variable speed drive and hold the return damper full open. Supply fan will maintain duct static setpoint. Discharge air temperature setpoint will be 90°F (adj.). Lock-out the outdoor air damper and relief air damper until the average space temperatures reaches 72°F (adj.). When the average space temperature reaches the setpoint, the morning warm-up sequence will be disabled, outdoor air damper will be enabled to start their respective "delayed damper" sequence. Optimal start/stop will be provided.

d) Cooling sequence to be lock-out.

4. Delayed Damper:

e) Following the morning warm-up sequence and temperatures are satisfied. Provide a damper restrictor to obtain a slow-opening process of the outdoor air damper until the damper reaches its minimum position, 1,860 CFM. (Minimum 180 seconds.)

5. Economizer:

f) Economizer will be available and have priority in both occupied heating and cooling modes.

g) When outdoor air temperature is below 55°F:
Modulate outdoor air damper, relief air dampers (MD-8 & MD-3) and return damper to maintain a discharge air temperature. Discharge air temperature will be reset by the worst case space temperature sensor to satisfy the space comfort. Discharge reset schedule will be from 50°F (adj.) on the low side and 55°F (adj.) on the high side. Relief air dampers (MD-8 & MD-3) shall operate in opposition to return air damper.

h) When the outdoor air temperature is between 55°F and 79°F, provide enthalpy control. Compare return and outdoor air enthalpy. There will be a 1°F deadband between outdoor and return enthalpy to choose economizer or cooling mode. If return air enthalpy is lower:
Enable occupied cooling mode. Discharge air temperature setpoint will be 55°F.

i) When the outdoor air temperature is between 55°F and 79°F, provide enthalpy control. Compare return and outdoor air enthalpy. There will be a 1°F deadband between outdoor and return enthalpy to choose economizer or cooling mode. If return air enthalpy is higher:
Modulate the outdoor air damper open and partially close the return air damper to maintain a discharge air temperature. Discharge air temperature will be reset by the worst case space temperature sensor to satisfy the space comfort. Discharge reset schedule will be from 50°F (adj.) on the low side and 55°F (adj.) on the high side. Relief air dampers (MD-8 & MD-3) shall operate in opposition to return air damper.

j) When the outdoor air temperature is above 79°F:
Enable occupied cooling mode. Discharge air temperature setpoint will be 55°F. Modulate outdoor air damper to minimum occupied position. (1,860 CFM)

6. Occupied Cooling:

k) The heating coil valve will be closed to coil.

l) Modulate cooling valve to maintain discharge air temperature. The

discharge air temperature will maintain a 55°F (adj.) setpoint.

7. Unoccupied Cooling:
   m) Supply fan will be off.
   n) The chilled water valve will be closed to coil.
   o) The heating coil valve will be closed to coil.
   p) Outdoor air and relief dampers (MD-8 & MD-3) will be fully closed and return damper will be open.
8. Occupied Heating:
   q) Modulate heating valve to maintain discharge air temperature. Discharge air temperature will be reset by the worst case space temperature sensor to satisfy the space comfort. Discharge reset schedule will be from 50°F (adj.) on the low side and 55°F (adj.) on the high side.
   r) Cooling coil valve will be closed to the coil and locked-out.
9. Unoccupied Heating:
   s) Supply fan will be off.
   t) Outdoor air and relief dampers (MD-8 & 3) will be fully closed and return damper will be open.
   u) Modulate heating valve to maintain 70°F (adj.) in fan section (mixed air temperature sensor).
   v) The VAV box space sensor calling for heat will cycle AHU on to maintain a reduced space temperature setpoint (adj.).
   w) AHU will be in recirculation mode; supply fan on, outdoor air and relief air dampers closed, return damper open.
   x) Cooling coil valve will be lock-out.
10. Variable Air Volume Boxes:
   y) Each air handler to be linked on the graphics and controlled with its respective group of VAV boxes.
   z) Refer to VAV sequence of operation.
11. Miscellaneous:
   aa) Provide “occupied/unoccupied” and “heat/cool” manual switching capabilities.
   bb) Provide night setback capability.
   cc) Provide outdoor air measuring capability in quantity of cubic feet per minute.
   dd) Provide interlock with Fume Hood exhaust fan, EF-7 to open the outdoor air damper to 2,560 cfm whenever the exhaust fan is energized. Outside air damper shall return to normal operating position when fan EF-7 is turned off.
   ee) Provide averaging type smoke detector, located in the return air plenum which shall shut down the unit upon sensing smoke. An alarm shall be indicated upon activation.

Points Monitored:

1. DDC system graphic.
2. DDC system on-off indication.
3. DDC system occupied/unoccupied mode.

4. Outdoor-air-temperature indication.
5. Supply-fan on-off indication.
6. Supply-fan-discharge static-pressure indication.
7. Supply-fan-discharge static-pressure set point.
8. Supply-fan speed.
9. Mixed-air-temperature indication.
10. Mixed-air-temperature set point.
11. Outside-air damper position.
12. Return-air damper position.
13. Relief-air damper position.
14. Outside air flow rate.
15. Return Air Relative humidity indication.
16. Fan-discharge air-temperature indication.
17. Fan-discharge air-temperature set point.
18. Heating-coil control-valve position.
19. Cooling-coil control-valve position.
20. Alarms

K. BOILER SYSTEM:

Two existing boiler modules B-1 & 2 with integral boiler control panel:

A remote mounted "Emergency Boiler Shut-off Switch" shall be furnished and installed by the T.C. contractor at each exit door to shut off all power to the boiler system. Switch shall be suitably labeled and located behind a protective clear cover.

The boiler control panel, outdoor sensors, main system supply and water temperature sensor and accessories shall be provided with the boiler equipment. T.C. contractor to coordinate accessories provided by the equipment supplier.

Water temperature sensors, safety and control devices to be installed by the T.C. contractor. All interlocks and control wiring to be furnished and installed by the T.C. contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be by Division 26.

Points Monitored:

1. DDC system graphic.
2. Boiler module status (each boiler)
3. Heating water supply temperature.
4. Heating water return temperature.
5. Outside air temperature.
6. Boiler control panel output points (coordinate with Boiler Manufacturer).
7. Alarms

L. HEATING HOT WATER PUMPING SYSTEM:

Mechanical Room Building Heating pumps P-1 & 2:

Provide control for new variable speed drive (VFD; supplied and installed by TC Contractor) and pressure differential sensor. Pumps shall be set for parallel operation with Lead-Lag-Stand-by Pumps.

1. Provide heating water flow meter.

Control Sequence:

1. After "Heating System Enable" is activated, the BAS shall energize the lead water pump. Pumps shall not cycle off when boiler status is "on".

2. When heating system is "on", "lead" pump shall energize and modulate based on differential pressure setpoint. If differential pressure setpoint is not able to be maintained with one pump "on", the lag pump shall be activated to maintain pressure setpoint.

3. When "lead" pump fails, the lag pump shall be activated with alarm activated and standby pumps becomes the lag pump with operation as per above. If lag pumps fails when called to be activated, the stand-by pump becomes the lag pump with alarm activated.

4. If stand-by pump does not activate when commanded to, alarm will activate.

5. When both lead and lag pumps are on, when system needs require one pump to operate, the lag becomes the lead pump, stand-by becomes lag and lead becomes stand-by.

Points Monitored:

1. DDC system graphic.
2. Pump status indication (each pump).
3. Pump VFD speed (each pump).
4. Static Pressure.
5. Static pressure set point.
6. Heating water flow.
7. Outside air temperature.
8. Alarms

M. DESICCANT DEHUMIDIFICATION/VENTILATION SYSTEM (D-1):

Desiccant dehumidifier/ventilation unit D-1:

The desiccant dehumidifiers shall be a packaged units and shall normally operate continuously unless shutdown by a safety device.

A space humidity sensor and temperature sensor located where indicated on the Drawings shall allow for Dehumidifier unit operation. The space humidity sensor shall operate the dehumidification portion of the unit to maintain a maximum level of humidity and the temperature sensor shall control the post heating portion of the unit to maintain a minimum space temperature.

These sensors shall be interfaced with the BAS and shall be adjustable. Sensors shall be coordinated with the unit manufacturer to be compatible with the unit DDC microprocessor controls.

Provide averaging type smoke detector, located in the return air plenum which shall shut down the unit upon sensing smoke. An alarm shall be indicated upon activation.

All space sensors, interlocks, relays and control wiring to be furnished and installed by the T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be furnished and installed by Division 26.

Points Monitored:

1. DDC system graphic.
2. Percent relative humidity.
3. Space dew point point setting.
4. Space dew point temperature.
5. Space temperature.
6. Space temperature set point.
7. Filter pressure drops (several locations).
8. Dirty filter condition.
9. Outside air temperature.
10. Dehumidifier control panel output points (coordinate with Manufacturer).
11. Alarms

N. DESICCANT DEHUMIDIFICATION SYSTEM (D-2):

Desiccant dehumidifier/ventilation unit, D-2:

The desiccant dehumidifiers shall be a packaged units and shall normally operate continuously unless shutdown by a safety device.

A space humidity sensor located where indicated on the Drawings shall allow for Dehumidifier unit operation. The space humidity sensor shall operate the dehumidification portion of the unit to maintain a maximum level of humidity.

These sensors shall be interfaced with the BAS and shall be adjustable.

Provide averaging type smoke detector, located in the return air plenum which shall shut down the unit upon sensing smoke. An alarm shall be indicated upon activation.

The space humidity sensor/controller shall be furnished by the unit manufacturer and installed by the T.C. Contractor.

Interface with unit furnished PLC and all control wiring to be furnished and installed by the T.C. Contractor. Coordinate control wiring termination point with Division 26. All control wiring to be routed in a dedicated conduit in accordance to the Division 26 standards. All power wiring to be furnished and installed by Division 26.

Points Monitored:

1. DDC system graphic.
2. Percent relative humidity.
3. Space humidity setting.
4. Space humidity.
5. Space temperature.
6. Filter pressure drops (several locations).
7. Dirty filter condition.
8. Dehumidifier control panel output points (coordinate with Manufacturer).
9. Alarms

PROVIDE PERMANENT PLASTIC ENGRAVED LABELS AT ALL EQUIPMENT INDICATING EQUIPMENT NUMBER AND AT ALL THERMOSTATS AND SENSOR INDICATING EQUIPMENT SERVED.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable electrical systems as indicated on the drawings and as specified herein

B. Design Requirements:
   1. The table included in this section under Hardware Design Requirements specifies the usage requirements for the hardware and equipment specified in the following sections:
      a. Section 26 05 29 Hangars and Supports for Electrical Systems
      b. Section 26 05 34 Conduit
      c. Section 26 05 37 Boxes

C. Electrical Work Specified Elsewhere:
   1. Every attempt has been made to indicate in these specifications and drawings all work required under Division 26. However, there may be additional specific requirements in the specifications, drawings, or addenda of other trades which pertain to the work of this trade, and any such requirements are hereby made a part of the requirements for this trade.

D. Design Intent:
   1. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
   2. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or Drawings, the Contractor shall furnish the item, system, or workmanship that is the highest quality, largest, or most closely fits the design intent.
   3. Refer to the General Conditions of the Contract for further clarification of Design

Intent.

4. The details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.
5. All sizes as given are minimum except as noted.
6. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to inspections, tests and approval from the commencement until the acceptance of the completed work.
7. Electrical requirements for equipment are based on design data. It shall be the responsibility of the Contractor to verify actual requirements with the provider of the equipment and adjust electrical installation based upon actual requirements.

E. Substitution of Materials:
   1. Refer to General Conditions of the Contract.
   2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the specified performance from the system into which these items are placed.

F. Continuity of Existing Services and Systems:
   1. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner and the Engineer. Any outage must be scheduled when the interruption causes the least interference with normal schedules and routines. No extra costs will be paid to the Contractor for such outages that must occur outside of regular weekly working hours.
   2. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

G. Intent of the project division of work:
   1. General Contractor shall coordinate and provide complete and operable system and project as shown.
   2. Electrical contractor to provide and install a complete and operable system as intended and described herein.
   3. Mechanical Contractor shall be provide DDC design and layout including System Integration, controls, design, hardware, equipment, and major.

1.04 RELATED SECTIONS

A. Common Work Results for Electrical are applicable to all Division 26 sections.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Review of shop drawings constitutes acceptance of general design only and will not release the Contractor for fulfilling the terms and intent of the contract documents.

C. Shop Drawings shall be prepared and submitted for the following work:

1. Section 26 05 29 - Hangers and Supports for Electrical Systems
2. Section 26 05 34 - Conduit
3. Section 26 05 37 - Boxes
4. Section 26 22 00 - Low Voltage Transformers
5. Section 26 24 16 - Panelboards
6. Section 26 90 00 - Process Instrumentation & Control

1.06 FACTORY TESTING

A. Refer to the requirements the individual technical sections.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submittal Requirements for Division 26 Operation & Maintenance Manuals and Instructions:
   1. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
      a. Copies of as-built submittals.
      b. Wiring diagrams for electrically powered or controlled equipment
      c. Records of tests performed to certify compliance with system requirements
      d. Certificates of inspection by regulatory agencies
      e. Parts lists for manufactured equipment
      f. Preventive maintenance recommendations
      g. Warranties
      h. Additional information as indicated in the technical specification sections
      i. Test Reports and Demonstration Log:
         1) Permanently record checks and tests and demonstrations.
         2) Submit copy of complete testing or demonstration report no later than 30 days after testing or demonstration is complete.

C. Operation & Maintenance Manuals and Instructions shall be prepared and submitted for the following equipment:
   1. Section 26 24 16 - Panelboards

1.08 QUALITY ASSURANCE

A. All work and materials shall conform to or exceed in every detail the applicable rules and requirements of the Minnesota State Electrical Code, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association standards, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

B. All work shall be performed under the direction of a State of Minnesota Licensed Master Electrician.

C. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published

standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled.

D. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
   1. Underwriters Laboratories Inc.
   2. Electrical Testing Laboratories, Inc.

E. Certificates and Inspections:
   1. Refer to the General Conditions of the Contract.
   2. Obtain and pay for all required inspections including but not limited to state or local electrical inspections and fuel tank inspections. Deliver original inspection certificates to the Engineer.

1.09 WARRANTY

A. See Division 01 for additional requirements.

1.10 EXTRA MATERIALS

A. See Division 01 for additional requirements.

1.11 DESIGN REQUIREMENTS

A. The following table specifies the usage requirements for the hardware and equipment specified in the following sections:
   1. Section 26 05 29 Hangars and Supports for Electrical Systems
   2. Section 26 05 34 Conduit
   3. Section 26 05 37 Boxes

PART 2 PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
   1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration are sufficient; no additional access provisions are required unless specifically indicated.

B. Drywall and Plaster Walls and Ceilings:
   1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needed service; minimum size is 12 x 12 inch.

2.02 SEALING AND FIRE-STOPPING

A. Refer to Architectural requirements.

B. Sealing and fire stopping of sleeves/openings between conduits, cable trays, wire ways, troughs, cable bus, bus duct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. Individuals skilled in such work shall perform the sealing and fire stopping.

C. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

D. Manufacturers:
   1. 3M, STI/SpecSeal, Tremco, or approved equal.
   2. The same manufacturer shall provide all fire stopping systems.
   3. The Contractor will be responsible for selecting the appropriate UL tested fire stop system for each application required on the project.

E. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

F. Contractor shall use fire stop putty, caulk sealant, intumescent wrap strips, intumescent fire stop collars, fire stop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

2.03 NON-RATED PENETRATIONS

A. Conduit Penetrations Through Below Grade Walls:
   1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.

B. Conduit and Cable Tray Penetrations:
   1. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections.

B. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

C. Identify conflicts with the work of other trades prior to installation of electrical system.

D. Electrical installation shall be based upon shop drawing requirements and field verified measurements. Adjust electrical system installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept electrical equipment on site. Inspect for damage.

B. Protect electrical equipment from weather, corrosion, and entrance of debris.

3.03 INSTALLATION

A. Excavation And Backfill:
   1. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with other sections of this specification.

B. Concrete Work:
   1. Coordinate the quantity and location of all cast-in-place concrete work with the architectural drawings.
   2. All cast-in-place concrete will be performed by the General Contractor unless noted otherwise. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

C. Cutting And Patching:
   1. Cutting and patching shall be performed in accordance with the requirements for architectural work. Refer to other sections of these specifications.

D. Building Access:
   1. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

E. Equipment Access:
   1. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish access doors and arrange for installation by appropriate trades.

F. Working Clearances:
   1. Minimum installed equipment working clearances as required by the NEC shall be maintained.
   2. Minimum required dedicated electrical equipment space as required by the NEC shall be maintained.
   3. Coordinate these requirements with the work of other trades.
   4. Identify conflicts with working space requirements prior to installation of equipment.

G. Coordination:
   1. Cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner. The Contractor shall check location of electrical outlets with respect to other installations before installing.

2. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, light fixtures, panel boards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
3. Coordinate all work prior to installation. Any installed work that is not coordinated and that interferes with the work of another trade shall be removed or relocated at no additional cost to the Owner.
4. Verify the integrity of fire or smoke ratings where penetrations are required.

H. Sleeves:
1. Process Equipment Areas:
   a. New poured concrete construction: cast in place, Schedule 40, PVC sleeve.
   b. All other construction: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and grout around the sleeve.
   c. Floor penetrations:
      1) Extend top of sleeve two inches above the floor.
      2) Where installation of sleeve in floor is not practical, provide two inch deep housekeeping pad extending three inches around cast in place conduits.
2. Non-Process Equipment Areas:
   a. Hollow walls: Schedule 40, PVC sleeves, grout around sleeve in masonry construction.
   b. All other Areas: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and utilize the core drilled opening as the sleeve.
3. Conduit Support:
   a. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to the floor structure.

I. Sealing And Firestopping:
1. Fire and/or Smoke Penetrations:
   a. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wire way, trough, etc.) penetrates a fire rated surface.
   b. Where fire stop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Fire stop mortar alone is not adequate to support any substantial weight.
2. Non-Rated Surfaces:
   a. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
   b. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
   c. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions.
   d. At interior partitions, conduit penetrations are required to be sealed for all areas. Apply sealant to both sides of the penetration in such a manner that the

annular space between the conduit sleeve and the conduit is completely filled.

J. Housekeeping and Clean-up
   1. On a daily basis, clean up and remove all debris and rubbish resulting from work and repair all damage to new and existing equipment resulting from work.
   2. Remove all tools, excess material, and unused equipment from the site when job is complete.

K. General Inspection and Cleaning of Electrical Equipment
   1. Inspect for physical damage and abnormal mechanical or electrical conditions.
   2. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the Engineer. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
   3. Compare equipment nameplate information with the Contract Drawings and report any discrepancies.
   4. Verify proper auxiliary device operation and indicators.
   5. Check tightness of accessible bolted electrical joints. Use torque wrench method.
   6. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
   7. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
   8. Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, horizontal and vertical busducts, MCC's, control panels, and any other similar equipment
   9. Clean All Equipment:
      a. Loosen attached particles and vacuum them away.
      b. Remove any remaining packing material adhesives with suitable cleaning solution.
      c. Touch-up factory applied finishes damaged during installation using manufacturer approved means to match original finish.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements the individual technical sections.

3.05 TRAINING

A. Refer to the requirements the individual technical sections.

END OF SECTION

SECTION 26 05 01

ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

1.03 DESCRIPTION OF WORK

A. Furnish labor and materials to demolish and remodel existing electrical systems as indicated on the drawings and as specified herein

B. Design Intent:
   1. Every effort has been made to identify major demolition and remodeling work required as part of this project. There may, however be minor work items not specifically identified for demolition or remodeling.
   2. The Contractor shall thoroughly review the demolition drawings and shall include work associated with demolition and remodeling of minor items such as receptacles, exit lights, and control stations affected by the work shown on the demolition drawings.
   3. Because of the demolition and remodeling work required as part of this project, the Contractor is required to investigate the extent of work on site prior to bidding. Failure to perform this investigation will not relieve the Contractor of responsibility for demolition and remodeling of the minor work items described.

C. Construction Methods:
   1. Where detailed construction methods are identified for demolition and remodeling of electrical equipment (for example, methods for implementing service change), it is not intended that the methods proposed be the only acceptable methods for completing the work. The Contractor is encouraged to investigate and propose alternate methods which simplify the work.
   2. Alternate methods shall be reviewed by the Engineer prior to commencing the work.
   3. Only alternate methods which adequately accomplish the goals of the specified methods will be allowed.

D. Furnish labor, materials, and controls for temporary HVAC system as required by time

of year and means and methods. The facility shall remain 100% operation and safe throughout construction.

E. Demolish and remodel as required.

1.04 RELATED SECTIONS

A. Architectural, structural, equipment, and mechanical demolition work as indicated on the drawings is related to electrical demolition and remodeling, but is not included under the scope of this section.

1.05 SUBMITTALS - NOT USED

1.06 FACTORY TESTING - NOT USED

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.08 QUALITY ASSURANCE

A. All materials and labor required under this section shall be compatible with existing equipment and conditions.

PART 2 PRODUCTS - NOT USED

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

B. Verify all circuiting arrangements

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

D. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing existing installation.

E. The Contractor shall review demolition drawings and existing conditions for the extent of demolition work required.

F. Commencement of demolition work indicates that Contractor accepts existing conditions and fully comprehends the extent of demolition work.

3.02 DELIVERY, STORAGE, AND HANDLING- NOT USED

3.03 PREPARATION

A. Identify existing electrical equipment which is to be removed.

B. Identify existing electrical equipment which is to remain but will be affected by demolition or new construction work.

C. Identify existing equipment which is to be removed and which the Owner wishes to retain. Owner shall have first right to all removed equipment not specifically being re-used. If Owner retains equipment, Contractor shall transport to designated storage

facility located on site. If Owner refuses equipment, Contractor shall be responsible for disposal.

D. Identify damaged or inoperable existing equipment prior to performing work.

E. Maintain access to existing electrical installations, which are to remain active.

F. Utilize materials and methods compatible with existing electrical installations. Verify existing requirements for compatibility.

3.04 GENERAL DEMOLITION OF ELECTRICAL WORK

A. Demolition of Electrical Work, Structure Modified:
   1. This paragraph defines requirements for electrical demolition where the surfaces or areas containing the work are to be removed.
   2. Disconnect electrical equipment which is to be removed.
   3. Remove surface mounted and free-standing electrical equipment.
   4. Remove existing wiring to source of supply.
   5. Remove surface mounted conduits and raceways.
   6. Disconnect concealed conduits from equipment which is to remain.
   7. Concealed conduits may be removed with structure which is to be removed.
   8. Transport Owner retained equipment to on-site location as directed by Owner.
   9. Dispose of all other removed equipment.

B. Demolition of Electrical Work, Structure Not Modified:
   1. This paragraph defines requirements for electrical demolition where the surfaces or areas containing the work are to remain.
   2. Disconnect electrical equipment which is to be removed.
   3. Remove surface mounted and free-standing electrical equipment.
   4. Remove existing wiring to source of supply.
   5. Remove surface mounted conduits and raceways.
   6. Concealed conduit which is abandoned shall be cut flush with walls and floors. Patch surfaces to match existing finish.
   7. Transport Owner retained equipment to on-site location as directed by Owner.
   8. Dispose of all other removed equipment.

3.05 GENERAL REMODELING OF ELECTRICAL WORK

A. Reconnection of Electrical Equipment
   1. This paragraph defines requirements for electrical remodeling where the conduit and/or conductors connecting existing equipment must be replaced because of remodeling work in the area.
   2. Thoroughly investigate existing wiring and conduit to determine requirements for reconnection.
   3. Provide temporary wiring and connections to maintain existing systems in service during construction. Minimize and coordinate necessary outages with the Owner. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
   4. Install new conduit and/or wiring as indicated to maintain existing operational characteristics or to provide new operational characteristics.

5. Demolish abandoned conduit and wiring as described above.
6. Remove temporary work upon completion of the permanent work.

B. Relocation of Electrical Equipment
1. This paragraph defines requirements for electrical remodeling where the existing equipment must be removed and re-installed in a new location and new conduit and conductors must be provided to reconnect the equipment.
2. Thoroughly investigate existing wiring and conduit to determine requirements for reconnection.
3. Provide temporary wiring and connections to maintain existing systems in service during construction. Minimize and coordinate necessary outages with the Owner. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
4. Remove equipment which is to be relocated.
5. Install equipment in designated new location.
6. Install new conduit and wiring as indicated to maintain existing operational characteristics or to provide new operational characteristics.
7. Demolish abandoned conduit and wiring as described above.
8. Remove temporary work upon completion of the permanent work.

3.06 CLEANING, PATCHING, AND REPAIR

A. Repair existing construction and finishes damaged during demolition and remodeling work. Refer to architectural specifications for patching requirements. Any damaged construction shall be repaired to match the finished, surrounding surfaces.

B. Clean and repair existing materials and equipment, which remain or are to be reused.

C. Clean exposed surfaces and check tightness of electrical connections.

D. Replace electrical equipment damaged during construction.

E. Remove construction debris from all electrical enclosures.

3.07 TESTING AND START-UP SERVICES - NOT USED

3.08 TRAINING - NOT USED

END OF SECTION

SECTION 26 05 02

UTILITY SERVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards:
      a. ANSI/NFPA 70 - National Electrical Code (NEC) and state amendments thereto, Current Edition.
   2. National Electrical Contractors Association (NECA), Standard of Installation, Current Edition.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Provide and install complete and operable utility services as required on the drawings and as specified herein.

B. Payment of Utility Company charges for service will be paid by an allowance of $5,000 which will be adjusted up or down by a change order to the Contract to reflect actual utility company invoices. Contractor handling charges, overhead, and mark-up shall be included in the base bid and are not included under this allowance.

C. Arrange with Electric utility for temporary disconnect of the WTP to allow the in installation of the proposed main Disconnect for the facility.
   1. Natural Gas Service:
      a. Service Provider: MN Power
      b. System Characteristics:
         1) Required service type: Install disconnect on the existing WTP Building Service.

D. Arrange with gas utility for permanent and temporary natural gas service as specified herein.
   1. Natural Gas Service:
      a. Service Provider: Local Provider City of Duluth
      b. System Characteristics:
         1) Required service type: Relocate existing line.

1.04 RELATED WORK ELSEWHERE

A. The following divisions may include work which is related to utility services, but which is not included under the scope of this section:
   1. Division 44 - Pollution Control Equipment.
   2. Division 45 - Industry-specific Manufacturing Equipment.

1.05 SHOP DRAWINGS

A. Submit shop drawings in accordance with the requirements of Division 01.

B. The following information shall be submitted specifically for utility services:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Documentation required by utility company for approval.

1.06 FACTORY TESTING (None)

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (None)

1.08 QUALITY ASSURANCE

A. Service entrance and metering equipment provided under this section shall be UL Listed for the service intended and shall be approved by the utility company.

B. All materials, equipment, and parts shall be new and unused of current manufacture.

C. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS (NONE)

PART 3 CONSTRUCTION METHODS

3.01 DIVISION OF WORK

A. The Contractor shall be responsible for coordinating conductor marking and color coding requirements with control system equipment supplier(s).

3.02 FIELD MEASUREMENTS

A. Verify existing conditions and dimensions.

B. Verify that service equipment is ready to be connected and energized.

C. Make arrangements with utility company and obtain required inspections before energizing service(s).

D. Coordinate location of utility company facilities to ensure proper access is available.

3.03 DELIVERY, STORAGE, AND HANDLING (None)

3.04 INSTALLATION

A. Install service entrance conduit and conductors in accordance with utility company instructions.

B. Install metering equipment in accordance with utility company instructions.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 V AND LESS)

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. ASTM International, originally known as the American Society for Testing and Materials, Specifications and Standards, current edition:
      a. ASTM B800-05 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers
      b. ASTM B801-99 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
   3. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. U.L. 44 - Rubber-Insulated Wires and Cables.
      b. U.L. 50 - Enclosures for Electrical Equipment.
      c. U.L. 83 - Thermoplastic-Insulated Wires.
      d. U.L. 514B - Conduit, Tubing, and Cable Fittings.
      e. U.L. 758 - 105 degree C Appliance Wiring Materials.
      f. U.L. 854 - Service Entrance Cables.
      g. U.L. 1063 - Machine-Tool Wires and Cables.
      h. U.L. 1277 - Type TC Power and Control Tray Cables.
      i. U.L. 1569 - Metal-Clad Cables
      j. UL 1581 - Vertical Tray.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable wire and cable systems as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for wire and cable:

1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
2. Clearly identify the types of wire and cable proposed.

1.05 QUALITY ASSURANCE

A. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

B. Wire and cable manufacturers shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development and production in accordance with ISO 9001.

C. All materials, equipment, and parts shall be new and unused of current manufacture.

D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS

2.01 WIRE AND CABLE - GENERAL PURPOSE (600V, COPPER)

A. Manufacturer: Contractor option.

B. General:
1. THWN/THHN general purpose building wire insulated with polyvinyl chloride (PVC) and covered with protective sheath of nylon intended for lighting and power circuits at 600 volts or less, in residential, commercial and industrial buildings.
2. The wire shall be suitable for 90 degree C maximum continuous conductor temperature in dry locations and 75 degree C in wet locations and listed by Underwriters Laboratories for use in accordance with the National Electrical Code.

C. Conductors:
1. Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.

D. Insulation:
1. Each conductor shall be insulated with PVC and sheathed with nylon complying with the requirements of UL Standard 83 for Types THHN/THWN and UL Standard 1063 for Type MTW and CSA C22.2 No. 75 for T90 Nylon.
2. Types THWN/THHN shall comply with the optional Gasoline and Oil Resistant rating of UL Standard 83. The insulation shall also comply with UL requirements for 105 degree C Appliance Wiring Material.
3. The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL Standard 83 for Types THWN or THHN. The minimum thickness at any point, of the PVC insulation, shall be not less than 90 percent of the specified average thickness.
4. The minimum thickness at any point of the nylon sheath shall be as specified in UL Standard 83 for Types THWN or THHN.

5. The PVC insulation shall be applied tightly to the conductor and shall be free-stripping.

E. Identification:
1. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations and optional ratings. The wire shall also be identified as C(UL) Type T90 Nylon or TWN75, FT1.

F. Tests:
1. Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistant listings; as Type MTW to UL Standard 1063 (stranded items); as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN75.

G. Usage:
1. General use power wiring, minimum size No.12 AWG.
2. General use control wiring, minimum size No.14 AWG.
3. Generator power and control wiring.
4. Power and control wiring.
5. Not Allowed for VFD motor feeders. VFD motor Feeders shall be shielded grounded VFD cable.

2.02 WIRE AND CABLE - GENERAL PURPOSE (600V, ALUMINUM)

A. Manufacturer: Contractor option.

B. General:
1. XHHW-2 general purpose building wire insulated with cross linked polyethylene intended for service and feeder circuits circuits at 600 volts or less, in residential, commercial and industrial buildings.
2. The wire shall be suitable for 90 degree C maximum continuous conductor temperature in wet or dry locations and listed by Underwriters Laboratories for use in accordance with the National Electrical Code.

C. Conductors:
1. Compact stranded aluminum AA-8000 series alloy conductors of a recognized Aluminum Association 8000 Series aluminum alloy per ASTM B800-05 and constructed in accordance with the specifications of ASTM B801-99.

D. Insulation:
1. Each conductor shall be insulated with cross linked polyethylene complying with the requirements of UL Standard 83 for Type XHHW-2.
2. Type XHHW-2 shall comply with the optional Gasoline and Oil Resistant rating of UL Standard 83.
3. The average thickness of cross linked polyethylene insulation, for a given conductor size, shall be as specified in UL Standard 83 for Types XHHW-2. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.

E. Identification:
   1. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations and optional ratings.

F. Tests:
   1. Wire shall be tested in accordance with the requirements of UL Standard 83 for Types XHHW-2 wire and for the optional Gasoline and Oil Resistant listings.

G. Usage:
   1. Service feeders circuit wiring only, minimum size No.2 AWG.
   2. Not allowed on Generator on other circuits.

2.03 SHIELDED POWER CABLE (600V)

A. Manufacturer: Contractor option.

B. General:
   1. Three conductor type TC Tray Cable insulated with cross linked polyethylene and PVC jacket overall, for use on circuits rated 600 volts and 90 degree C maximum continuous conductor temperature in wet or dry locations.
   2. Cables approved for installation in cable trays in accordance with the NEC and for installation in air, in ducts or conduits, in tray or trough, in open wiring or direct buried.

C. Conductors:
   1. Shall be Class B stranded uncoated soft copper.
   2. Suitable separator over the conductor may be used at the option of the manufacturer.
   3. Three phase conductors shall be cabled together with a Class B stranded, uncoated copper grounding conductor and suitable non-hygroscopic fillers to make round.
   4. Length of lay shall not exceed 35 times the phase conductor diameter.
   5. The grounding conductor shall comply with the requirements of UL Standard 1277.
   6. The cable assembly shall be covered with a copper tape shield with drain wire, applied with a 10 percent minimum lap.

D. Insulation:
   1. Each phase conductor shall be insulated with chemically cross linked polyethylene, meeting Type XHHW-2 requirements of Underwriters Laboratories.
   2. The average thickness of insulation shall be as specified in UL Standard 44 for Type XHHW-2 conductors. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.
   3. The insulated phase conductors shall be black in color and shall be printed with the numerals "1", "2", and "3" on their surface.
   4. Each cable shall have a PVC protective jacket applied over the taped assembly. The jacket shall meet the Sunlight Resistant requirements of UL Standard 1277.
   5. The average jacket thickness shall be in accordance with UL Standard 1277. The minimum thickness at any point shall be not less than 80 percent of the specified average thickness.

E. Identification:
1. Cables shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, voltage rating, and required UL information.

F. Tests:
1. Individual conductors and completed cables shall be tested in accordance with UL requirements for Type TC Power Control Tray Cables having XHHW-2 conductors.
2. Cables shall be capable of passing the ribbon burner cable tray flame test requirements of UL and IEEE.

G. Usage:
1. Power wiring for motor loads controlled by adjustable frequency drives, where so indicated on the drawings.

2.04 SHIELDED POWER CABLE - ARMORED (600V)

A. Manufacturer: Contractor option.

B. General:
1. Three conductor type TC Tray Cable insulated and armored, with cross linked polyethylene and PVC jacket overall, for use on circuits rated 600 volts and 90 degree C maximum continuous conductor temperature in wet or dry locations.
2. Cables approved for installation in cable trays in accordance with the NEC and for installation in air, in ducts or conduits, in tray or trough, in open wiring or direct buried.

C. Conductors:
1. Shall be Class B stranded uncoated soft copper.
2. Suitable separator over the conductor may be used at the option of the manufacturer.
3. Three phase conductors shall be cabled together with a Class B stranded, uncoated copper grounding conductor and suitable non-hygroscopic fillers to make round.
4. Length of lay shall not exceed 35 times the phase conductor diameter.
5. The grounding conductor shall comply with the requirements of UL Standard 1277.
6. The cable assembly shall be covered with a copper tape shield with drain wire, applied with a 10 percent minimum lap.

D. Insulation:
1. Each phase conductor shall be insulated with chemically cross linked polyethylene, meeting Type XHHW-2 requirements of Underwriters Laboratories.
2. The average thickness of insulation shall be as specified in UL Standard 44 for Type XHHW-2 conductors. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.
3. The insulated phase conductors shall be black in color and shall be printed with the numerals "1", "2", and "3" on their surface.
4. Each cable shall have a PVC protective jacket applied over the taped assembly. The jacket shall meet the Sunlight Resistant requirements of UL Standard 1277.

5. The average jacket thickness shall be in accordance with UL Standard 1277. The minimum thickness at any point shall be not less than 80 percent of the specified average thickness.

E. Armor:
   1. Impervious, corrugated continuous seam-welded aluminum alloy sheath per UL 1569.
   2. Armor shall be pressure tested and shall meet grounding requirements of NEC article 250.

F. Cable end fittings:
   1. Manufacturer:
      a. Hubbell Killark Clencher 2000 MCR series.
      b. Or equal.
   2. Fittings shall be designed for termination of continuously corrugated or interlocked armor type cables.
   3. Fittings shall comply with the following:
      a. Heavy-duty nickel-plated brass construction.
      b. Moisture-sealing O-ring to prevent entry of moisture under cable armor.
      c. Cable jacket and O-ring seals.
      d. Stainless-steel compression spring for positive electrical connection and compliance with UL requirements.
   4. Testing:
      a. Short-circuit testing shall comply with requirements of UL-514B.
      b. Corrosion testing shall comply with requirements of UL-50.

G. Identification:
   1. Cables shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, voltage rating, and required UL information.

H. Tests:
   1. Individual conductors and completed cables shall be tested in accordance with UL requirements for Type TC Power Control Tray Cables having XHHW-2 conductors.
   2. Cables shall be capable of passing the ribbon burner cable tray flame test requirements of UL and IEEE.

I. Usage:
   1. Power wiring for motor loads controlled by adjustable frequency drives, where so indicated on the drawings.

2.05 SHIELDED INSTRUMENTATION CABLE (300V)

A. Manufacturer: CONTRACTOR option.

B. General:

1. Power limited tray cable - two conductor, No.16 AWG (7x24) bare copper, PVC insulation, overall shield with No.18 AWG (7x26) tinned copper drain wire, PVC jacket with nylon ripcord.

C. Electrical Characteristics:
1. Max. Operating voltage: 300Vrms.
2. Conductor DC resistance at 20 deg. C: 3.7 Ohms/1000 ft.
3. Shield DC resistance at 20 degrees C: 5.1 Ohms/1000 ft.
4. Capacitance between conductors at 1 kHz: 61 pF/ft.
5. Capacitance between conductor and shield at 1 kHz: 114 pF/ft.
6. Inductance: 0.19 uH/ft.

D. Physical Characteristics:
1. Temperature rating: -30 to 105 degrees C.
2. Insulation material: PVC.
3. Average insulation thickness: 0.016-in.
4. Jacket material: Sun resistant PVC.
5. Jacket thickness: 0.037-in. nominal.
6. Shield: Aluminum/Polyester, 100 percent coverage.
7. Overall lay length: 2-in. (6 twists/ft).
8. Maximum pulling tension: 94 lbs.
9. Minimum bend radius: 2.6-in.
10. Flame resistance: UL 1581 vertical tray.

E. Usage:
1. Instrumentation cable.

2.06 UTP CONTROL CABLE

A. Manufacturer:
1. Belden DataTwist 350 (1700A).
2. Or equal.

B. General:
1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 24 AWG, solid bare copper, Polyolefin insulated, adjoined singles, ripcord, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
2. Supports Category 5e applications such as 100 Base TX, 100 Base VG Anylan, and 155 ATM. Ideal for use in high bandwidth applications such as 622 ATM and gigabit Ethernet.
3. Multimedia applications include AES/EBU digital audio and RS-422 machine control.
4. Support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video.
5. UL tested for use with high speed audio-video systems in accordance with FCC Class A digital devices at a fundamental frequency of 135 MHz.

6. Suitable for "noisy" environments such as running next to power cables and transformers.

C. Physical Characteristics:
1. Temperature range: -20 TO 80 deg. C.
2. Insulation material: Polyolefin.
3. Jacket material: PVC.
4. Maximum pulling tension: 40 lbs.
5. Minimum conductor OD: 0.020-in.
6. Minimum insulation OD: 0.035-in.
7. Minimum bend radius: 0.25-in.
8. Flame test: UL 1581 Vertical Tray.
9. Color code:
   a. Pair 1: white/blue & blue
   b. Pair 2: white/orange & orange
   c. Pair 3: white/green & green
   d. Pair 4: white/brown & brown

D. Electrical Characteristics:
1. Maximum operating voltage: 300 V rms.
2. Nominal capacitance at 1 kHz: 15 pF/ft.
3. Nominal velocity of propagation: 70 percent.
4. Delay skew (nS/1000-ft): 25 maximum.
5. Delay at 100 MHz (nS/1000-ft): 510 maximum.
6. Capacitance unbalance (pF/1000-ft): 66.0 maximum.
7. DCR at 20C (Ohms/1000-ft): 9.0 maximum.
8. DCR unbalance (percent): 3.0 maximum.

E. Usage:
1. Instrumentation & Control system UTP cable.

2.07 UTP PATCH CABLE

A. Manufacturer:
1. Belden DataTwist 350 (1752A).
2. Or equal.

B. General:
1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 24 AWG, stranded tinned copper, Polyolefin insulated, adjoined singles, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
2. High flexibility patch cordage. RJ-45 compatible for either T568A or T568B configurations.
3. Design minimizes changes in electrical characteristics due to bending and kinking associated with patch cables.
4. Patch cable impedance is matched with DataTwist 350 horizontal cables to reduce signal reflections caused by impedance mismatches and decrease system return loss.
5. Resistant to attenuation increases due to high humidity environments.

C. Physical Characteristics:
1. Temperature range: -20 TO 80 deg. C.
2. Insulation material: Polyolefin.
3. Jacket material: PVC.
4. Maximum pulling tension: 40 lbs.
5. Minimum conductor OD: 0.022-in.
6. Minimum insulation OD: 0.037-in.
7. Minimum bend radius: 0.25-in.
8. Flame test: UL 1581 Vertical Tray.
9. Color code:
   a. Pair 1: white/blue & blue
   b. Pair 2: white/orange & orange
   c. Pair 3: white/green & green
   d. Pair 4: white/brown & brown

D. Electrical Characteristics:
1. Maximum operating voltage: 300 V rms.
2. Nominal capacitance at 1 kHz: 15 pF/ft.
3. Nominal velocity of propagation: 70 percent.
4. Delay skew (nS/1000-ft): 25 maximum.
5. Delay at 100 MHz (nS/1000-ft): 510 maximum.
6. Capacitance unbalance (pF/1000-ft): 66.0 maximum.
7. DCR at 20C (Ohms/1000-ft): 9.0 maximum.
8. DCR unbalance (percent): 3.0 maximum.

E. Usage:
1. Instrumentation & Control system UTP patch cable.

2.08 FIBER OPTIC CABLE

A. Manufacturer:
1. Optical Cable Corporation: DX006, as shown on the drawings.
2. or equal

B. Overall cable:
1. Multi-strand cable with FRP outer jacket
   a. 6-strands multi-mode.
2. Cable material shall be all di-electric.
3. Cable shall be filled with water blocking material.
4. Outer sheath: The outer sheath shall be marked with the manufacturers name identifying the cable type, year of manufacturer, and sequential length markings. The markings shall be in a contrasting color to the cable jacket.
5. Temperature range: -40 to 70 degrees C.
6. Humidity range: 0 to 100%.
7. Maximum tensile strength: During installation - 2700 n, long term - 890 n.
8. Bending radius: Installation - 20 times cable diameter; no load - 10 times cable diameter.

9. Cabling shall carry an OFNR rating (Optical Fiber Non-Conductive Riser) and shall be listed as being suitable for use in a `vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. An acceptable method of defining fire-resistant characteristics shall be that the cable passes the requirements of the Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts (ANSI/UL 1666-1986).

C. Individual Multi-mode optical fibers:
   1. Fiber Type: Multi-mode, doped silica core surrounded by a concentric glass cladding.
   2. Index Profile: Graded index.
   3. Transmission windows: 850-nm and 1300-nm.
   4. Core Diameter (nom): 62.5 nm (microns) +/- 3.
   5. Cladding diameter: 125-nm +/- 2.
   6. Core-clad Diameter: < 3 nm.
   7. Cladding Non-circularity: <2.0%.
   8. Fiber Coating Diameter:
      a. 250 nm +/- 15 (primary coating).
      b. 900 nm (nominal) Secondary coating (tight buffer).
      c. All coatings shall be mechanically strippable without damaging the optical fiber.
   9. Attenuation (max. @ 23+/-5 C).
      a. @ 850 nm 3.75-dB/km.
      b. @ 1300 nm 1.5-dB/km
   10. When tested in accordance with FOTP-3, “Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components”, the average change in attenuation over the rated temperature range of the cable shall not exceed 0.50 dB/km with 80% of the measured fibers not exceeding 0.25 dB/km.
   11. Bandwidth (min.)
      a. @ 850 nm 160-MHz*km
      b. @ 1300 nm 500-MHz*km
   12. No multimode optical fiber shall show a point of discontinuity greater than 0.2 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that fiber.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical system.

C. Adjust electrical system installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept electrical equipment on site. Inspect for damage.

B. Protect electrical equipment from weather, corrosion, and entrance of debris.

3.03 INSTALLATION

A. Pre-Installation:
   1. Verify that interior of building has been protected from weather.
   2. Verify that mechanical work likely to damage wire has been completed.
   3. Completely and thoroughly swab raceway prior to installation.
   4. Verify that field measurements are as shown on drawings.
   5. Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.
   6. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
   7. Determine required separation between cable and other work.
   8. Determine cable routing to avoid interference with other work.
   9. Any single conduit or raceway utilized for a feeder circuit shall contain only power conductors of a single feeder circuit. Do not combine feeder circuits without engineer's written approval.
   10. Contract drawings indicate individual homerun equipment connections. Contractor may combine branch circuits of common types in single conduits provided the following conditions are met:
      a. NEC requirements for conductor de-rating are satisfied.
      b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
   11. No more than eight 24VDC analog circuits may be combined in a single conduit unless specifically stated otherwise on the drawings.

B. Conductor Sizing:
   1. Conductor sizes are based on copper unless otherwise noted.
   2. Use conductor not smaller than No.12 AWG for power and lighting circuits.
   3. Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
   4. Where circuit wiring length exceeds length identified on the feeder schedule, increase wire size as needed to maintain a maximum voltage drop of three percent.
   5. Use conductor not smaller than No.14 AWG for control circuits.
   6. Unless shown otherwise on the contract drawings, power wiring shall be No.12 AWG.

C. Wire Pulling:
   1. Pull all conductors into raceway at same time.
   2. No.4 AWG and larger wire and power cables shall lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets.
   3. The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.

D. Splices and Terminations:
   1. Splices and terminations shall not be made within raceways.
   2. Clean conductor surfaces before splicing or terminating.
   3. Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.
   4. Insulated spring wire connectors may be used to splice 120V power circuits.
   5. Control, communication, and data transmission wire and cable shall not be spliced.
   6. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
   7. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
   8. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

E. Motors:
   1. Motor wiring to motors less than 10 horsepower shall be spliced and terminated with fully insulated crimp-on end cap with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.
   2. Motor wiring to motors 10 horsepower or larger shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.

F. Unshielded power cables:
   1. Unshielded power cables shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.

G. Aluminum Conductor Connections:
   1. Do not transition from copper to aluminum conductor when extending existing copper conductors.
   2. Mechanical Screw Type Connectors:
      a. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
      b. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
      c. Clean the conductor surface using a wire brush and apply a listed joint compound.
      d. Tighten the connection per the connector manufacturer's recommendation.
      e. Wipe off any excess joint compound.
   3. Mechanical Compression Type Connectors:

a. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
b. The lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color coded. Lug barrel shall be factory prefilled with a joint compound Listed by UL.
c. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
d. Clean conductor surface using a wire brush.
e. Crimp the connection per the connector manufacturer's recommendation.
f. Wipe off any excess joint compound.

4. Termination of Aluminum Conductor to Aluminum Bus:
   a. Prepare a mechanical screw or compression type connection.
   b. Hardware:
      1) Bolts: Anodized aluminum alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
      2) Nuts: Aluminum alloys 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
      3) Washers: Flat aluminum alloy 2024-T4, Type A plain, standard wide series conforming to ANSI B27.2.
   c. Lubricate and tighten the hardware as per the manufacturer's recommendations.
5. Termination of Aluminum Conductor to Copper Bus:
   a. Prepare a mechanical screw or compression type connection.
   b. Hardware:
      1) Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
      2) Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
      3) Washers: Should be of steel, Type A plain standard wide series conforming to ANSI B27.2.
      4) Belleville conical spring washers: shall be of hardened steel, cadmium plated or silicone bronze.
   c. Lubricate and tighten the hardware as per the manufacturer's recommendations.
6. Termination of Aluminum Conductor to Equipment Not Equipped for Termination of Aluminum Conductor:
   a. Prepare compression connection using an adapter Listed by UL for the purpose or by pigtailing a short length of suitable size of copper conductor to the aluminum conductor with a compression connector Listed by UL.
   b. Provide an insulating cover over adapter body or the compression connector.
   c. Terminate the adapter or the pigtail on to the equipment per manufacturer's recommendation.

3.04 TESTING AND START-UP SERVICES

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each conductor.

D. Feeder or branch circuits with ampacity greater than 100 amperes shall be tested after installation to measure insulation resistance of each conductor.

E. All equipment shall be disconnected and the wire ends shall be cleaned and dried.

F. Connect Megohmeter between conductor and a grounded point in the enclosure and energize until the reading stabilizes.

G. Perform an infrared survey of all aluminum conductor connections after the installation is complete and in normal service. Infrared surveys shall be performed with a minimum of 30 percent of rated full load. All connections with elevated temperatures shall be corrected by the contractor.

3.05 TRAINING - NOT USED

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
      b. ANSI/NFPA 99 - Health Care Facilities.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.
   5. Institute of Electrical and Electronics Engineers (IEEE), Specifications and Standards, current edition:
      a. IEEE 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable grounding and bonding systems as indicated on the drawings and as specified herein.

B. Furnish and install complete ground electrode in the proposed building foundation.

C. Furnish and install complete grounding system for the service and standby power system.

1.04 RELATED SECTIONS - NOT USED

1.05 SUBMITTALS - NOT USED

1.06 FACTORY TESTING - NOT USED

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.08 QUALITY ASSURANCE

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms. Additional grounding electrodes shall be used to satisfy

ground resistance requirements where required by earth conditions.

PART 2 PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 3/4-inch minimum.

C. Length: 10-feet minimum. Rod shall be driven at least 9.5-feet deep.

D. Use one or more ground rods to obtain the minimum specified ground resistance. This applies to manholes, padmount switches, transformers, service entrances, and all other equipment requiring a supplemental grounding electrode. Minimum of three ground rods shall be used to ground the service entrance as indicated on plans.

2.02 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.03 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.04 EXOTHERMIC CONNECTIONS

A. Select the appropriate kit for specific types, sizes, and combinations of conductors and other items to be connected. Field personnel shall be trained in execution of welds.

2.05 WIRE

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Manhole and Vault Bonding: No. 4/0 minimum.

D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical system.

C. Adjust electrical system installation to satisfy field requirements.

3.02 INSTALLATION

A. General:
1. Verify that final backfill and compaction has been completed before driving rod electrodes.
2. Install products in accordance with manufacturer instructions.
3. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
4. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
5. Attach grounds permanently before permanent building service is energized.
6. Install rod electrodes at locations indicated or as required by local code, whichever requires the most rods. Install additional rod electrodes as required to achieve specified resistance to ground.
7. Connect grounding electrode conductor and reinforcing steel in foundation footing. Bond steel together.
8. Bond all conductive components to meet Regulatory Requirements.
9. Bond together metal siding not attached to grounded structure; bond to ground.
10. All separate ground wires shall be enclosed in rigid galvanized steel conduit and bonded at both ends to the rigid galvanized steel conduit with an approved fitting.

B. Less than 600 volt system grounding:
1. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
2. Copper grounding electrode conductor shall be sized as indicated or as required by NEC, whichever is larger and shall be extended from secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Bonding jumper shall be installed around water meter. Install conductor in separate rigid conduit. Bond conduit as described above.
3. Receptacle Grounding: All receptacles installed shall have a separate grounding contact.

4. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
5. Bond together each metallic raceway, pipe, duct and other metal objects.
6. Equipment Grounding Conductor: Separate, insulated green conductor shall be installed within each raceway and cable tray, sized per NEC or as indicated in the contract documents whichever is larger. Terminate each end on suitable lug, bus, enclosure or bushing, per NEC. Install a ground wire from each device to the respective enclosure.

3.03 TESTING AND START-UP SERVICES

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.04 TRAINING - NOT USED

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American Iron and Steel Institute (AISI), Specifications and Standards, current edition.
   2. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   3. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
      a. ASTM A653 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
      b. ASTM A1011 - Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Ally and High-Strength Low Alloy with Improved Formability (Formerly ASTM A570).
      c. ASTM F1136 - Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners.
      d. ASTM A907 - Standard Specification for Steel, Sheet, and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled, Structural Quality.
      e. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   4. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   5. Metal Framing Manufacturers Association (MFMA), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Furnish and install supporting devices as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for supporting devices:
   1. Submit outline drawings and dimensions for equipment support racks.

1.05 QUALITY ASSURANCE

A. Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request

B. Stainless steel bolted framing parts shall be stamped to identify the material. Material certification sheets and test reports must be made available by the manufacturer upon request.

C. All materials, equipment, and parts shall be new and unused of current manufacture.

D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS

2.01 STRUT, CHANNELS, AND CONNECTORS

A. Manufacturers:
   1. Cooper B-Line, Inc.
   2. or equal.

B. General:
   1. Strut shall be 1-5/8-inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.

C. Materials and Finish:
   1. Galvanized Steel: All strut, fittings and hardware shall be galvanized made of AISI Type 304 stainless steel.

2.02 ANCHORS AND FASTENERS

A. Concrete and Structural Elements: Use stainless steel precast insert system, expansion anchors and preset inserts.

B. Steel Structural Elements: Use stainless steel beam clamps.

C. Concrete Surfaces: Use stainless steel self-drilling anchors and expansion anchors.

D. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use SS toggle bolts or hollow wall fasteners.

E. Solid Masonry Walls: Use stainless steel expansion anchors and preset inserts.

F. Sheet Metal: Use stainless steel sheet metal screws.

G. Wood: Use stainless steel wood screws.

H. All other fasteners: stainless steel screws, suitable for the required usage.

2.03 HARDWARE

A. Conduit and equipment supports, clamps, and other miscellaneous materials shall be constructed of the following materials as scheduled in Section 26 05 00.
   1. PVC coated, galvanized, malleable iron.
   2. Stainless steel.
   3. PVC.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base locations and dimensions on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust equipment support rack installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept supporting devices on site. Inspect for damage.

B. Protect supporting devices from corrosion and damage. Do not install damaged materials.

3.03 INSTALLATION

A. General:
   1. Furnish and install supports and fasteners for all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.
   2. Thoroughly clean and remove construction debris from installation.

B. Strut Channel:
   1. Install strut in accordance with MFMA-102 "Guidelines for the Use of Metal Framing"; in accordance with equipment manufacturer's recommendations, and with recognized industry practices.
   2. Fabricate supports from channel. Rigidly weld members or use hexagon head bolts to present a neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
   3. File and de-bur cut ends of galvanized support channel and spray paint with cold galvanized paint to prevent rusting.
   4. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

C. Anchors and Fasteners:
   1. Provide anchors, fasteners, and supports in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting".
   2. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or

conduit.

3. Do not use spring steel clips and anchors.
4. Do not use powder-actuated anchors.
5. Obtain permission from Engineer before drilling or cutting structural members.
6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
7. Use channel supports to stand cabinets and panelboards 1-5/8-inch off interior or exterior surfaces of exterior walls.
8. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using anchors and fasteners.
9. Install free-standing electrical equipment on 3-inch concrete pads unless indicated otherwise on the drawings.
10. Use threaded rod, minimum size 3/8-inch, for supports where indicated on the drawings.
11. Install products in accordance with manufacturer instructions.

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. ANSI C80.1 - Electrical Rigid Steel Conduit (ERSC).
      b. ANSI C80.3 - Steel Electrical Metallic Tubing (EMT).
      c. ANSI C80.5 - Electrical Rigid Aluminum Conduit (ERAC).
      d. NFPA 70 - National Electrical Code.
   2. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
      a. ASTM F2160 - Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter.
      b. ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR) Based on Controlled Inside Diameter.
      c. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR) Based on Controlled Outside Diameter.
      d. ASTM D3350 - Polyethylene Plastics Pipe and Fittings Materials.
   3. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   4. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
      b. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association.
      c. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association.
      d. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association.
      e. NEMA TC 7 - Smooth Wall Coilable Polyethylene Electrical Plastic Conduit.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 1 - Standard for Flexible Metal Conduit

b. UL 6 - Electrical Rigid Metal Conduit - Steel.
c. UL 6A - Standard for Electrical Rigid Metal Conduit - Aluminum and Stainless Steel.
d. UL 651A Type EB and A Rigid PVC Conduit and HDPE conduit.
e. UL 651B Continuous Length HDPE.
f. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit.
g. UL 2239 - Standard for Safety for Hardware for the Support of Conduit, Tubing, and Cable.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable conduit system as indicated on the drawings, scheduled on the Drawings, and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for conduit:
1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
2. Clearly identify the types of conduit and fittings proposed.

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 GALVANIZED RIGID METAL CONDUIT (TYPE RMCS)

A. Manufacturer: Contractor option.

B. Conduit:

1. Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
2. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.
3. Top-coated with a compatible organic layer to inhibit white rust and increase corrosion resistance.
4. Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.

C. Conduit Bodies:
1. Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.
2. Tapered, threaded hubs with integral bushing.
3. Stainless steel hardware.
4. Cover constructed of same material with solid gasket.

D. Fittings:
1. Ferrous metal construction electro-galvanized inside and out.
2. Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

2.02 PVC GALVANIZED RIGID METAL CONDUIT (TYPE RMCCS)

A. Manufacturer:
1. Perma-Cote Industries.
2. Robroy.
3. Or equal.

B. General:
1. Conduit shall be UL Listed and the coating shall have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit.
2. Independent certified test results shall be available to confirm coating adhesion under the following conditions:
3. Conduit immersed in boiling water with a minimum mean time to adhesion failure of 200 hours.
4. Conduit and condulet exposure to 150 degrees F and 95 percent relative humidity with a minimum mean time to failure of 30 days.
5. No trace of internal coating shall be visible on a white cloth following six wipes over the coating that has been wetted with acetone.
6. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

C. Conduit:
1. Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, and a defect free interior surface, and a continuous welded seam.
2. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.
3. Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.
4. Coating:
   a. External: PVC, 40 mils nominal, free of blisters, bubbles, and pinholes.
   b. Internal: Urethane, 2 mils minimum.
5. Threaded connections:
   a. Factory threads: factory coated.
   b. Field threads: protected by coating sleeve extension on female fitting. Sleeve extension shall be equivalent in length to the nominal conduit size and the inside diameter less than the outside diameter of the coated conduit.
6. Strength:
   a. Coating bond to conduit shall be stronger than tensile strength of coating. Field cut, thread, and bent conduit shall not damage conduit.

D. Conduit Bodies:
1. Ferrous metal construction electro-galvanized inside and out and PVC coated to match the conduit.
2. Tapered, threaded hubs with integral bushing.
3. Stainless steel or encapsulated stainless steel hardware.
4. PVC coated cover constructed of same material with solid tongue-in-groove gasket.

E. Fittings:
1. Ferrous metal construction electro-galvanized inside and out and PVC coated to match conduit.

2.03 RIGID NON-METALLIC CONDUIT (TYPE RNC)

A. Manufacturer:
1. Carlon.
2. Or equal.

B. Conduit:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-2.
3. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections, which could mar conductors or cables.
4. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.

5. Schedule 80 non-metallic conduit shall be used in locations subject to physical damage. Schedule 40 non-metallic conduit may be used in all other locations.

C. Conduit Bodies:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.
3. Stainless steel hardware.
4. Cover constructed of same material with solid gasket.

D. Fittings:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

2.04 RIGID ALUMINUM CONDUIT

A. Manufacturer: Contractor's option.

B. Conduit:
1. Heavy wall tube manufactured of 6063 aluminum alloy in temper designation T-1 with an accurate circular cross section, a uniform wall thickness and a defect free interior surface.
2. Factory cut threads, 0.75-inch taper per foot.

C. Conduit Bodies:
1. Copper free aluminum construction coated with aluminum acrylic paint.
2. Tapered, threaded hubs with integral bushing.
3. Stainless steel hardware.
4. Cover constructed of same material with solid gasket.

D. Fittings:
1. Copper free aluminum construction.
2. Components critical to performance such as setscrews, split rings, and locknuts are adequately designed to insure positive bonds.

2.05 ELECTRICAL METALLIC TUBING

A. Manufacturer: Contractor's option.

B. Conduit:
1. Mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
2. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.

C. Fittings:
1. Setscrew, steel construction electro-galvanized inside and out.
2. Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

2.06 RIGID NONMETALLIC FIBERGLASS CONDUIT

A. Manufacturer:
1. Enduro Composite Systems.
2. Or equal.

B. Conduit:
1. Resin: vinyl ester, chemically resistant.
2. Glass reinforcement:
a. Conduit: fifty percent by weight.
b. Fittings: eighteen percent by weight.
3. Fire retardence: comply with 5 inch flame test per UL 1684.
4. Size: Schedule 40.
5. UV Resistance: UV stabilized with integral inhibitor and polyester surface veil.

C. Conduit Bodies:
1. Manufacturing process: compression molding.
2. Hardware:
a. Fasteners: stainless steel.
b. Threaded inserts: monel.

D. Fittings:
1. Constructed of materials compatible with equal in corrosion resistance to fiberglass conduit.

2.07 FLEXIBLE METALLIC CONDUIT

E. Manufacturer: Contractor's option.

F. Usage:
1. Use only in conjunction with electrical metallic tubing

G. Conduit:
1. Single strip, helically wound, galvanized steel with smooth interior surface conforming to applicable UL Standards.
2. Minimum size 1/2 inch may be used in lengths not to exceed 3 feet. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.

H. Fittings:
1. Connectors shall be malleable iron or steel with insulated throat, squeeze-type, with annular gripping rib. Particular attention shall be given to maintaining ground bond and firm support through flexible connections. Connections shall have insulated throats.

2.08 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT

A. Manufacturer: Contractor's option.

B. Usage:
1. Use in conjunction with rigid nonmetallic PVC conduit.
2. Use in conjunction with PVC coated galvanized rigid metal conduit.
3. Use in conjunction with rigid aluminum conduit.

C. Conduit:
1. Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.
2. Jacket shall be positively locked to core to prevent sleeving.
3. Minimum size 1/2 inch may be used in lengths not to exceed 3 feet. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.

D. Fittings:
1. Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.
2. Where used in conjunction with PVC coated galvanized rigid metal or rigid aluminum conduit connectors shall be malleable iron or steel, electro zinc plated and PVC coated, with insulated throat and taper threaded hub.
3. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
4. All fittings shall be liquid tight.

2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT

A. Manufacturer:
1. Carlon Carflex.
2. Or equal.

B. Usage:
1. Use in conjunction with rigid nonmetallic PVC conduit.
2. Use in conjunction with rigid nonmetallic fiberglass conduit.

C. Conduit:
1. Conduit shall have a smooth inner surface with integral reinforcement within the conduit wall.
2. Conduit shall be designated as a Type LFNC-B (or FNMC-B), listed to UL standard UL1660 and suitable for use at conduit temperatures of 80 degrees C (dry), 60 degrees C (wet and oil resistant).
3. Conduit shall be flame resistant and when used with listed fittings, approved for the installation of electrical conductors.
4. Conduit shall be installed in accordance with applicable sections of the NEC and/or local electrical codes.
5. Conduit shall be marked OUTDOOR for outdoor applications exposed to sunlight and weathering conditions and marked DIRECT BURIAL for direct burial applications.
6. The National Evaluation Service, Inc shall evaluate conduit for installation within a three-hour or less fire-resistive floor/ceiling and two-hour fire-resistive wall construction.

D. Fittings:
1. Molded from high strength, chemical resistant, glass filled thermoplastic.
2. Fittings shall be listed for the use with liquid tight flexible nonmetallic conduit and shall be marked LFNC-B (FNMC-B).
3. Fittings uses for direct burial applications shall be listed for WET LOCATIONS.
4. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
5. All fittings shall be liquid tight.

2.10 LIQUIDTIGHT HAZARDOUS LOCATION FLEXIBLE CONDUIT (STAINLESS STEEL BRAID)

A. Manufacturer:
1. Crouse-Hinds EC Coupling.
2. Or equal.

B. Usage:
1. Use for all non-intrinsically safe, hazardous location installations.

C. Conduit:
1. Conduit shall have an insulating wire duct with smooth inner surface inside a flexible brass inner core. Packing material shall be woven cotton impregnated with asphalt.
2. Flexible portion of coupling shall be covered with stainless steel braid.
3. Conduit shall bear U.L. label indicating suitability for use in hazardous location as identified on the drawings.

D. Fittings:
1. Integral stainless steel end fittings shall be included with coupling.
2. Coupling shall be available with two threaded male end fittings or one female union and one threaded male end fitting.

3. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
4. All fittings shall be liquid tight.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Conduit rough-in shall be based upon shop drawing requirements.

B. The Contractor shall be responsible for coordinating conduit location and rough-in with actual equipment conditions and requirements.

C. Field verify all measurements. Do not base conduit rough-in or equipment locations on the contract drawings.

D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.

E. Adjust conduit system installation to satisfy field requirements.

3.02 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."

B. Arrange supports to prevent misalignment during wiring installation.

C. Support conduit using PVC coated steel or stainless steel straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related conduits; support using conduit rack. Construct rack using 304 stainless steel channel; provide space on each for 25 percent additional conduits.

E. Fasten conduit supports to building structure and surface under provisions of Section 16190.

F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

G. Do not attach conduit to ceiling support wires.

H. Arrange conduit to maintain headroom and present neat appearance.

I. Route conduit parallel and perpendicular to walls.

J. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

K. Route conduit in and under slab from point-to-point.

L. Do not cross conduits in slab.

M. Maintain adequate clearance between conduit and piping.

N. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

O. Cut conduit square using saw or pipe cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire are inserted in fitting. Allow joint to cure for 20 minutes, minimum.

R. Use conduit hubs to fasten conduit to NEMA 4X boxes in damp and wet locations.

S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic factory elbows for bends in metal conduit larger than 2-inch size.

T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

V. Provide suitable pull string in each empty conduit except sleeves and nipples.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Ground and bond conduit under provisions of Section 16170.

Y. Identify conduit under provisions of Section 16195.

Z. Install plastic coated conduit in accordance with manufacturer's instructions. All 90 degree bends shall be manufactured elbows. Touch-up PVC coating after installation.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

3.04 CONDUIT SEPARATION

A. Provide separate conduit system for 120-volt and 480-volt circuits.

B. Provide separate conduit system for 120-volt control wiring.

C. Provide separate conduit system for manufacturer sensor cables.

D. Provide separate conduit system for low voltage control.

E. Provide separate conduit for analog control wiring.

F. Control wiring on drawings is indicated as being a separate conduit. Control wires of similar types are shown in separate conduits on the drawings. Control wires may be combined into common conduits as long as the systems are separated as detailed above. Combine wiring into a maximum of 30% fill (additional 10% fill is reserved for future). Minimum conduit size is 3/4".

G. Provide separate conduit system for all intrinsically safe wiring. By NEC code, this cannot be combined with other wiring. Provide separation for all float switches and other devices indicated as having intrinsically safe protection.

3.05 ANALOG CABLE CONDUIT SIZE

A. 0 - 4 analog shielded cables - 3/4" conduit.

B. 5 - 8 analog shielded cables - 1 1/4" conduit.

C. More than 8 analog shielded cables - use multiple conduits.

3.06 INSTRUMENTATION AND CONTROL WIRING CONDUIT

A. Instrumentation and control wires may be combined in common conduits and junction boxes as stated in above.

B. Wires and cables shall not be spliced in junction boxes unless specifically shown on drawings as being a splice box or detailed as such. Typically float switches must be spliced in a junction box and the cabling cannot be run directly into the control panel.

C. Junction boxes may be used in conduit system to provide a central pulling point for cables.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris.

C. Store conduit above grade. Provide from environment with suitable covering.

D. Protect PVC and PVC coated conduit from sunlight.

3.03 INSTALLATION

A. General:
   1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.
   2. Arrange conduit to maintain headroom and present neat appearance.
   3. Design raceway systems to minimize the number of fittings, couplings, kicks, and offsets.
   4. Raceways located above lowest floor level:
      a. Route conduit parallel and perpendicular to walls.
      b. All raceways shall be level and straight.
      c. Vertical conduits shall be plumb.
   5. Raceways located in or under lowest level floor:
      a. Route conduit in and under slab from point-to-point.
      b. Do not cross conduits in slab.
   6. Do not use flexible conduit in place of bends, conduit bodies, or expansion fittings.
   7. Flexible conduit shall be used at all equipment terminations. Maximum length of 24-inches unless specifically allowed otherwise by Engineer based upon field conditions.
   8. Do not use cords for equipment connections unless specifically allowed otherwise by Engineer based upon field conditions.

B. Raceway sizing:
   1. Size raceways as indicated on drawings.
   2. Where raceways sizes are not indicated on drawings, size in accordance with NEC requirements. Minimum size 3/4-inch.
   3. Exposed conduit runs not longer than 10-feet in length and terminating at a single device may be 1/2-inch unless prohibited by NEC.

C. Raceway Installation:
   1. Maintain adequate clearance between conduit and piping.
   2. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
   3. Cut conduit square using saw or pipe cutter; de-burr cut ends.
   4. Bring conduit to shoulder of fittings; fasten securely.
   5. Use conduit hubs to fasten conduit to NEMA 4X and NEMA 12 boxes.
   6. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic factory elbows for bends in metal conduit larger than 2-inch size.
   7. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
   8. Suitable pull string shall be installed in each empty conduit, sleeves and nipples excepted.
   9. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
   10. Remove all debris and moisture from raceways prior to installing conductors.
   11. Ground and bond conduit under provisions of Section 26 05 26.

12. Identify conduit under provisions of Section 26 05 53.
13. Install plastic coated conduit in accordance with manufacturer's instructions. All 90 degree bends shall be manufactured elbows. Touch-up PVC coating after installation.
14. All field cut threads shall be coated with Thomas & Betts Kopr-Shield prior to assembly.

D. Structural Coordination:
1. Suitable fittings, designed and listed for the purpose, shall be used to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
2. Install conduit to preserve fire resistance rating of partitions and other elements.
3. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
4. Where conduit passes between areas subject to variable temperatures, seal conduits to prevent air interchange and condensation formation. Use conduit fitting specifically manufactured for this purpose.

E. Raceway Support:
1. General:
a. Arrange supports to prevent misalignment during wiring installation.
b. Do not permanently support conduit with wire or perforated pipe straps.
c. Remove wire used for temporary supports.
d. Do not attach conduit to ceiling support wires.
e. Channel, rod, and hardware shall comply with the requirements of Section 26 05 29.
2. Hardware:
a. Construct conduit support rack with channel and rod to support conduits not supported from structure.
b. Support conduit with channel anchored to structure when conduit offset from structure is required.
c. Secure conduits to channel with pipe straps.
d. Support conduit from structure when conduit offset from structure is not required.
e. Secure conduits directly to structure with one-hole strap and conduit spacer.

F. Conduit Separation:
1. Separate conduit systems shall be used for the following circuit categories:
a. 120-volt power circuits.
b. 480-volt power circuits.
c. 120-volt control circuits.
d. 24 VDC analog control circuits.
e. Intrinsically safe control circuits.
f. UTP control cables.
g. Manufacturer supplied cables (for example, magnetic flow meter cables).
h. Radio frequency coaxial cables (for example, antenna cables).

2. The contract drawings show individual homerun equipment connections. The Contractor may combine circuits of common types (as identified above) into single conduits provided the following conditions are met:
    a. NEC requirements for conductor de-rating are satisfied.
    b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
    c. No more than eight 24VDC analog circuits are combined in a single conduit, unless specifically stated otherwise on the drawings.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

END OF SECTION

SECTION 26 05 37

BOXES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
      b. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
      c. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable box systems as indicated on the drawings, scheduled in Drawings, and as specified herein.

B. All Boxes located on the exterior of the building shall be custom painted to match the building exterior. Tentative custom paint color shall be Tnemec 70BR Worn path. Final color shall be selected by the owner and engineer during submittals.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for boxes:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of boxes proposed.

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes:
   1. Galvanized steel, with stamped knockouts.
   2. Gangable, suitable for number of devices shown.
   3. Suitable for flush mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.

B. Luminaire and Equipment Supporting Boxes:
   1. Rated for weight of equipment supported; include 3/8-inch male fixture studs where required.

C. Cast Boxes:
   1. Cast ferralloy or aluminum, deep type, gasketed cover, threaded hubs.
   2. Suitable for surface or flush mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.

D. PVC Coated Cast Boxes:
   1. PVC coated cast ferralloy, deep type, gasketed cover, threaded hubs.
   2. Suitable for surface mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.
   3. Of the same manufacturer as the associated PVC coated conduit.

2.02 PULL AND JUNCTION BOXES

A. General:
   1. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).

2. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

B. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

C. Boxes Larger than 12 Inches (300 mm) in any dimension shall have a hinged cover, be rated NEMA 4X, and constructed of stainless steel.

D. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

E. Cast Metal Boxes for Hazardous Locations: Type 7, cast malleable iron with drilled and tapped conduit entrance. Cast malleable iron cover, non-hinged with Type 316 stainless steel screws and gasketed.

F. Cast Metal Boxes for Underground Installations: Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Hot dipped galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws. Cover Legend: ELECTRIC.

G. Fiberglass Handholes for Underground Installations: Die- molded with pre-cut 6 x 6 inch (150 x 150 mm) cable entrance at center bottom of each side; fiberglass weatherproof cover with non-skid finish.

H. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more capacity.

I. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

J. Wireways shall not be used in lieu of junction boxes.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Box rough-in shall be based upon shop drawing requirements.

B. The Contractor shall be responsible for coordinating box location and rough-in with actual equipment conditions and requirements.

C. Field verify all measurements. Do not base box rough-in or equipment locations on the contract drawings.

D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.

E. Adjust box locations to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept boxes on site. Inspect for damage.

B. Protect boxes from corrosion and entrance of debris.

C. Store boxes above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. General:
   1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.

B. Box Installation:
   1. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
   2. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
   3. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
   4. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
   5. Use flush mounting outlet boxes in all areas.
   6. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.
   7. Use gang box where more than one device is mounted together. Do not use sectional box.
   8. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.
   9. Position outlet boxes to locate luminaires as shown on lighting plans.
   10. Adjust flush-mounting outlets to make front flush with finished wall material.
   11. Install knockout closure in unused box opening.

C. Structural Coordination:
   1. Install boxes to preserve fire resistance rating of partitions and other elements.
   2. Install flush mounting box without damaging wall insulation vapor barrier or reducing its effectiveness. Provide vapor box or vapor barrier hat for each box flush mounted in an exterior wall.
   3. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
   4. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

D. Box Support:
   1. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

2. Use stamped steel bridges to fasten flush mounting outlet box between studs.
3. Use adjustable stainless steel channel fasteners for hung ceiling outlet box.
4. Do not fasten boxes to ceiling support wires.
5. Support boxes independently of conduit.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

END OF SECTION

SECTION 26 05 41

WIRING DEVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
      b. ANSI/NFPA 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
   2. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA WD 1 - General Purpose Wiring Devices.
      b. NEMA WD 6 - Wiring Device Configurations.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Provide and install complete and operable wiring devices as required on the drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

A. The following divisions may include work which is related to wiring devices, but which is not included under the scope of this section:
   1. Division 40 - Process Integration.
   2. Division 42 - Process Heating, Cooling, and Drying Equipment.
   3. Division 44 - Pollution Control Equipment.

1.05 SHOP DRAWINGS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for wiring devices:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of wiring devices proposed.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

D. Manufacturer shall specialize in manufacture of products specified in this Section with minimum three years experience.

PART 2 PRODUCTS

2.01 120V SPECIFICATION GRADE WALL SWITCHES

A. Single Pole Switch:

1. Hubbell.
2. Or equal.

B. Double Pole Switch:

1. Hubbell.
2. Or equal.

C. Three-way Switch:

1. Hubbell.
2. Or equal.

D. Four-way Switch:

1. Hubbell.
2. Or equal.

E. Indicator Switch:

1. Hubbell.
2. Or equal.

F. Weather-proof Switch:

1. Hubbell.
2. Or equal.

G. Explosion Proof Switch:

1. Appleton.
2. Crouse-Hinds.
3. Or equal.

2.02 120V SPECIFICATION GRADE RECEPTACLES

A. Duplex Convenience Receptacle:

1. Hubbell.
2. Or equal.

B. GFCI Receptacle:
   1. Hubbell.
   2. Or equal.

C. WP/GFCI Receptacle:
   1. Hubbell.
   2. Or equal.

2.03 WALL PLATES

A. Wall plates shall be installed as follows:
   1. Use multi-screw gasketed cast plate where cast outlet boxes are required. Covers shall not be attached by using a single screw mounting into the wiring device, but shall be attached by mounting directly to the box.
   2. Use Crouse Hinds WLRS or WLRD wet location covers for receptacles identified as “WP” which are located inside structures.
   3. Use aluminum or cast metal cover rated for “Constant Use” for receptacles identified as “WP” and that are exposed to the weather.
   4. Use Crouse-Hinds OS185 cover for all switches identified as “WP”.

PART 3 CONSTRUCTION METHODS

3.01 DIVISION OF WORK

A. The Contractor shall have overall system responsibility and shall provide all materials and labor necessary provide a complete and operable system and comply with all requirements of this section.

B. The Contractor shall be responsible for coordinating device locations with actual equipment conditions and requirements.

3.02 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact wiring device locations on the contract drawings.

B. Adjust location of wiring devices to satisfy field requirements.

3.03 INSTALLATION

A. Wiring Device Installation:
   1. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
   2. Provide extension rings to bring outlet boxes flush with finished surface.
   3. Clean debris from outlet boxes.
   4. Install products in accordance with manufacturer's instructions.
   5. Install devices plumb and level.
   6. Install switches with OFF position down.
   7. Install receptacles with grounding pole on top.
   8. Connect wiring device grounding terminal to branch circuit equipment grounding

conductor.

9. Install plates on switch, receptacle, and blank outlets in all areas.
10. Connect wiring devices by wrapping conductor around screw terminal.
11. Provide stainless steel hardware.
12. Install wall switch 46 inches above finished floor.
13. Install convenience receptacle 18 inches above finished floor.
14. Install convenience receptacle 6 inches above counter.
15. Adjust devices and wall plates to be flush and level.

B. Structural Coordination:
   1. Verify outlet boxes are installed at proper height.
   2. Verify wall openings are neatly cut and will be completely covered by wall plates.
   3. Verify floor boxes are adjusted properly.

3.04 TESTING AND STARTUP SERVICES

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
      b. ANSI Z535.4 - Product Safety Signs and Labels.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

1.03 DESCRIPTION OF WORK

A. Furnish and install electrical identification systems as indicated on the drawings and as specified herein.

1.04 SUBMITTALS - NOT USED

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE - NOT USED

1.08 WARRANTY - NOT USED

1.09 EXTRA MATERIALS - NOT USED

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Engraved three-layer laminated plastic, black letters on white background.

B. Lettering:
   1. 1/4-inch letters for identifying individual equipment and loads.
   2. 1/2-inch letters for identifying grouped equipment and loads.

2.02 CONDUCTOR MARKING

A. The ends of each conductor shall be marked with circuit number, motor number, wire or terminal number.

B. Control system wire marking shall be coordinated with control system and equipment shop drawings.

C. Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink sleeve. Markers shall be shrunk around the wire to ensure a tight, non-slip bond with a compatible heat gun.

D. Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322.

2.03 CONDUCTOR COLOR CODING

A. Conductors No.6 AWG and smaller shall be provided with color coded insulation as described herein. Conductors larger than No.6 AWG may be color coded with appropriately colored Scotch No.35 tape at each end.

B. Color Coding:
   1. 277/480 vac system shall be colored brown, orange, yellow, and gray for phases A, B, C, and neutral respectively.
   2. 120/208 vac system shall be colored black, red, blue, and white for phases A, B, C, and neutral respectively.
   3. 120/240 vac shall be colored black, red, and white for Line 1, Line 2, and neutral respectively.
   4. 120 vac control wiring shall be colored red.
   5. 24 VDC control wiring shall be colored purple and purple with white stripe for positive and negative conductors respectively.
   6. Intrinsically safe control wiring shall be colored light blue.
   7. Conductors within control cabinets and motor control centers which are supplied from an external source shall be colored yellow.
   8. Grounding conductor and equipment ground conductors shall be colored green.

2.04 CONDUIT MARKING

A. Colored band markers shall be field painted.

B. Color:
   1. 480 Volt System: Yellow.
   2. 208 Volt and 240 Volt System: White.
   3. Fire Alarm System: Red.
   4. Low Voltage Communication System: Black.
   5. Process Instrumentation and Control System: Blue.

2.05 EQUIPMENT, ENCLOSURE, AND CABINET WARNING SIGNS

A. Electrical Voltage and Shock Hazard Signs
   1. Provide OSHA Voltage and Shock Hazard sign for each electrical enclosure, cabinet, or other piece of equipment that presents an electrical hazard under normal operating circumstances or presents an electrical hazard while the enclosure is open.

B. Electrical Arc Flash Hazard Signs
   1. Provide Arc Flash Hazard sign for each electrical enclosure, cabinet, or other piece of equipment that presents an arc flash hazard in accordance with NEC and ANSI Z535.4.

C. Electrical Source Signs
   1. Provide sign indicating voltage level and source for each component of the power distribution system and for all control panels.
   2. Provide indicating multiple sources where equipment is fed from multiple sources or where signal wiring is present that is powered from a source external to the equipment

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS - NOT USED

3.02 DELIVERY, STORAGE, AND HANDLING - NOT USED

3.03 INSTALLATION

A. Nameplates:
   1. Provide nameplates for grouped equipment such as panelboards, transformers, motor control centers, and control panels. Nameplate shall identify tag number, voltage, ampere rating, and description.
   2. Provide nameplates for individual equipment such as motor control center compartments, field instruments, and field control stations. Nameplate shall identify tag number and description.
   3. Provide nameplates for individual receptacles. Nameplate shall identify panel and circuit number supplying the receptacle.
   4. Provide nameplates for control cabinets and motor control center compartments which contain wiring supplied from an external source. Nameplate shall state: Multiple power sources within, verify all power supplies are disconnected before servicing equipment.
   5. Nameplates shall be secured to the front of equipment enclosures with stainless steel screws or rivets. Double sided tape will not be acceptable.
   6. Secure nameplates for flush mounted panelboards behind the panelboard door.

B. Conductor Marking:
   1. Mark conductors at every termination and splice point.
   2. Mark conductors with wire numbers identified by control system supplier, with panel and circuit identification, or with MCC compartment and wire numbers.

C. Conduit Marking:
   1. Furnish colored band markers for each conduit longer than six feet and mark each conduit a minimum of twenty feet on center.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA ST 1 - Specialty Transformers
      b. NEMA ST20 - Dry Type Transformers for General Applications.
      c. NEMA TP1 - Guide for Determining Energy Efficiency for Distribution Transformers.
      d. NEMA TP2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.
   4. International Electrical Testing Association (NETA)
      a. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable lighting and distribution transformers as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for low voltage transformers:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Performance data and physical dimensions including outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS - NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: All transformers provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than fifty years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 ENERGY EFFICIENT, DRY-TYPE TRANSFORMERS

A. Manufacturer:
   1. Square D.
   2. Cutler-Hammer.
   3. or equal.

B. Ratings:
   1. Insulating materials shall exceed NEMA ST20 standards and be rated for 220 degree C, UL component recognized insulation system.
   2. Transformers rated 15kVA and larger shall be 150 degree C temperature rise above 40 degree C ambient.
   3. Transformers rated 25kVA and larger shall have a minimum of 4 - 2.5 percent full capacity primary taps.
   4. The maximum temperature of the top of the enclosure shall not exceed 50 degree C rise above a 40 degree C ambient.
   5. Transformer voltage and kVA ratings shall be as indicated on the drawings.

C. Efficiency:
   1. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 and Department of Energy “Energy Star” Program when operated at 35 percent of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

2. Minimum transformer efficiency shall comply with the following table:

TRANSFORMER MINIMUM EFFICIENCY			
SINGLE PHASE		THREE PHASE	
KVA	PERCENT EFFICIENCY	KVA	PERCENT EFFICIENCY
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8

D. Construction:
1. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.
2. All cores shall be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.
3. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
4. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

E. Sound Levels:
1. Sound levels shall not to exceed the following:
   a. 15 to 50KVA - 45dB
   b. 51 to 150kVA - 50dB
   c. 151 to 300kVA - 55dB
   d. 301 to 500kVA - 60dB
   e. 501 to 700kVA - 62dB
   f. 701 to 1000kVA - 64dB

g. 1001 to 1500kVA - 65dB
h. 1501 to 2000kVA- 66dB

F. Accessories
1. Provide the following accessories where indicated on the drawings:
a. Weathershields
b. Wall mounting brackets.
c. Ceiling mounting brackets.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact transformer locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust transformer installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept transformers on site. Inspect for damage.

B. Protect transformers from corrosion and entrance of debris.

C. Store transformers above grade. Protect from environment with suitable covering.

D. Handle transformers using only lifting eyes and brackets provided for that purpose.

3.03 INSTALLATION

A. General:
1. Install transformers in accordance with NECA "Standard of Installation.", all requirements of the NEC, and manufacturer recommended practices.

B. Separately Mounted Transformer Installation:
1. Set transformer plumb and level.
2. Use flexible conduit, 2-foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
3. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
4. Provide sufficient space around transformer for cooling as recommended by the manufacturer.

C. Structural Coordination:
1. Provide structural supports suitable for the transformer weight for wall and ceiling mounted units.

3.04 TESTING AND START-UP SERVICES

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments within

2-1/2 percent of the nominal operating voltage after the building is in full operation.

3.05 TRAINING - NOT USED

END OF SECTION

SECTION 26 23 29.16
ADJUSTABLE FREQUENCY DRIVE – HVAC

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.

1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
   a. NFPA 70 - National Electrical Code.
2. Canadian Standards Associates (CSA), Specifications and Standards, Current Edition.
3. European Committee for Electrotechnical Standardization (CENELEC), Current Edition.
   a. EN 60947 - Low-Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters
4. Electrical and Electronic Manufacturers Association Canada (EEMAC), Specifications and Standards, Current Edition.
5. Institute of Electrical and Electronics Engineers (IEEE), current edition.
   a. IEEE 519-1992 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
6. International Electrotechnical Association (IEC), Specifications and Standards, Current Edition:
   a. IEC-60439 - Low Voltage Switchgear and Control Gear Assemblies.
7. National Electrical Contractors Association (NECA), current edition.
   a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
8. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition:
   a. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
   b. ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.
   c. ICS 4-2000 - Industrial Control and Systems: Terminal Blocks.
   d. ICS 5-2000 - Industrial Control and Systems: Control Circuit and Pilot Devices.

e. ICS 6-1993 - Industrial Control and Systems Enclosures
f. ICS 7-1993 - Industrial Control and Systems Adjustable-Speed Drives
g. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

9. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition:
   a. UL 508C - Power Conversion Equipment.
10. EN 61000-3-12, EN 61800-3 (1996) +A11 (2000) Category C2
   a. Fulfill all EMC immunity requirements
11. Institute of Electrical and Electronic Engineers (IEEE)
   a. IEEE 519-1992: Guide for harmonic content and control at the point of common coupling

B. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

C. The adjustable frequency drives and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL, CUL, and NEMA.\

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
1. Division 23 – Heating, Ventilating and Air Conditioning (HVAC)
2. Division 26 - Electrical

B. This specification describes the electrical, mechanical, environmental, agency and reliability requirements for three-phase, Adjustable Frequency Drives (AFD) as specified herein and as shown on the contract drawings.

C. Furnish and install complete and operable adjustable frequency drive systems as indicated on the drawings and as specified herein.

D. Motor control equipment specified under this section shall be the product of a single manufacture and shall be the same as that provided under other sections unless stated otherwise.

E. Adjustable frequency drive systems work may include work in new motor control centers and/or work in existing motor control centers. Refer to the drawings for detailed description of the work.

F. AFD and motor circuit shall be sized by the CONTRACTORS to match the actual motors and equipment provided by the contract.

G. When required the AFD shall be sized to convert single-phase service power to

three-phase motor control power.

H. AFD's shall provide the following:

1. Integrated Soft Start Ramp.

2. Integrated PID speed control.

3. Integrated Soft Stop Ramp.

I. AFD's shall integrate into DDC loop communication network.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein in accordance with the requirements specified under Division 23 & 26.

C. The following information shall be submitted to the Engineer.

1. Dimensioned outline drawing.

2. Control Schematic diagram.

3. Power and control connection diagram(s)

D. Submit electronic copies of the above information.

E. The following information shall be submitted specifically for adjustable frequency drive systems:

1. Submit harmonic voltage distortion analysis based upon the minimum three phase bolted fault short circuit current available at the point of service. Submittal data shall not relieve contractor of specified performance requirements. Analysis shall include:

a. Comparison with IEEE 519 standards for acceptable voltage distortions on such systems.

F. When requested by the Engineer the following product information shall be submitted:

1. Product bulletins

2. Technical product data sheets

3. Harmonic analysis results

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein in accordance with the requirements specified under Section 26 24 19, which state that submittals for all motor control equipment be included as part of the submittal for the complete, integrated process instrumentation and control system and in accordance with the requirements specified under Section 26 90 01.

C. The following information shall be provided specifically for adjustable frequency drive systems:
   1. Motor controller data listing identifying the configured values of all adjustable settings and configurable parameters.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications:
   1. All equipment provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than twenty years of documented experience.
   2. The adjustable frequency drive system manufacturer shall have been engaged in the manufacture of PWM style adjustable frequency drives for a minimum of ten years.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Adjustable frequency drive system manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.07 QUALIFICATIONS

A. The supplier of the assembly shall be the manufacturer of the electromechanical power components used within the assembly, such as bypass contactors when specified.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified.

C. The supplier of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Electronic copies of the equipment operation and maintenance manuals shall be provided.

B. Operation and maintenance manuals shall include the following information:

1. Instruction books
2. Dimensional drawings and schematics

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton / Cutler-Hammer products, H-Max series.

B. Allen Bradley, equivalent series.

C. Naming specific venders does not imply acceptance of their standard products nor relieve them from meeting these specifications in their entirety.

1.01 ADJUSTABLE FREQUENCY DRIVES (AFD)

A. Where shown on the drawings, adjustable frequency drives 0.50 through 800 HP shall have the following features:

1. The AFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on a low overload application at 40° C ambient and 1.5 - 10 kHz switching frequency with automatic switching frequency de-rating in case of overload.
2. The AFD's shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFD's are not accepted. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar Junction Transistors, GTOs or SCRs are not accepted. The AFD shall run at the above listed switching frequencies.
3. The AFD's shall have an efficiency at full load and speed that exceeds 97%. The efficiency shall exceed 90% at 50% speed.
4. The AFD's shall maintain a minimum line side displacement power factor of 0.96, regardless of speed and load for VFD's less than 75 HP. The AFD's shall maintain a minimum line side displacement power factor of .99, regardless of speed and load for motors greater than 75 HP.

5. The AFD's shall have a one (1) minute overload current rating of 110% for low overload applications.
6. The AFD's shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AFD.
7. The AFD's shall have an integral EMI/RFI filter as standard.
8. VFD must contain a circuit breaker, fused disconnect is not acceptable.
9. When requested, harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load. The calculations shall be made with the point of common coupling (PCC) being the point where the utility feeds multiple customers.
10. Total harmonic distortion shall be calculated based on total demand distortion conditions as defined in IEEE 519-1992. Copies of these calculations are to be made available upon request. The contractor shall provide any needed information to the AFD supplier three (3) weeks prior to requiring harmonic calculations.
11. The AFD's shall be able to start into a spinning motor. The AFD's shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD's shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
12. Standard operating conditions shall be:

NOTE TO SPEC. WRITER: CONSULTANT TO CHOOSE CORRECT SYSTEM VOLTAGE FROM LIST BELOW

a. Incoming Power: Three-phase, 208 / 230 / 480 (+10% to -10%) and 50/60 Hz (+10 to -5%) power to a fixed potential DC bus level.
b. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.
c. Speed regulation of +/- 0.5% of base speed.
d. Load inertia dependent carryover (ride through) during utility loss.
e. Insensitive to input line rotation.
f. Humidity: 0 to 95% (non-condensing and non-corrosive).
g. Altitude: 0 to 3,300 feet (1000 meters) above sea level.
h. Ambient Temperature: -10 to 40 °C (VT).
i. Storage Temperature: -40 to 70 °C.

13. Control features
    a. Keypad
        1. Frequently accessed AFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the AFD. Keypads

must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not accepted, and particularly those that use alphanumeric code and tables. Keypads shall be adjustable for contrast with large characters easily visible in normal ambient light.

2. The AFD shall include a Hand-Off-Auto selection and an Inverter/Bypass selection. When in "Hand" the AFD will be started and the speed will be controlled from the keypad. When in "Off", the AFD will be stopped. In "Auto", the AFD will start via an external contact closure or a communication network and the AFD speed will be controlled via an external speed reference.
3. The keypad shall have copy / paste capability.
4. Upon initial power up of the AFD, the keypad shall display a start up guide that will sequence all the necessary parameter adjustments for general start up.
5. Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's USB port and Windows™ based software. In addition the software shall permit control and monitoring via the AFD's RS485 port. The manufacturer shall supply a the required software. An easily understood instruction manual and software help screens shall also be provided. The computer software shall be used for modifying the drive setup and reviewing diagnostic and trend information as outlined in this section through section 18.
6. The operator shall be able to scroll through the keypad menu to choose between the following:
    i. Monitor
    ii. Parameters
    iii. Diagnostics
    iv. I/O and Hardware
    v. User Settings
    vi. Favorites
    vii. Direct Access ID

b. The following setups and adjustments, at a minimum, are to be available:
1. Start command from keypad, remote or communications port
2. Speed command from keypad, remote or communications port
3. Motor direction selection
4. Maximum and minimum speed limits
5. Acceleration and deceleration times, two settable ranges
6. Critical (skip) frequency avoidance
7. Torque limit

8. Multiple attempt restart function
9. Multiple preset speeds adjustment
10. Catch a spinning motor start or normal start selection
11. Programmable analog output

c. Inputs/Outputs

1. Inputs – A minimum of six (6) programmable digital inputs, two (2) analog inputs shall be provided with the following available as a minimum:
    i. Remote HOA Hand/On/Off
    ii. Remote forward/reverse
    iii. Remote preset speeds
    iv. Remote external fault
    v. Remote fault reset
    vi. Process control speed reference interface, 4-20 mA DC
    vii. Potentiometer or process control speed reference interface, 0-10V DC
    viii. RS485 Programming and Operator Interface Port
2. Outputs – A minimum of two (2) programmable form C Relay outputs, (1) programmable form A Relay output, and (1) programmable analog output shall be provided, with the following available at minimum.
3. Programmable relay outputs selectable with the following available at minimum:
    i. Fault
    ii. Run
    iii. Ready
    iv. Reversing
    v. Preset Speed
    vi. At speed
    vii. Wrong Direction
    viii. Damper Control Relay
    ix. Over temperature Alarm
4. Programmable analog output signal, selectable with the following available at minimum:
    i. Output frequency
    ii. Frequency reference
    iii. Motor speed
    iv. Output current
    v. Motor torque

vi. Motor power
vii. Motor voltage
viii. DC link voltage
ix. PID controller set point value
x. PID controller output value
xi. PID controller feedback value
xii. PID controller error value

d. Capability of two additional expandable I/O interface cards. Upon installation, software shall automatically identify the interface card and activate the appropriate parameters. This should be done without adding any new software.

14. Monitoring and Displays

a. The AFD's display shall be a multi-line graphic type window capable of displaying nine lines of text and the following thirteen (13) status indicators:

i. Run
ii. Forward
iii. Reverse
iv. Stop
v. Ready
vi. Alarm
vii. Fault
viii. I/O Terminal
ix. Keypad
x. Fieldbus
xi. Hand
xii. Auto
xiii. Off

b. The AFD's keypad shall be capable of displaying the following monitoring functions at a minimum and be able to monitor any nine of them on a single screen:

i. Motor Speed (RPM and %)
ii. Analog Input 1
iii. Analog Input 2
iv. Output frequency
v. Motor current
vi. Motor torque
vii. Motor power (kW and %)
viii. Motor voltage

ix. DC-link voltage
x. Heat sink temperature
xi. Motor temperature
xii. Run time hours (resettable)
xiii. Power on hours (resettable)
xiv. Total megawatt hours
xv. Megawatt hours (resetable)
xvi. Digital inputs status
xvii. Analog and relay outputs status
xviii. PID references

c. The AFD's keypad shall be able to measure in the following units:
i. Temperature in Fahrenheit
ii. Temperature in Celsius
iii. PSIG
iv. BAR
v. FEET
vi. Inches of Water Column
vii. Gallons per minute
viii. Feet per minute
ix. Cubic Feet per minute
x. Parts per Million
xi. %

15. Protective Functions
a. The AFD shall include the following protective features at minimum:
i. Overcurrent
ii. Overvoltage
iii. System fault
iv. Undervoltage
v. Input line supervision
vi. Output phase supervision
vii. Under temperature
viii. Overtemperature
ix. Motor stalled
x. Motor over temperature
xi. Motor under load

b. The AFD shall provide ground fault protection during power-up, starting, and running. AFD's with no ground fault protection during running are not accepted.

16. Diagnostic Features
    a. Active Faults
        1. The last 10 faults shall be recorded and stored in sequential order
        2. Fault name and description of fault shall be displayed on the keypad.
        3. Fault or alarm display shall blink
        4. Display drive data at time of fault (including date and time of occurrence)
        5. In the event several faults occur simultaneously, the sequence of active faults shall be viewable.
        6. During a fault, the drive must be able to identify the following:
            i. Code
            ii. ID
            iii. State
            iv. Date
            v. Time
            vi. Operating Time
            vii. Motor Current
            viii. Output Frequency
            ix. Output Voltage
            x. DC-Link Voltage
            xi. Motor Control Status
            xii. Motor Temperature
            xiii. Heat Sink Temperature
    b. Fault History
        1. The last 40 faults shall be recorded and stored in sequential order.
        2. Display drive data (including date and time) at time of fault
17. Additional features included in the AFD's:
    a. The current withstand rating of the open VFD shall be 100,000 AIC.
    b. Built in communication capability options shall include Modbus RTU, Johnson Controls Metasys N2, Bacnet MSTP, Bacnet/IP. Modbus/TCP and expansion card communications shall include LonWorks
    c. The AFD shall have a cooling fan that is field replaceable using non-screw accessibility.
    d. AFD shall have conformal coated circuit boards for maximum protection of air quality conditions meeting IEC 60068-2-60 requirements. Chemical

vapors IEC 60721-3-3, unit in operation class 3C3 and mechanical particles IEC 60721-3-3, unit in operation, class 3S2.

e. AFD shall not use Electrolytic Capacitors within the power circuit and shall have a minimal maintenance free shelf life of no less than 5 years.

f. AFD shall have an active (not static V/Hz curve) energy control algorithm to ensure maximum energy savings. AFD software shall include energy optimization algorithm. The software algorithm shall compare output voltage to the motor load. The output voltage is optimized to reduce the motor core losses and maintain a high enough voltage to prevent the motor from becoming unstable.

18. Enclosure

    a. The AFD may be designed in a NEMA Type 1, NEMA 12, or NEMA 3R enclosure.

    b. The current withstand rating of the enclosed VFD shall be 65,000 AIC.

    c. The AFD shall have complete front accessibility with easily removable assemblies.

    d. Cable entry shall be top or bottom entry.

19. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

2.02 CONTROL POWER TRANSFORMER

A. Provide a control power transformer mounted and wired inside of the drive system enclosure.

B. The transformer shall be rated for drive power plus 250VA for customer use.

2.03 PILOT CONTROL DEVICES

A. Provide front of inner door panel mounted pilot devices as shown on drawings or described in section 26 90 01.

B. Provide remote AFD HMI modules.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.
2. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The AFD shall trip electronically without device failure.
3. After all tests have been performed; each AFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.
4. After the burn-in cycle is complete, each AFD shall be put through a motor load test before inspection and shipping.

B. All testing and manufacturing procedures shall be ISO 9001 certified.

3.02 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Identify deviation from physical sizes shown on the drawings to Engineer prior to bid date.

D. Contractor shall be responsible for modifications to the installation due to deviations from physical sizes shown on the drawings.

E. Identify conflicts with the work of other trades prior to installation of electrical equipment.

F. Record nameplate data for each motor served.

3.03 DELIVERY, STORAGE, AND HANDLING

A. Accept adjustable frequency motor controllers on site. Inspect for damage.

B. The Contractor shall be responsible for all equipment necessary to receive, unload, move into building, and install motor control centers.

C. The Contractor shall be responsible for coordinating specific shipping split requirements with the manufacturer/supplier.

D. Conform to written instructions of manufacturer.

E. Protect adjustable frequency motor controllers from corrosion and entrance of debris.

F. Store adjustable frequency motor controllers above grade. Protect from environment with suitable covering.

3.04 INSTALLATION

A. Adjust disconnecting means trip settings to satisfy motor nameplate requirements.

B. Record information for motor data labels and install motor data labels.

C. Adjust all programmable drive features, including but not limited to auto restart parameters. The drive system must automatically restart after a power fail condition.

D. Provide typed label inside each unit identifying configured values for all programmable drive parameters.

E. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of all connections.

F. Verify that cooling fans are operating properly.

G. Thoroughly clean and remove construction debris from filters, enclosure interior and exterior.

3.05 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of AFD on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer’s installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.

B. The Contractor under the technical direction of the manufacturer's service representative shall perform the following minimum work.
   1. Inspection and final adjustments.
   2. Operational and functional checks of AFD and spare parts.
   3. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

3.06 MAINTENANCE / WARRANTY SERVICE

A. Warranty to commence 12 months from the date of start-up.

3.07 FIELD TESTING

3.08 TRAINING

A. The Contractor shall provide a training session for up to 8 hours owner's representatives for 2normal workdays with a maximum of 2 trips at a job site location determined by the owner. Training and instruction time shall be in addition to that required for start-up service.

B. The manufacturer's qualified representative shall conduct the training.

C. The training program shall consist of the following:
   1. Instructions on the proper operation of the equipment.
   2. Instructions on the proper maintenance of the equipment.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA PB 1 - Panelboards
      b. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
      c. NEMA AB 1 - Molded Case Circuit Breakers.
      d. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
      e. NEMA 250 - Enclosures for Electrical Equipment.
   4. International Electrical Testing Association (NETA)
      a. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL 50 - Enclosures for Electrical Equipment
      b. UL 67 - Panelboards.
      c. UL 98 - Enclosed and Dead-front Switches
      d. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
   6. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
      b. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
   7. Federal Specifications and standards, current edition:
      a. W-P-115C - Type I Class 1
      b. W-C-375B - Molded Case Circuit Breakers
      c. W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
      d. W-P115C - Type 1 Class 2 Load Center

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable panelboards as indicated on the drawings and as specified herein.

B. Furnish and install the lighting panels and panel boards as shown and scheduled on the plans:

1. LP-L4B – 208/120VAC 4W

2. PP – 480VAC 3W

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for panelboards:

1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
2. Overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. Illustrate one line diagrams with applicable voltage systems.
3. Equipment ratings for voltage, amperage, and short circuit.

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit the following information specifically for panelboards:

1. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: All panelboards provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than fifty years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.07 WARRANTY

A. See Division 01 for additional requirements.

1.08 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 480VAC Lighting and Appliance Panelboards

A. Manufacturers:
   1. Square D Company NF - Class 1670
   2. Cutler-Hammer
   3. or equal

B. Interior:
   1. Rated 480Y/277 vac maximum. Continuous main current ratings, as indicated on drawings, not to exceed 600 amperes maximum for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
   2. UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.
   3. Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar.
   4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
   5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
   6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.
   7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
   8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

9. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Interior phase bus shall be pre-drilled to accommodate field installable options such as sub-feed lugs, sub-feed breakers, thru-feed lugs.
11. Interiors shall accept 125 ampere breakers in group mounted branch construction.

C. Main Circuit Breaker:
1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 degrees C ambient environment. Thermal elements shall be ambient compensating above 40 degrees C.
2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
3. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position where indicated on the drawings.
5. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application. Lug body shall be bolted in place; snap-in designs are not acceptable.
6. The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

D. Branch Circuit Breakers:
1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
2. Molded case branch circuit breakers shall have bolt-on type bus connectors.

3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
4. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.
5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
6. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application.
7. Breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Auxiliary Switch, and Alarm Switch.
8. Circuit breakers shall be UL Listed with the following ratings where indicated on the drawings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), and (15-20A) Switch Duty (SWD)

E. Enclosures:
1. Type 1:
   a. Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
   b. Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
   c. Box width shall not exceed 26-inches wide.
   d. Type 1 Fronts:
   e. Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   f. Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on the drawings.
   g. Panelboards rated 250 amperes and below shall have fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.
   h. Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
2. Type 3R, 5, and 12:

a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
b. All doors shall be gasketed and equipped with a tumbler type vault lock and two additional quarter turn fasteners on enclosures 59-inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
c. Maximum enclosure dimensions shall not exceed 21-inches wide and 9.5-inches deep.

2.02 240VAC LIGHTING AND APPLIANCE PANELBOARDS

A. Manufacturers:
1. Square D Company NQOD - Class 1630
2. Cutler-Hammer Pow-R-Line
3. or equal

B. Interior:
1. Rated for 240VAC / 48VDC maximum. Continuous main current ratings, as indicated on the drawings, not to exceed 600 amperes maximum.
2. UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.
3. Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.
4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
6. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.
7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Circuit Breakers:

a. Main circuit breakers shall be vertically mounted.
b. Sub-feed circuit breakers shall be vertically mounted.
c. Molded case branch circuit breakers shall have bolt-on type bus connectors.
d. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
e. The exposed faceplates of all branch circuit breakers shall be flush with one another.

C. Enclosures:
1. Type 1:
a. Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Zinc-coated galvannealed steel will not be acceptable.
b. Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
c. Box width shall be 26-inch wide maximum.
d. Type 1 Fronts:
1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on the drawings.
3) Panelboards shall have fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
2. Type 3R, 5, and 12:
a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59-inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
c. Maximum enclosure dimensions shall not exceed 21-inches wide and 6.5-inches deep.

D. Manual Transfer Assembly:
1. Provide U.L. Listed manual transfer assembly where indicated on the drawings.
2. Manual transfer shall consist of two backfed main circuit breakers sized as indicated on the drawings complete with retaining kits and mechanical

interlock to prevent both circuit breakers from simultaneously being in the "on" position.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.
6. Circuit breakers shall be factory sealed with a hologram quality mark and shall have date code on face of circuit breaker.
7. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end use equipment along with the statement "Caution - Series Rated System. _____ A Available. Identical Replacement Component Required".
8. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.
9. The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position for all circuits that supply exit signs, emergency lights, energy management, control system panels, and fire alarm panels.
10. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
11. Circuit breakers shall be fixed construction with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable lugs. Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90 degree C rated wire, sized according to the 75 degree C temperature rating in the National Electrical Code.
12. All circuit breakers shall be capable of accepting bus connections.

B. Thermal-Magnetic Circuit Breakers
   1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
   2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40 degree C ambient temperature.
   3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.
   4. Standard two- and three-pole circuit breakers up to 250 amperes at 600 VAC shall be UL Listed as HACR type.

C. Equipment Ground Fault Protection (Thermal Magnetic Circuit Breakers)
   1. Circuit breakers 250 amperes and less shall be equipped with a Ground Fault Module.
   2. Ground fault sensing system shall be modified zero sequence sensing type.
   3. The ground fault system shall require no external power to trip the circuit breaker.
   4. Companion circuit breaker shall be equipped with a ground-fault shunt trip.
   5. The ground fault sensing system shall be suitable for use on grounded systems. The ground fault sensing system shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.
   6. Ground fault pickup current setting and time delay shall be field adjustable. A switch shall be provided for setting ground fault pickup point. A means to seal the pickup and delay adjustments shall be provided.
   7. The ground fault sensing system shall include a ground fault memory circuit to sum the time increments of intermittent arcing ground faults above the pickup point.
   8. A means of testing the ground fault system to meet the on-site testing requirements of NEC Section 230-95(c) shall be provided.
   9. Local visual ground fault trip indication shall be provided.
   10. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on the drawings.
   11. The companion circuit breaker shall be capable of being group mounted.
   12. The ground fault sensing system shall not affect interrupting rating of the companion circuit breaker.

D. Electronic Trip Circuit Breakers With Standard Function Trip System
   1. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the drawings.
   2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
   3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be

clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80 percent of their ampere rating continuously.

4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
   a. Long Time Pickup Instantaneous Pickup
   b. Long Time Delay
   c. Short Time Pickup (I^2t OUT only)
   d. Short Time Delay (I^2t IN only)
5. A means to seal the trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
6. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
7. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in true rms with 2 percent accuracy.
8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
9. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
10. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
11. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

E. Electronic Trip Circuit Breaker With Full Function Trip System
   1. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated drawings.
   2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
   3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100 percent of their ampere rating continuously (except for 600 A frame and 2500 A frame).
   4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
      a. Long Time Pickup Instantaneous Pickup
      b. Long Time Delay

c. Short Time Pickup
d. Short Time Delay (I^2t IN and I^2t OUT)

5. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short-time withstand ratings shall be specified in rms symmetrical amperes, as shown on the drawings.
6. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
8. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2 percent accuracy.
9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
10. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
11. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
12. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.
13. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
14. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on drawings.

F. Equipment Ground Fault Protection (Electronic Trip Circuit Breakers)

1. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.
2. A separate neutral current transformer shall be provided for three-phase four-wire systems as indicated on drawings.
3. Ground fault sensing system shall be residual sensing type.
4. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.
5. A means of testing the ground fault system to meet the on-site testing requirements of NEC Section 230-95(c) shall be provided.
6. Local visual trip indication for a ground fault trip occurrence shall be provided.
7. Zone Selective Interlocking (ZSI) communications capabilities on the ground fault

function compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on drawings shall be provided.

8. Circuit breakers shall be provided with communications capabilities for remote alarm indication only (no trip) per NEC Section 700-7(d) for emergency systems.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact panelboard locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust panelboard installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept panelboard on site. Inspect for damage.

B. Protect panelboard from corrosion and entrance of debris.

C. Store panelboard above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install panelboards plumb and flush with wall finishes.

B. Install panelboards such that top of panel is located at an elevation of 6-feet above finished floor elevation.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

E. Stub five empty 1-inch conduits to accessible location above ceiling or below floor of each flush-mounted panelboard to allow for future expansion.

F. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent. Take care to maintain proper phasing for multi wire branch circuits.

G. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

H. Verify that bonding jumper is properly installed in service entrance rated panels.

I. Thoroughly clean and remove construction debris from panelboard interior and exterior.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

3.05 TRAINING

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

END OF SECTION

SECTION 26 28 16

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA FU 1 - Low Voltage Cartridge Fuses
      b. NEMA KS 1 - Enclosed Switches
      c. NEMA 250 - Enclosures for Electrical Equipment.
   4. International Electrical Testing Association (NETA)
      a. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 98 - Enclosed and Dead Front Switches

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable enclosed circuit breakers as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for enclosed circuit breakers:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

1.05 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Division 01 for additional requirements.

1.07 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 250VAC/600VAC ENCLOSED CIRCUIT BREAKER

A. Manufacturers:
   1. Square D Company
   2. Cutler-Hammer
   3. or equal

B. Operating Mechanism:
   1. The circuit breaker operating handle shall be:
      a. Directly operable through the front cover of the enclosure for Type 1 enclosures.
      b. Externally operable with the operating mechanism being an integral part of the box, not the cover for circuit breakers through 1000 amperes in Type 3R, 4X, Type 12, and Type 12K enclosures.
      d. Externally operable with the operating mechanism being an integral part of the cover for Type 7 and Type 9 enclosures.
   2. Provisions for padlocking the circuit breaker in the OFF position shall be provided.
   3. Enclosures designated as Type 3R, 4X, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and prevent turning the circuit breaker ON when the enclosure cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

C. Enclosure:
   1. Covers:
      a. Type 1 and 3R painted aluminum or steel enclosures: attached with welded pin-type hinges.
      b. Type 7/9 enclosures: attached with Type 316 stainless steel bolts.

2. Finish:
    a. Type 1 enclosures: gray baked enamel paint electrodeposited on cleaned, phosphate pre-treated steel.
    b. Type 4X Fiberglass or poly construction. Stainless steel enclosures shall not be allowed.
3. The external operating handle shall be provided with a dual colored, red/black indicating handle knob.
4. Conduit Connections:
    a. Type 1, & 12K: tangential knockouts.
    b. Type 12 and 4-4X-5: no knockouts; supply watertight hubs.
    c. Type 7 and 9: threaded conduit openings in both endwalls.
    d. Type 3R: interchangeable bolt-on hubs in the top endwall.
5. Cover sealing means for enclosures rated through 1200 ampere shall be quick-release trunk latches (Type 4-4X-5 stainless steel, 12, and 12K).
6. Type 12, 4-4X-5 enclosures shall be dual rated as Type 3R to facilitate their use in outdoor applications.

D. ENCLOSURE RATINGS

1. A. The integrated equipment short circuit current rating shall be equal to the interrupting rating at the supply voltage marked on the circuit breaker installed, up to 200,000 rms symmetrical amperes short circuit current, or as shown on enclosure wiring diagram.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact enclosed circuit breaker locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust enclosed circuit breaker installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept enclosed circuit breakers on site. Inspect for damage.

B. Protect enclosed circuit breakers from corrosion and entrance of debris.

C. Store enclosed circuit breakers above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install enclosed circuit breakers plumb and level.

B. Install enclosed circuit breakers such that top of enclosure is located at an elevation of 6-feet above finished floor elevation.

C. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

D. Verify that bonding jumper is properly installed in service entrance rated circuit breakers.

E. Thoroughly clean and remove construction debris from switch interior and exterior.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

3.05 TRAINING

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

END OF SECTION

SECTION 26 28 16.15

DISCONNECT RATED PLUGS AND RECEPTCLES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 98 - Enclosed and Dead Front Switches

B. Plugs and receptacles must be listed to UL Subject 2682 'Switch Rated Plugs and Receptacles.' (Alternate for Canada: Plugs and receptacles must be CSA listed to UL Subject 2682 'Switch Rated Plugs and Receptacles').

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable plugs and enclosed circuit breakers as indicated on the drawings and as specified herein.

B. Furnish plugs and receptacles with optional Aux Pilot Contacts when required. The Contactor may elect to provide multiple plugs sets instead of Aux Pilot Contacts.
   1. Aux Pilot Contacts shall be provided for signals form motors; such as thermostats and seal fails signals.
   2. Aux Pilot Contacts shall be provided to signal to motor controller the motor circuit is open.
   3. Aux Pilot Contacts shall be provided for signals and equipment/device connections.

C. Selection of Plugs and Receptacles types are shall be based on application and environment if is being installed.

D. Plugs and Receptacles and be labeled and oriented to prevent incorrect connections.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for enclosed circuit breakers:

1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
2. Outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

1.05 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Division 01 for additional requirements.

1.07 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

1. Meltric
2. or equal

2.02 DECONTACTOR SERIES SWITCH RATED PLUGS & RECEPTACLES

A. Plugs and receptacles must have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.

B. Receptacles must have dead front construction: live parts must be inaccessible to thin tool or wire.

C. Plugs and receptacles must be able to close at least once on a conditional short-circuit current of 65,000A. (Short circuit testing should be performed with RK1 current limiting fuses sized at 400% of the highest full load motor ampacity associated with the device).

D. Plugs and receptacles must incorporate an integral switching mechanism to ensure the load is broken before the plug is removed from the receptacle.

E. Plug and receptacle wire terminals must be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.

F. The minimum environmental rating of plugs and receptacles must be Type 3R (DS Series), Type 4X and IP 66+67 (DSN Series), or IP67 (DB Series).

G. Ingress protection must be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation (except DB Series).

H. Plugs and receptacles must have a system of different keying positions in order to discriminate between circuits or incompatible operating voltages or frequencies.

I. Plugs and receptacles installed outdoor must be able to withstand UV radiation.

J. Plugs and receptacles shall be Meltric Decontactor Series or equal.

2.03 SPECIFICATIONS FOR DXN HAZARDOUS DUTY RATED PLUGS & RECEPTACLES

A. Plugs and receptacles shall be UL or CSA rated for Class I Division 2 Group A, B, C, D and Class II Division 2 Group E, F, G environments.

B. Plugs and receptacles shall be rated to ATEX II 2 G/D DUST T85 EEx ed IIC T6.

C. The minimum environmental rating of plugs and receptacles must be IP 66+67. Ingress Protection must be achieved automatically when the plug is fully inserted into the receptacles, without any additional manual operation.

D. Receptacles shall have a dead front, live parts must be inaccessible to a thin tool or wire.

E. Plugs and receptacles shall have constant pressure butt-contacts with solid silver-nickel contact tips. Pin and sleeve contacts are not permitted.

F. Plugs and receptacles shall be able to safely connect and disconnect equipment under full load in potentially explosive environments.

G. Hazardous duty rated plugs and receptacles shall be Meltric DXN Series or equal.

2.04 SPECIFICATIONS FOR PF/PFQ HIGH AMPERAGE PLUGS & RECEPTACLES

A. Plugs and receptacles must be Meltric PF/PFQ Series or equal.

B. Plugs and receptacles must have constant pressure type silver contacts. Pin and sleeve contacts are not permitted.

C. Receptacles must have a safety shutter to protect female contacts and inhibit access to live parts.

D. The minimum environmental rating of plugs and receptacles must be IP 66/67.

E. Plug and receptacles must feature a mechanical locking system that engages pilot contacts and subsequently energizes the plug. Furthermore, the plug cannot be removed from the receptacles without releasing the mechanical lock and thus disengaging the pilot contacts which must be electrically interlocked via a pilot control circuit.

F. Plug and receptacle casing must be epoxy coated aluminum material.

2.05 SPECIFICATIONS FOR DR SERIES PLUGS & RECEPTACLES

A. Plugs and receptacles must have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.

B. Receptacles must have dead front construction: live parts must be inaccessible to thin tool or wire.

C. Plugs and receptacles must incorporate an integral load break mechanism to ensure the load is broken before the plug is removed from the receptacle.

D. Plug and receptacle wire terminals must be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.

E. The minimum environmental rating of plugs and receptacles must be Type 3R.

F. Ingress protection must be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.

G. Plugs and receptacles must have a system of different keying positions in order to discriminate between circuits or incompatible operating voltages or frequencies.

H. Plugs and receptacles installed outdoor must be able to withstand UV radiation.

I. Plugs and receptacles shall be Meltric DR Series or equal.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact disconnect and application locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust enclosed circuit breaker installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept plugs and receptacles on site. Inspect for damage.

B. Protect plugs and receptacles from corrosion and entrance of debris.

C. Store plugs and receptacles above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install plugs and receptacles plumb and level.

B. Install plugs and receptacles such that top of enclosure is located at an elevation of 6-

feet above finished floor elevation.

C. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

D. Verify that bonding jumper is properly installed in service entrance rated circuit breakers.

E. Thoroughly clean and remove construction debris from the interior and exterior.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
         1) NFPA 70 - National Electrical Code.
      b. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
      c. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
         1) NEMA FU 1 - Low Voltage Cartridge Fuses
         2) NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
         3) NEMA 250 - Enclosures for Electrical Equipment.
      d. International Electrical Testing Association (NETA)
         1) NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
      e. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
         1) UL 98 - Enclosed and Dead Front Switches

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable enclosed switches as indicated on the drawings and as specified herein.

B. Furnish and install spare fuse cabinet.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for enclosed switches:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Outline drawings with dimensions.
   3. Equipment ratings for voltage, amperage, horsepower and short circuit.

1.05 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Division 01 for additional requirements.

1.07 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Supply five spare fuses of each type supplied for this project

PART 2 PRODUCTS

2.01 250VAC/600VAC HEAVY DUTY DISCONNECT SWITCH

A. Manufacturers:
   1. Square D Company
   2. Cutler-Hammer
   3. or equal

B. Switch Interior:
   1. All switches shall have switch blades which are visible when the switch is off and the cover is open.
   2. Lugs shall be front removable and UL Listed for 60 degree C or 75 degree C aluminum or copper conductors as required by the application.
   3. Fusible switches shall be equipped with factory installed or field installed fuse pullers.
   4. Switches shall be equipped with plated copper current carrying parts to resist corrosion.
   5. Switches shall be equipped with removable arc suppressors to facilitate access to line side lugs.
   6. Switches shall have provisions for a field installable electrical interlock.

C. Switch Mechanism:
   1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be restrained by the operating handle after the closing or opening action of the contacts has started.
   2. The operating handle shall be an integral part of the box, not the cover.

3. The handle position shall travel at least 90 degrees between off and on positions to clearly distinguish and indicate handle position.
4. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is on and prevent turning the switch on when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

D. Switch Enclosures:
   1. Environmental Rating:
      a. Service entrance switch, exterior: Type 3R, painted.
      b. Service entrance switch, interior: Type 1, painted.
      c. Disconnect switch, exterior: Type 3R, painted.
      d. Disconnect switch, interior: Type 1, 4x, or 12.
   2. Covers:
      a. Type 1, 3R, and 12 stainless steel enclosures: attached with welded pin-type hinges.
      b. Type 7/9 enclosures: attached with Type 316 stainless steel bolts.
   3. Finish:
      a. Type 1 enclosures: gray baked enamel paint electrodeposited on cleaned, phosphate pre-treated steel.
      b. Type 4X fiber glass or poly construction enclosures: stainless steel will not be allowed.
   4. The enclosure shall have on and off markings stamped or cast into the cover.
   5. The operating handle shall be provided with a dual colored, red/black position indication.
   6. All switches shall have provisions to accept up to three 3/8-inch hasp padlocks to lock the operating handle in the off position.
   7. Exterior switches shall have provisions to accept one 3/8-inch hasp padlocks to lock the operating handle in the on position.
   8. Conduit Entrance:
      a. Tangential knockouts shall be provided for Type 1 switches rated 30-600A.
      b. Watertight conduit hubs for Type 3R switches.
   9. Cover sealing means for switches rated through 200 amperes shall be quick release trunk latches (Type 1, 3R, 4X stainless steel enclosures)
   10. Type 3R to facilitate their use in outdoor applications.

E. Switch Ratings:
   1. Switch shall be suitable for use as service entrance equipment where use is indicated on the drawings.
   2. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.
   3. Switches shall be rated for the voltage applied.
   4. The UL Listed short circuit current rating of the switches shall be:
      a. 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).
      b. 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes).
      c. 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

2.02 FUSES

A. Manufacturers:
   1. Bussmann
   2. or equal

B. 250 Volt Fuses:
   1. Class RK-1, one end rejection or to fit mountings specified. 0-600 ampere, 200,000 ampere interrupting rating.
   2. Low-Peak LPN-R, dual element, time delay with short circuit protection for motor, transformer, feeder and main service protection.

C. 600 Volt Fuses:
   1. Class RK-1, one-end rejection or to fit mountings specified, 0-600 ampere, 200,000 ampere interrupting rating.
   2. Low-Peak LPS-R, dual element, time delay with short circuit protection. 0-600 ampere, 200,000 ampere interrupting rating for motor, transformer, feeder and main service protection.
   3. Class L, bolt-in, 601-6,000 amperes, 200,000 ampere interrupting rating.
   4. HI-CAP KRP-C, time delay for overload and short circuit protection. 601-6,000 amperes, 200,000 ampere interrupting rating for motor, transformer, feeder and main service protection.
   5. Class CC, fast acting, single element, 0-30 amperes, 200,000 ampere interrupting rating.

2.03 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

B. Doors: Hinged, with padlock hasp.

C. Finish: Field painted.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact enclosed switch locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust enclosed switch installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept enclosed switches on site. Inspect for damage.

B. Protect enclosed switches from corrosion and entrance of debris.

C. Store enclosed switches above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install fuses where switches are indicated as fusible switches on the drawings.

B. Install wall mounted enclosure for spare fuses.

C. Install enclosed switches plumb and level.

D. Install enclosed switches such that top of enclosure is located at an elevation of 6-feet above finished floor elevation.

E. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

F. Verify that bonding jumper is properly installed in service entrance rated switches.

G. Thoroughly clean and remove construction debris from switch interior and exterior.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

3.05 TRAINING

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

END OF SECTION

SECTION 26 29 13

MOTOR CONTROLLERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. Canadian Standards Associates (CSA), Specifications and Standards, Current Edition.
   3. European Committee for Electrotechnical Standardization (CENELEC), Current Edition.
      a. EN 60947 - Low-Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters
   4. Electrical and Electronic Manufacturers Association Canada (EEMAC), Specifications and Standards, Current Edition.
   5. International Electrotechnical Association (IEC), Specifications and Standards, Current Edition:
      a. IEC-60439 - Low Voltage Switchgear and Control Gear Assemblies.
   6. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   7. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition:
      a. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
      b. ICS 4-2000 - Industrial Control and Systems: Terminal Blocks.
      c. ICS 5-2000 - Industrial Control and Systems: Control Circuit and Pilot Devices.
      d. ICS 6-1993 - Industrial Control and Systems Enclosures.
   8. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition:
      a. UL 508 - Industrial Control Equipment.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 24 19 - Motor Control Centers
   2. Section 26 90 00 - Process Instrumentation & Control

B. Furnish and install complete and operable motor controllers as indicated on the drawings and as specified herein.

C. Motor control equipment specified under this section shall be the product of a single manufacture and shall be the same as that provided under Section 26 24 19 unless stated otherwise.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein in accordance with the requirements specified under Section 26 24 19, which state that submittals for all motor control equipment be included as part of the submittal for the complete, integrated process instrumentation and control system and in accordance with the requirements specified under Section 26 90 00.

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein in accordance with the requirements specified under Section 26 24 19, which state that submittals for all motor control equipment be included as part of the submittal for the complete, integrated process instrumentation and control system and in accordance with the requirements specified under Section 26 90 00.

C. The following information shall be provided specifically for adjustable frequency drive systems:
   1. Motor controller data listing identifying the configured values of all adjustable settings and configurable parameters.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: All motor controllers provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than twenty years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Motor Control Center manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.07 WARRANTY

A. See Division 01 for additional requirements.

1.08 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Allen-Bradley.

B. Eaton/Cutler-Hammer.

C. Square D.

2.02 MANUAL MOTOR CONTROLLERS

A. Manual Single-Phase or Three-Phase Starters:
   1. The starter shall have a quick-make/quick-break toggle mechanism.
   2. The overload shall have a field adjustment allowing up to +/- 10 percent variance in ratings of the nominal heater value.
   3. The closure of the contacts shall be blocked while the line terminals are exposed. The operating handle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED
   4. The enclosure shall be NEMA 1 - General Purpose, NEMA 1B - General Purpose Flush Mounted, NEMA 3/4/5 - Watertight, or NEMA 7D - Hazardous Location as indicated on the contact drawings.
   5. The starter shall have provisions for padlocking in the OFF position

2.03 ELECTROMECHANICAL MOTOR CONTROLLERS

A. Overload Protection:
   1. General:
      a. Provide Type 2 overload protection where indicated on the drawings.
      b. Provide Type 1 overload protection where indicated on the drawings and for all motor controllers where overload protection type is not specified on the drawings.
   2. Type 1 Overload Protection:
      a. Motor starter units shall have a 3-pole manual reset solid-state overload relays with alarm contacts and providing Class 20 operation with the following protection features:
         1) Over current.
         2) Phase loss.
         3) Ground fault.
         4) Jam protection.
   3. Type 2 Overload Protection:
      a. Motor starter units shall have a manual reset electronic overload relay that incorporates the following features:
         1) On-board DeviceNet communications.
         2) LEDs for status indication.
         3) Test/Reset button.
         4) Adjustable trip of NEMA Class 5 to 30. Unless indicated, the trip class

shall be set for NEMA Class 20 operation.

5) Four inputs and two outputs. Refer to the drawings for connection requirements.
6) Protective Functions:
   (a) Functions shall provide a programmable trip level, warning level, time delay, and inhibit window.
   (b) Protective functions shall include thermal overload, underload, jam, current imbalance, stall, phase loss, zero sequence ground fault (if specified), and PTC thermistor input (if specified on drawings).
7) Current Monitoring functions shall include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized and ground fault current (if specified).
8) Diagnostic Information shall include device status, warning status, time to reset, trip status, time to overload trip, and history of last five trips.

B. Non-Reversing Starters:
   1. Magnetic starters through NEMA Size 9 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have one (1) NO auxiliary contact
   2. Coils shall be permanently marked with voltage, frequency and part number
   3. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Size 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed

C. Reversing Starters:
   1. Reversing starters shall consist of two (2) contactors and a single overload relay assembled together. The contactors shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously
   2. Magnetic starters through NEMA Size 8 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring
   3. Coils shall be permanently marked with voltage, frequency and part number
   4. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Sizes 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed

D. Two-Speed Starters:
   1. Two-speed, one-winding starters shall consist of one three-pole contactor and one five-pole contactor and a single overload relay assembled together. The contactors shall be electrically interlocked to short the low speed motor terminals when high speed is activated.
   2. Two-speed, two-winding starters shall consist of two three-pole contactors and a single overload relay assembled together. The contactors shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously.

3. Magnetic starters through NEMA Size 6 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring
4. Coils shall be permanently marked with voltage, frequency and part number
5. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any combination of normally open or normally closed contacts. Sizes 3 through 6 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any combination of normally open or normally closed contacts

2.04 ISOLATION CONTACTORS

A. General:
1. Contactors shall be NEMA rated devices suitable for the application intended.
2. Provide Isolation contactors where indicated on the drawings.

B. Isolation:
1. Input contactor shall provide positive isolation of the controller from line power.
2. Input contactor shall close when motor is signaled to start, energizing the controller and allowing adjustable speed control.
3. Input contactor shall open after the controller has stopped the motor and de-energize the controller.
4. Input contactor shall not switch loaded motor under any circumstances.
5. Input contractor shall not switch control power.

2.05 ENCLOSURES

A. The enclosure shall be NEMA 12 as indicated on the contract drawings.

B. Starters shall have an adjustable instantaneous motor circuit protector (HMCP) type disconnect device.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact motor controller locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Identify deviation from physical sizes shown on the drawings to Engineer prior to bid date.

D. Contractor shall be responsible for modifications to the installation due to deviations from physical sizes shown on the drawings.

E. Identify conflicts with the work of other trades prior to installation of electrical equipment.

F. Record nameplate data for each motor served.

G. Adjust motor controller installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept motor controller on site. Inspect for damage.

B. The Contractor shall be responsible for all equipment necessary to receive, unload, move into building, and install motor control centers.

C. Conform to written instructions of manufacturer.

D. Protect motor controllers from corrosion and entrance of debris.

E. Store motor controllers above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Adjust disconnecting means trip settings to satisfy motor nameplate requirements.

B. Provide overload relays sized and adjusted for the actual nameplate data recorded for each motor. No additional compensation will be allowed due to failure to select overload devices based upon actual motor nameplate data.

C. Record information for motor data labels and install motor data labels.

D. Install motor controllers plumb and flush with wall finishes.

E. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of all connections.

F. Thoroughly clean and remove construction debris from panelboard interior and exterior.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

B. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TRAINING

A. Refer to the requirements of Section 26 08 00 - Commissioning of Electrical Systems.

B. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

END OF SECTION

SECTION 26 90 60

ETHERNET NETWORKING EQUIPMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. ANSI/ISA-5.1-1984 - Instrumentation Symbols and Identification.
      b. ANSI/ISA-5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
      c. ANSI/ISA-95.00.01-2000 - Enterprise Control System Integration, Part 1: Models and Terminology.
      d. ANSI/ISA-TR99.00.01-2004, Security Technologies for Manufacturing and Control Systems.
      e. ANSI/ISA-TR99.00.02-2004, Integrating Electronic Security into the Manufacturing and Control Systems Environment.
   2. Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Specifications and Standards, current edition:
      a. TIA/EIA-568-A - Commercial Building Telecommunications Wiring.
      b. TIA/EIA-569-A - Commercial Building Standards for Telecommunications Pathways and Spaces.
      c. TIA/EIA-606 - Documentation.
      d. TIA/EIA-607 - Commercial Building Bonding and Grounding Requirements.
      e. TIA/EIA TSB-67 - Transmission Performance for Field Testing of Unshielded Twisted Pair Cabling Systems.
      f. TIA/EIA TSB-72 - Centralized Optical Fiber Cabling Guidelines.
      g. TIA/EIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant.
      h. TIA/EIA-429-AAA - Detail Specification for 62.5 - UM Core Diameter/125-UM Platting Diameter Class 1A Multimode, Graded Index Optical Wave Guide Fibers.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of: .
   1. Section 26 90 00 - Process Instrumentation & Control.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for Ethernet networking equipment:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Identify all software licensing requirements.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for human-machine interface equipment:
   1. The following information shall be provided specifically for Industrial Ethernet Network:
      a. As-built printout of all software configuration including data tables, passwords, and other parameters.
      b. Connection diagrams for each individual piece of equipment.
      c. Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
      d. Complete front elevation drawing of equipment rack and exact component layout within rack.
      e. Provide copy of written warranty.
      f. Complete test reports for fiber optic cable. Provide a fiber test form which includes the following:
         1) Date and time of:
            (a) Fiber installation.
            (b) Fiber termination.
            (c) Testing.
         2) Testing equipment used information including:
            (a) Make.
            (b) Model.
            (c) Date of calibration.

3) Name of person performing test and the installers.
4) dB loss of each connector installed.
5) dB loss of each fiber segment.
6) End to end attenuation.
7) Optical Time Domaine Reflectometer (OTDR) Signature trace.
8) Cable shall be tested at the following frequencies:
(a) 850 nm.
(b) 1300 nm.

g. Complete test report for category 6 cabling. Provide test form which includes the following:
1) Date and time of:
(a) Cable installation.
(b) Cable termination.
(c) Testing report.
2) Testing equipment used information including:
(a) Make.
(b) Model.
(c) Date of calibration.
3) Name of person performing test and the installers.
4) Provide in spreadsheet format. Cable number with test reporting of cable length at near-end crosstalk and attenuation at frequency MHz at 1, 4, 10, 20 and 100. Also indicate room number of each jack.

h. Submit software license certificates, manufacturer provided software documentation, and software installation media.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 INDUSTRIAL ETHERNET NETWORK SWITCH, 16-PORT

A. Manufacturer:
   1. N-TRON Corp. Model 516TX
   2. or equal

B. General
   1. High Reliability/Availability
   2. Extended Environmental Specifications
   3. Rugged DIN-Rail Enclosure
   4. High Performance
   5. MTBF greater than 2M Hours (measured)
   6. Ease of Use
      a. Plug & Play Operation
      b. Auto-sensing 10/100BaseT
      c. Auto-sensing Full/Half Duplex
      d. Auto Cable Sensing (MDIX)
      e. Unmanaged Operation
      f. Compact DIN-Rail Package
   7. Increased Performance
      a. Full Wire Speed Capable
      b. 100BaseFX Fiber Uplink
      c. Full Duplex Capable
      d. Eliminates Network Collisions
      e. Increases Network Determinism
   8. N-View Switch Viewing Option
      a. The N-TRON N-View OLE for Process Control (OPC) Server Software an be combined with popular HMI software packages to add network traffic monitoring, trending and alarming to any application using N-Tron switches configured with the N-View option. N-TRON's N-View OPC Server collects 45 different traffic variables per port and 5 system level variables per switch. This information can provide a complete overview of the network load, service quality, and packet traffic. OPC client software can use N-View OPC Server data to resolve network problems quickly and improve system reliability.

C. Switch Properties
   1. Number of MAC Addresses: 4,000
   2. Aging Time: Programmable
   3. Latency Min.: 2.2 us
   4. Backplane Speed: 2.6Gb/s
   5. Switching Method: Store & Forward

D. Shock & Vibration
   1. Shock: 200g @ 10ms

2. Vibration/Seismic: 50g, 5-200Hz, Triaxial

E. Electrical
1. Input Voltage: 10-30 VDC
2. Input Current: 400 mA at 24V
3. Heavy-duty, industrial power supply, rack-mounted.

F. Environmental
1. Operating Temperature: -40 to 85 degrees C (for -S option 509FX) -20 to 70° C Operating, -40 to 85° C Storage
2. Storage Temperature: -40 to 85 degrees C
3. Operating Humidity: 10 to 95 percent, non-condensing
4. Operating Altitude: 0 to 10,000 ft.

G. Network Media
1. 10BaseT: >Cat3 Cable
2. 100BaseTX: >Cat5 Cable

I. Connectors
1. 10/100BaseTX: Sixteen (16) RJ-45 Copper Ports

J. Recommended Wiring Clearance:
1. Front: 5-inch
2. Side: 3-inch

K. Emissions and Safety Approvals:
1. FCC Part 15 Class A
2. UL Listed (US & Canada)
3. CLASS I, DIV 2, GROUPS A,B,C,D, T4A
4. CE: EN55011,EN61000-6-2 and -6-4
5. EN61000-4-2, 3, 4, 5, 6, 11, EN61010-1
6. Class III, Pollution Degree2, Installation Category I

2.02 INDUSTRIAL ETHERNET NETWORK SWITCH, 8-PORT

A. Manufacturer:
1. N-TRON Corp. Model 508TX
2. or equal

B. General
1. High Reliability/Availability
2. Extended Environmental Specifications
3. Rugged DIN-Rail Enclosure
4. High Performance
5. MTBF greater than 2M Hours (measured)
6. Ease of Use
   a. Plug & Play Operation
   b. Auto-sensing 10/100BaseT
   c. Auto-sensing Full/Half Duplex
   d. Auto Cable Sensing (MDIX)

e. Unmanaged Operation
f. Compact DIN-Rail Package

7. Increased Performance
   a. Full Wire Speed Capable
   b. 100BaseFX Fiber Uplink
   c. Full Duplex Capable
   d. Eliminates Network Collisions
   e. Increases Network Determinism

8. N-View Switch Viewing Option
   a. The N-TRON N-View OLE for Process Control (OPC) Server Software an be combined with popular HMI software packages to add network traffic monitoring, trending and alarming to any application using N-Tron switches configured with the N-View option. N-TRON's N-View OPC Server collects 45 different traffic variables per port and 5 system level variables per switch. This information can provide a complete overview of the network load, service quality, and packet traffic. OPC client software can use N-View OPC Server data to resolve network problems quickly and improve system reliability.

C. Switch Properties
   1. Number of MAC Addresses: 4,000
   2. Aging Time: Programmable
   3. Latency Min.: 2.2 us
   4. Backplane Speed: 2.6Gb/s
   5. Switching Method: Store & Forward

D. Shock & Vibration
   1. Shock: 200g @ 10ms
   2. Vibration/Seismic: 50g, 5-200Hz, Triaxial
   3. Note: Unit must be bulkhead mounting to achieve these levels.

E. Electrical
   1. Redundant Input Voltage: 10-30 VDC
   2. Input Current: 200 mA@ 24V
   3. Heavy-duty, industrial power supply, rack-mounted.

F. Environmental
   1. Operating Temperature: -40 to 85 degrees C
   2. Storage Temperature: -40 to 85 degrees C
   3. Operating Humidity: 10 to 95 percent, non-condensing
   4. Operating Altitude: 0 to 10,000 ft.

G. Network Media
   1. 10BaseT: >Cat5 Cable
   2. 100BaseTX: >Cat6 Cable

H. Connectors
   1. 10/100BaseT: Eight (8) RJ-45 Copper Ports

2. Serial Port: Com Parameters 9600,n,8,1

I. Recommended Wiring Clearance:
1. Front: 2-inch
2. Side: 3-inch

J. Emissions and Safety Approvals:
1. FCC Part 15 Class A
2. UL Listed (US & Canada)
3. CLASS I, DIV 2, GROUPS A,B,C,D, T4A
4. CE: EN55011,EN61000-6-2 and -6-4
5. EN61000-4-2, 3, 4, 5, 6, 11, EN61010-1
6. Class III, Pollution Degree2, Installation Category I

2.03 UTP CONTROL CABLE

A. Manufacturer:
1. Belden DataTwist 350 (1700A).
2. Or equal.

B. General:
1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 24 AWG, solid bare copper, Polyolefin insulated, adjoined singles, ripcord, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
2. Supports Category 5e applications such as 100 Base TX, 100 Base VG Anylan, and 155 ATM. Ideal for use in high bandwidth applications such as 622 ATM and gigabit Ethernet.
3. Multimedia applications include AES/EBU digital audio and RS-422 machine control.
4. Support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video.
5. UL tested for use with high speed audio-video systems in accordance with FCC Class A digital devices at a fundamental frequency of 135 MHz.
6. Suitable for "noisy" environments such as running next to power cables and transformers.

C. Physical Characteristics:
1. Temperature range: -20 TO 80 deg. C.
2. Insulation material: Polyolefin.
3. Jacket material: PVC.
4. Maximum pulling tension: 40 lbs.
5. Minimum conductor OD: 0.020-in.
6. Minimum insulation OD: 0.035-in.
7. Minimum bend radius: 0.25-in.
8. Flame test: UL 1581 Vertical Tray.
9. Color code:
a. Pair 1: white/blue & blue
b. Pair 2: white/orange & orange
c. Pair 3: white/green & green

d. Pair 4: white/brown & brown

D. Electrical Characteristics:
1. Maximum operating voltage: 300 V rms.
2. Nominal capacitance at 1 kHz: 15 pF/ft.
3. Nominal velocity of propagation: 70 percent.
4. Delay skew (nS/1000-ft): 25 maximum.
5. Delay at 100 MHz (nS/1000-ft): 510 maximum.
6. Capacitance unbalance (pF/1000-ft): 66.0 maximum.
7. DCR at 20C (Ohms/1000-ft): 9.0 maximum.
8. DCR unbalance (percent): 3.0 maximum.

E. Usage:
1. Instrumentation & Control system UTP cable.

2.04 UTP PATCH CABLE

A. Manufacturer:
1. Belden DataTwist 350 (1752A).
2. Or equal.

B. General:
1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 24 AWG, stranded tinned copper, Polyolefin insulated, adjoined singles, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
2. High flexibility patch cordage. RJ-45 compatible for either T568A or T568B configurations.
3. Design minimizes changes in electrical characteristics due to bending and kinking associated with patch cables.
4. Patch cable impedance is matched with DataTwist 350 horizontal cables to reduce signal reflections caused by impedance mismatches and decrease system return loss.
5. Resistant to attenuation increases due to high humidity environments.

C. Physical Characteristics:
1. Temperature range: -20 TO 80 deg. C.
2. Insulation material: Polyolefin.
3. Jacket material: PVC.
4. Maximum pulling tension: 40 lbs.
5. Minimum conductor OD: 0.022-in.
6. Minimum insulation OD: 0.037-in.
7. Minimum bend radius: 0.25-in.
8. Flame test: UL 1581 Vertical Tray.
9. Color code:
a. Pair 1: white/blue & blue
b. Pair 2: white/orange & orange
c. Pair 3: white/green & green
d. Pair 4: white/brown & brown

D. Electrical Characteristics:
   1. Maximum operating voltage: 300 V rms.
   2. Nominal capacitance at 1 kHz: 15 pF/ft.
   3. Nominal velocity of propagation: 70 percent.
   4. Delay skew (nS/1000-ft): 25 maximum.
   5. Delay at 100 MHz (nS/1000-ft): 510 maximum.
   6. Capacitance unbalance (pF/1000-ft): 66.0 maximum.
   7. DCR at 20C (Ohms/1000-ft): 9.0 maximum.
   8. DCR unbalance (percent): 3.0 maximum.

E. Usage:
   1. Instrumentation & Control system UTP patch cable.

PART 3 CONSTRUCTION METHODS

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.04 SOFTWARE CONFIGURATION SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.06 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil and subsoil.

B. Cutting, grading, and rough contouring the site.

PART 2 PRODUCTS (N/A)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Notify utility company to remove and relocate utilities as required.

D. Protect above and below grade utilities which are to remain.

E. Protect benchmarks from excavation equipment and vehicular traffic.

3.03 TOPSOIL EXCAVATION

A. Excavate all topsoil and organic material from areas to be further excavated, relandscaped, or regraded.

B. Stockpile in area designated on site. Remove excess topsoil not being reused, from site.

C. Do not excavate wet topsoil.

3.04 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.

B. Excavate all subsoil containing tree root systems within the building area.

C. Stockpile in area designated on site. Remove excess subsoil not being reused, from site.

D. Do not excavate wet subsoil.

3.05 GRADING

A. Grade areas to contours and elevations with unfrozen materials.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Slope grade away from building minimum 4 inches in 10 feet, unless noted otherwise.

D. Make grade changes gradual. Blend slope into level areas.

E. Remove surplus fill materials from site.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Building excavation.

1.02 PROTECTION

A. Protect benchmarks from equipment and vehicular traffic.

B. Protect above and below grade utilities which are to remain.

C. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

F. Grade excavation top perimeter to prevent surface water run-off into excavation.

PART 2 PRODUCTS (N/A)

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground utilities. Stake and flag locations.

C. Identify and flag surface and aerial utilities.

D. Notify utility company to remove and relocate utilities.

E. Maintain and protect existing utilities remaining which pass through work area.

3.02 EXCAVATION

A. Excavate subsoil required for stoop foundations, exterior slab, construction operations, and other work.

B. Machine slope banks to angle of repose or less until shored.

C. Excavation shall not interfere with normal 45 degree bearing splay of any foundation.

D. Hand trim excavation and leave free of loose matter.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume.

F. Correct unauthorized excavation at no cost to Owner.

G. Fill over-excavated areas under bearing surfaces in accordance with direction by Engineer.

H. Stockpile excavated material in area designated on site and remove excess subsoil not being reused, or not re-usable from site.

I. Excavation for building foundations shall extend to footing bearing.

3.03 DEWATERING

A. Water collected in footing trenches from surface run-off or seepage of groundwater shall be removed by sump pump or other conventional dewatering method prior to placement of foundation concrete.

B. Any soil softened by standing water shall be removed prior to resuming construction activities.

C. Site grades shall be maintained during construction to prevent flow toward open excavations and the construction area.

END OF SECTION

SECTION 31 23 23

BACKFILL AND COMPACTION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Backfilling to subgrade elevations around foundations, sidewalks, slab.

B. Compaction of existing subsoil prior to backfilling.

C. Compaction requirements.

PART 2 PRODUCTS

2.01 COMMON FILL MATERIALS

A. Type A: Subsoil; Existing, free of all topsoil and organic material, roots, gravel larger than 3-inch size, and debris may be used to backfill around building foundations.

B. Type B: Imported borrow, sand, conforming to the gradations required in Section 209 of the State of Wisconsin Department of Transportation Standard Specifications.

C. Type C: Imported borrow, aggregate base course, 3/4-inch dense graded base, crushed stone or crushed gravel conforming to the gradations required in Section 3149.2B1 of the MnDOT Specifications.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify foundation or basement walls are braced to support surcharge forces imposed by backfilling operations.

B. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen.

3.02 BACKFILLING

A. Backfill areas to contours and elevations. Use unfrozen materials.

B. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Place and compact fill materials in continuous layers not exceeding 8 inches loose depth.

D. Maintain optimum moisture content of backfill materials to attain required compaction density.

E. Backfill simultaneously on each side of unsupported foundation walls.

F. Slope grade away from building minimum 2 inches in 10 feet unless noted otherwise.

G. Make changes in grade gradual. Blend slopes into level areas.

H. Remove surplus backfill materials from site.

I. Leave stockpile areas completely free of excess fill materials.

3.03 TOLERANCES

A. Top Surface of Backfilling: Plus or minus 1 inch.

B. Allow adequate space for topsoil or paving.

3.04 SCHEDULE OF LOCATIONS

A. The paragraphs below identify location, fill material to be used and compaction expressed as a percentage of maximum density with ANSI/ASTM D1557.

B. Around Foundations Within the Foundation and Under the Exterior Slab Area: Type B, each lift compacted to 95 percent.

C. Fill Under Grass Areas at Exterior Side of Perimeter of slab or Foundation Walls: Type A or B, compacted to 95 percent.

D. Fill and Base Course Under Concrete Sidewalks and Slab Thickened Edge: Type B or C, provide 6-inch thick layer, compact to 95 percent.

E. Fill Under Concrete Slab: Type C, compact to 95 percent.

END OF SECTION

SECTION 31 25 00

EROSION CONTROL AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work under this section shall cover providing the necessary materials, equipment and labor to control erosion by the methods specified herein.

B. The Contractor shall submit for approval by the Engineer an Erosion Control Plan as required in this section for accomplishing temporary erosion control, prior to beginning any construction on the project.

C. The Contractor shall schedule and conduct construction activities in a manner that will minimize soil erosion and the resulting siltation and turbidity of surface waters in accordance with Mn/DOT 2573

1.02 RELATED WORK ELSEWHERE

A. Grading – Division 31

B. Seeding - Division 32

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. "Protecting Water Quality in Urban Areas, Best Management Practices for Minnesota," Minnesota Pollution Control Agency, Division of Water Quality, Current Edition.
2. Minnesota Department of Transportation (Mn/DOT), Standard Specifications For Construction, Current Edition.
3. Minnesota Department of Transportation (Mn/DOT), Boiler Plate Special Provisions, Current Edition
4. Minnesota Statutes, Chapters 115 and 116, and Minnesota Rules, Chapter 7001.

1.04 SUBMITTALS

A. Submit the Engineer an Erosion Control Plan for accomplishing temporary erosion control, prior to beginning any construction on the project.

PART 2 PRODUCTS AND MATERIALS

2.01 STRAW OR HAY MULCH

A. Unless otherwise specified mulch shall be straw or hay, reasonably free of grain, weed, seed and mold. Mulch materials shall not contain excessive moisture that might prevent feeding through a mulch blower machine. Wood cellulose fiber may be used only upon approval be the Engineer.

2.02 EROSION CONTROL BLANKET

A. Erosion Control Blanket shall conform to meet the requirements of Mn/DOT 3885.

B. In lawn areas, anchoring devices shall be biodegradable. Anchoring devices shall substantially degrade within 3 to 6 months during warm soil conditions. Steel wire pins or staples shall not be allowed.

C. Netting shall be bonded sufficiently to the parent material for the life of the product.

2.03 FILTER FABRIC

A. Filter fabric shall be a nonwoven geosynthetic and shall be ultraviolet stabilized.

B. Filter fabric shall be Mirafi 140N, Supac 5NP, or equal.

2.04 STRAW BALE EROSION BARRIERS

A. Bales used for erosion control shall be either hay or straw, shall have rectangular surfaces, and shall be tightly bound with twine, not wire. The material in the bales shall be reasonably free of grain, weed seed and mold, and shall be dry and suitable for the purpose intended.

2.05 SEDIMENT CONTROL FENCE (SILT FENCE)

A. Silt Fence shall be in accordance with Section 3886 of the Mn/DOT Specifications.

B. The geotextile fabric shall be insect, mildew and rot resistant. The geotextile shall be furnished in a wrapping that will protect the fabric from ultraviolet radiation and from abrasion due to shipping. The geotextile fabric shall be kept dry until installed.

C. The Contractor shall furnish the Engineer at the time of delivery of the geotextile fabric a manufacturer's Certificate of Compliance that the geotextile fabric as furnished meets the above requirements.

PART 3 CONSTRUCTION METHODS

3.01 EROSION CONTROL REQUIREMENTS

A. The erosion control requirements specified in the project Storm Water Pollution Prevention Plan (SWPPP) shall be adhered to at all times.

B. The Contractor shall perform temporary erosion control measures. The Contractor shall control water pollution, erosion, and siltation through the use of intercepting embankments, mulches, erosion mats, and other erosion control devices or methods.

C. The Contractor shall submit for approval, the plan of operations for accomplishing temporary erosion control work relating to grubbing, grading, paving and other work which might create erosion unless the requirement therefore is waived by the Engineer. The Plan shall include a schedule of proposed erosion control activities.

D. The area of land disturbed by grubbing, excavation, borrow and fill operations at any one time shall be subject to the approval of the Engineer and the duration of such exposure prior to final trimming, finishing and seeding or application of temporary erosion control measures shall be as short as practicable.

E. All exposed soil areas with a continuous positive slope within 200 feet of surface waters, including pond sides slopes, curb and gutter systems, storm sewer inlets, temporary or permanent drainage ditches, or other storm water conveyance systems, shall have temporary erosion protection cover for the exposed soil areas within the time frame indicated in the SWPPP.

F. Pipe outlets shall be provided with temporary energy dissipation within 24 hours of connecting the pipe to a surface water.

G. The Engineer shall have full authority to suspend or limit grading and other land disturbing operations pending adequate performance of such permanent erosion control measures as finish grading, topsoiling, mulching, matting and seeding and any temporary erosion control measures ordered by the Engineer.

H. Grading operations shall be performed in proper sequence with other work to minimize erosion.

I. The Contractor shall take all possible precautions to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday.

J. All storm drain inlets shall be protected with hay bale enclosures, sediment control fence or equivalent barrier approved by the Engineer.

K. All disturbed ground left inactive for seven (7) or more days shall be stabilized by mulching or covering, or other equivalent control measure.

L. Sediment control fences, hay bales, or equivalent control measures shall be placed along all sideslope and downslope sides of the site. If a channel or area of concentrated runoff passes through the site, sediment control fences shall be placed along the channel edges to reduce sediment reaching the channel.

M. Any soil or dirt storage piles containing more than ten cubic yards of material should not be located with a downslope drainage length of less than 25 feet to a roadway or drainage channel. If remaining for more than seven (7) days, they shall be stabilized by mulching, tarps or other means. Erosion from piles which will be in existence for less than seven (7) days shall be controlled by placing hay bales or sediment control fence barriers around the pile.

N. Contractor shall remove all temporary erosion control measures used on the project (MN/DOT 2573.3) once final restoration has been achieved in accordance with the NPDES permit.

3.02 APPLICATION OF STRAW OR HAY MULCH

A. The Contractor shall furnish, haul and evenly apply straw or hay mulch at a rate not less than 1-1/2 tons per acre to a loose depth of 1 or 2 inches. The mulch spreading equipment shall utilize forced air to blow mulch material onto the seeded area, unless otherwise approved by the Engineer.

B. Unless otherwise designated the Contractor shall anchor the straw or hay mulch by one of the following methods:

1. Cutting into the soil with notched edges of a weighted disc so that the mulch is partially embedded in the soil.
2. Treating the mulch with natural tackifier to anchor it in place. When this method is used the natural tackifier shall be used as an overspray to cover the mulch. Natural tackifiers shall be applied at the rate specified by the manufcturer.

3.03 PLACING EROSION CONTROL BLANKET

A. Installation instructions shall be supplied by the manufacturer. The Contractor shall install the blanket in accordance with the manufacturer's recommendations and in accordance with Mn/DOT 2575.3J requirements for erosion control blanket except as may be modified herein.

B. The blanket shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, blanket shall be unrolled and applied parallel to the direction of drainage. On slopes, blanket shall be applied parallel to the slope direction.

C. In ditches and on steep slopes each upslope and each downslope end of each piece of blanket shall be placed in a 4 inch trench, stapled on 12 inch centers, backfilled and tamped. Where one roll ends and second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12 inch overlap, placed in a 4 inch trench, stapled on 12 inch centers, backfilled and tamped.

D. On slopes, where two or more widths of blanket are applied, the two edges shall be overlapped. The exposed edge of the lap joint shall be stapled at12 to 18 inch intervals. The body of the blanket shall be stapled according to the manufacturer's installation instructions.

E. Where heavy concentrations of water or extremely erodible soil conditions exist, as noted on the contract drawings, erosion checks shall be installed at intervals of 50 feet, or less. Such a check shall consist of a 4 inch deep trench perpendicular to the flow direction across the entire width of the fabric. The blanket shall be stapled at 9 inch intervals along the bottom of the trench across the entire width of the blanket. The trench shall then be backfilled and tamped.

F. If staples become loosened, or if any fabric loosens, is torn or undermined, repairs shall be made immediately without additional compensation.

G. Erosion blanket when used in conjunction with fertilizing and seeding done for surface restoration, shall be installed immediately after fertilizing and seeding operations have been completed. Straw or hay mulch shall not be used under the fabric.

3.04 PLACING HAY BALE BARRIERS

A. Sufficient bales shall be on the site to create the necessary barriers prior to the start of groundbreaking operations. The bales shall be stacked and covered with plastic sheeting until required for use.

B. Straw bale barriers to separate sediment from runoff shall be placed in the locations and to the widths shown on the contract drawings. The bales shall be placed with the cut side of the bale downward, in a shallow trench excavated for that purpose. The bales shall be fixed in place using reinforcing rod, steel or wood fence posts extending completely through the bale and driven at least 18 inches into the ground. Two rods or posts shall be placed in each bale, one at each 1/3 point. If a bale in a barrier is wholly or partially destroyed during the course of the project the Contractor shall, at its own expense, replace that bale with a fresh, unused bale. If drainage erodes a path underneath the bale barrier, the Contractor shall utilize a 4 foot wide strip of filter fabric on the upstream side of the bales to prevent the undercutting. A width of 18 inches of the fabric shall be fastened to the bales and 30 inches shall be placed on the ground and weighted down with stones. The bales shall be in place at the end of the first day's construction and shall be placed immediately if heavy rainfall begins during the first day's construction.

3.05 SEDIMENT REMOVAL

A. The Contractor is responsible for preventing or minimizing the potential for erosion or siltation after temporary erosion or sediment control work has been performed. The Contractor shall retrieve all sediment that has left the Project site, to the fullest extent possible. Unless the Project has received approval or certification for depositing fill into surface waters, the Contractor shall remove all deltas and sediment deposited in drainage ways or catch basins and restabilize the areas where sediment removal results in exposed soil. The removal and stabilization shall take place within 7 calendar days of discovery unless precluded by legal, regulatory, or physical access restraints. If precluded, removal and stabilization must take place within 7 calendar days of obtaining access. The Contractor is responsible for contacting all local, regional, state, and Federal authorities before working in surface waters and obtaining applicable permits.

3.06 INSPECTION AND MAINTENANCE

A. The Contractor shall inspect the construction site once every 7 days, within 24 hours of any rainfall event greater than 1/2 inch during 24 hours and at least daily during periods of prolonged rainfall.

B. Maintenance shall be performed as follows
   1. Silt fence shall be repaired, replaced or supplemented when they become nonfunctional or sediment reaches 1/3 their height.
   2. Sedimentation Basins shall be drained and sediment removed when depth of sediment reaches one-half of the basin storage volume.

C. Contractor shall keep a written record of all inspection and maintenance activities. Copies of the inspection maintenance records shall be kept on-site during construction.

3.07 PERMIT TERMINATION

A. The Contractor must ensure the site meets the criteria for final stabilization.

B. The Contractor is responsible for completing the Notice of Termination and submitting the NOT to the Owner.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Providing and placing topsoil.

C. Seeding and mulching.

D. Maintenance.

1.02 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.03 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:

1. 85/80 Kentucky Blue Grass: 15 percent.
2. Creeping Red Fescue Grass: 45 percent.
3. Perennial Rye Grass: 10 percent.
4. Tall Fescue: 30 percent.

2.02 SOIL MATERIALS

A. Topsoil: Excavated from site and free of weeds or imported fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots.

2.03 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.03 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.

3.04 SEEDING

A. Apply seed at a rate of 6 to 7 pounds per 1000 square feet evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season: April 1 to July 1 or September 1 to October 31.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 2 inches of soil.

3.05 MAINTENANCE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

B. Water to prevent grass and soil from drying out.

C. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

D. Immediately reseed areas which show bare spots.

E. Protect seeded areas with warning signs.

3.06 ACCEPTANCE

A. The work will be considered acceptable after a 2-inch uniform stand of grass is attained and all gullies, rivulets, and washouts have been repaired to the satisfaction of the Architect. The Contractor shall request the Architect's inspection and acceptance will be made in writing when the above conditions have been complied with.

END OF SECTION

SECTION 40 23 23

PROCESS PIPING, VALVES AND SPECIALTIES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute (ANSI) Standards, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   3. American Water Works Association (AWWA) Standards, Current Edition.
   4. Commercial Standards (CS) U.S. Department of Commerce Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover the furnishing of all materials, equipment, supervision and labor necessary to install all process piping, valves and specialties. This section shall not apply to electrical conduit or piping for heating and ventilating or plumbing.

B. The work under this section shall cover at least the following:
   1. Relocation and offsetting of the existing 4" drain line.
   2. Relocation of (2) existing ¾ HP sample pumps.
   3. Relocation and reconfiguration of the sample piping.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. High Performance Coatings - Division 09

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. The manuals shall include operating and maintenance literature for all components provided. The submitted literature shall be in sufficient detail to allow for the installation, operation, adjustment, calibration, maintenance and removal of each component provided.

B. Preparation of this document shall be in conformance with the requirements stated in Submittals - Division 01 of these specifications. The Contractor shall submit to the Engineer for review an outline of any variations of information for the operation and maintenance manuals and other documentation he proposes to prepare.

PART 2 PRODUCTS AND MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer of wastewater processing piping shall have a minimum of 10 years experience in the construction of municipal and industrial piping and appurtenances and shall conform to the required ratings and certifications as indicated.

B. All products specified within this section shall be manufactured in the North America.

2.02 PIPE, GENERAL

A. All piping shall conform to the sizes shown on the contract drawings and shall be of the type and quality as scheduled, unless otherwise designated on the contract drawings.

2.03 PROCESS PIPE

A. Exposed Process Pipe 3 inches and larger

1. Ductile Iron (DI). Pipe shall meet the requirements of ANSI A21.15 (AWWA C115); Class 53. Joint construction shall be flanged type with required bolts and full-face gasket, meeting the requirements of ANSI A21.11 (AWWA C111). Fittings shall be ductile iron, meeting the requirements of ANSI 21.10 (AWWA C110). Standard cement mortar lining shall meet the requirements of ANSI 21.04 (AWWA C104). All exposed ductile iron pipe shall be factory primed in accordance with High Performance Coatings - Division 09 of these specifications.

B. Exposed Process Pipe 2 1/2 inches and smaller

1. Copper (CU). Pipe shall meet the requirements of ASTM B88, ASTM B585, and ASTM B641 for rigid seamless tubing. The name or trademark of the manufacturer, and type shall be permanently and plainly marked on the pipe at intervals not greater than 1-1/2 feet. Fittings shall be cast brass meeting the

requirements of ASTM B62 and ASTM B687 having an alloy composition of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead, having uniformity in wall thickness and strength, and free of any defects. Installation shall be in accordance with governing plumbing codes.

2. Polyvinyl Chloride (PVC). Pipe shall meet the requirements of ASTM D1785, for Schedule 40 or Schedule 80. Joint construction shall be threaded or solvent welded, as preferred by the Contractor. Joints constructed of threaded couplings and fittings shall meet the requirements of ASTM D2464, ASTM D2466, and ASTM D3915 as they apply. Joints constructed of socket-type couplings and fittings and solvent welded shall meet the requirements of ASTM D2467, ASTM D2564, ASTM D2672, and ASTM D2855, as they apply.

3. Chlorinated Polyvinyl Chloride (CPVC). Pipe shall meet the requirements of ASTM F441, for Schedule 40 or Schedule 80. Joint construction shall be threaded or solvent welded, as preferred by the Contractor. Joints constructed of threaded couplings and fittings shall meet the requirements of ASTM D3915 and ASTM F437, as they apply. Joints constructed of socket type couplings and fittings and solvent welded shall meet the requirements of ASTM D2855, ASTM F438, ASTM F439 and ASTM F493, as they apply.

C. Buried Process Pipe 2 1/2 inches and smaller

1. Copper (CU). Pipe shall meet the requirements of ASTM B88, ASTM B585 and ASTM B641 for Type "K" soft annealed seamless tubing. The name or trademark of the manufacturer, and type shall be permanently and plainly marked on the tubing at intervals not greater than 1-1/2 feet. Fittings shall be cast brass meeting the requirements of ASTM B62 and ASTM B687 having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead, having uniformity in wall thickness and strength, and free of any defect which may affect serviceability. Connections shall be made with flared flanged joints or compression type joints. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer.

2.04 VALVES

A. All valves less than 4 inch shall be bronze body manufactured by Nibco or equal.

1. Ball Valves
2. Unions
3. Check Valves
4. Gate Valves
5. Needle Valves
6. Fittings
7. Etc…

B. All valves 4 inch and larger shall be designed so that they can be repacked without removing the bonnet. The packing shall be adjustable. Valves shall conform to the

sizes shown on the contract drawings and shall be of the type and quality as follows, unless otherwise designated on the contract drawings.

C. Solenoid Valve

1. Furnish and install a 1/2-inch, two-way pilot operated solenoid valve on the pump prelube line. Valve shall be designed for normally closed operation, and rated to 150 psi pressure. Valve shall have brass body, bonnet and seat; stainless steel enclosing tube, plunger, and plunger spring; and Buna-N diaphragm. Electric operator shall be compatible with prelube solenoid timer and relay to be furnished by Electrical Contractor. Solenoid valve shall be Model GP400, as manufactured by Parker-Hannifin Corporation, or equal.

2.05 FLANGE ADAPTERS

A. Flange adapters shall consist of a flange, gasket and set screws. The flange shall be ductile iron, ASTM A536, Grade 65-45-12. The gasket shall be SBR Buna-S, suitable for use with wastewater. The set screws shall be AISI 4140 steel, Tensile 190,000 psi minimum, heat treated to Rockwell C42-50 and zinc plated for corrosion resistance. Set screws on sizes 2 inch through 16 inch shall have a breakaway head that shears at the recommended torque leaving a square head.

B. All flange adapters shall have a minimum working pressure equal to the pipe on which they are installed.

C. Flange adapters shall be Uni-Flange, manufactured by the Ford Meter Box Company, Inc. or equal.

D. Flange adapters shall only be installed as shown on the contract drawings or where approved by the Engineer.

2.06 PRESSURE GAUGES

A. Pressure gauges shall be a minimum of 3-1/2 inches in diameter, read from 0 to ____ psi and be calibrated in both psi and feet. One gauge shall be installed to the pump discharge head and one shall be installed after the check valve as shown on the contract drawings.

2.07 SAMPLING TAP

A. A smooth end sampling tap shall be located just downstream of check valve.

2.08 COUPLING

A. The coupling on the well discharge line shall be 4 inch diameter Style 38 (Steel Coupling for Cast-Iron Pipe Sizes) by Dresser Industries, Inc., or equal.

2.09 PIPE HANGERS

A. Pipe hangers shall consist of ceiling flange threaded rod, and adjustable clevis type hanger constructed of carbon steel.

2.10 PIPE SUPPORTS

A. Pipe supports shall consist of a base flange, support rod with threaded ends for height adjustment, and a saddle type or stanchion type support as required.

B. Pipe supports where ceiling mounted to concrete surfaces shall consist of a base flange, support rod with threaded ends for height adjustment, and a saddle type or stanchion type support as required.

C. Pipe supports shall be wall-mounted brackets where pipelines are located within 3-feet of walls. Maintain minimum of 7-foot clearance under supports.
   1. Provide U-bolt attachment, roller, or pipe saddle above the bracket.
   2. Where clearance is limited, suspend clevis hanger from wall bracket.
   3. Provide floor-mounted type support stands with adjustable pipe column, circular cradle, and floor attachment flange where wall or ceiling mount are not feasible and maintenance access will not be interrupted.

D. Install hangers and supports as required to support piping shown on plans; conform to American Standard Code for Pressure Piping, ANSI B31.1. Provide galvanized or stainless structural steel members required for supporting or anchoring piping and accessories.
   1. Exterior and underwater pipe supports shall be type 316 stainless steel.
   2. Pipe supports in wet atmosphere or corrosive chemical areas, shall be type 316 stainless steel.
   3. Interior room locations not subject to wet or corrosive conditions shall have pipe supports of hot-dipped galvanized steel construction.

E. Design and locate supports, anchors, rollers and guides and show on shop drawing submittal subject to acceptance of Engineer.
   1. Absence of pipe support and details on the drawings shall not relieve the Contractor of responsibility for providing supports.
   2. Maintain equipment maintenance clearance around all equipment and operator and equipment removal egress paths throughout all Rooms.

2.11 EXPANSION JOINTS

A. Expansion joints shall be of the bellow type with filled arches suitable for temperatures of minus 20 degrees F to plus 180 degrees F equipped with limit bolts to restrict maximum extension.

B.

2.12 LABELING AND TAGGING

A. Provide "Non-Potable Water" sign at every non-potable water outlet.

B. Furnish and install adequate marking of exposed accessible process equipment, piping and control devices, per ANSI A13.1.

C. Piping. Painted stencil, or self-adhesive vinyl markers over finished insulation covering. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

D. Valves. Minimum diameter plastic engraved tags, 1-1/2 inches. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

E. Submit schedule of identification labels/tags for Engineer approval.

2.13 WALL SLEEVES AND WALL PIPES

A. Wall sleeves and wall pipes shall conform to the requirements of the process piping as indicated on the contract drawings and as specified as follows:
   1. Ductile Iron: ASTM A536, Grade 60-40-18

B. Wall pipes shall be used at all locations where pipes penetrate concrete walls.

2.14 MODULAR RUBBER WALL SEAL

A. Modular rubber wall seal shall be mechanical type, consisting of inter-locking synthetic rubber links. The elastomeric element shall be sized and selected per manufacturer's recommendation and have the following properties as designated:
   1. Standard service application (-40 degrees F to 250 degrees F) EPDM: ASTM D2000 M3BA510.

B. Assembly of synthetic rubber links connected with stainless steel bolts. When the bolts are tightened, pressure plates shall compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.

C. Modular rubber wall seals shall be used where pipes penetrate existing concrete walls and as otherwise indicated on the contract drawings. Use of modular rubber seals in any other locations shall require written approval of the Engineer.

D. Modular rubber wall seal shall be Link-Seal, manufactured by Thunderline Corporation or equal.

2.15 PAINTING

A. Painting of process piping, valves and specialties shall be in accordance with requirements specified in High Performance Coatings - Division 09 of these specifications.

B. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

PART 3 CONSTRUCTION METHODS

3.01 GENERAL

A. The Mechanical Contractor is responsible for process piping within the limits shown on the contract drawings.

B. All pipe shall be carefully unloaded so it will not be chipped, cracked or have the surface coating damaged. It shall be carefully stored so it is in no way damaged or made unsuitable for its purpose. Pipe shall not be skidded upon the ground. Damaged pipe shall be immediately removed from the work site.

3.02 EQUIPMENT START-UP

A. The pump control valve shall be started by a factory-trained representative who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance. All other equipment shall be started up when installation has been approved as ready for operation. A trained technician shall supervise the startup, make all necessary adjustments and run field tests in the presence of the Engineer.

3.03 PIPE INSTALLATION

A. Primary line and elevation will be provided by the Engineer. Line and elevation will be established in the field, which, in conjunction with information on the contract drawings, will be sufficient control for the work. The Contractor shall be responsible for preserving the control stakes, marks or nails and if disturbed, shall pay the actual cost of replacement. Notice shall be given one week in advance to give the Engineer enough time to set the control. The Contractor shall transfer line and elevation from the primary control by approved methods. Such methods may vary at different locations to achieve the desired degree of accuracy.

B. Pipes shall be laid with ends abutting and true to line and elevation. Joints shall be full depth or rigidly fixed and located for proper alignment of piping. Pipe suspended or exposed shall be placed at the elevations indicated and supported as shown on the contract drawings. Any work which has been disturbed or which does not conform to

line and elevation before final acceptance shall be removed and reconstructed by the Contractor at his expense.

C. Pipes shall be installed with the minimum depth of cover as called for on the contract drawings or as defined in Special Procedures - Division 01 of these specifications.

D. Manufacturer's recommended installation procedures shall be followed.

3.04 PERMISSIBLE LEAKAGE

A. Leakage is not permissible on any exposed line or any line that will be placed under pressure or suction. The Contractor shall at his own expense locate and repair the defective joints until the leakage is within the limits described above.

3.05 VALVE INSTALLATION

A. Valves shall be installed per the manufacturer's recommendations. Valves shall be operated prior to system start-up to ensure proper installation and full range of operation.

3.06 GAUGE INSTALLATION

A. Gauges shall be installed per the manufacturer's recommendations. Gauges shall be tested prior to system start-up to ensure proper operation, which shall include range of motion, lack of oscillations caused by vibration and correct calibration for the installation.

3.07 PERMISSIBLE LEAKAGE

A. Leakage is not permissible on any exposed line or any line that will be placed under pressure or suction. The Contractor shall at his own expense locate and repair the defective joints until the leakage is within the limits described above.

3.08 TESTING

A. General. The following tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall be responsible for providing all labor, materials and equipment for the testing.

B. Pressure Test. All pressure lines shall be tested until successfully meeting the requirements of ANSI A26.00 (AWWA C600), latest edition, for pressure and leakage testing excepting exposed lines which are allowed no leakage. Temporary capping and thrust restraint of open lines will be required for testing.

C. Bacteriological Test. The Contractor shall be responsible for sampling water from process piping after installation. All process piping in contact with potable water shall be tested. All costs for bacteriological testing shall be included in the lump sum

bid for the Work. Two "safe" water tests with respect to coliform bacteria shall be obtained at an interval of 24-hours apart and the laboratory reports shall be submitted to the Engineer.

D. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective materials.

3.09 PIPE HANGERS AND SUPPORTS

A. Piping hangers and their supports shall be sized per the pipe manufacturer's requirements for the process fluid carried, but in no case shall this be less than 3/4 inch wide, 18 gauge steel strap or ring type hangers secured by screw fasteners. Hangers in contact with un-insulated copper tubing or brass piping shall be electrolytically coated and shall be sized accordingly for the outside diameter of the pipe.

B. The location of the hangers and supports shall be coordinated with the structural work to assure that the structural members will support the intended load. In lieu of separate hangers or supports, the Contractor shall submit for approval a detailed drawing of the type of hanger or support he proposes to furnish for handling and supporting multiple pipes.

3.10 HORIZONTAL PIPING

A. Hangers and their supports shall be installed at intervals specified below, at locations not more than 3 feet from ends of each runout and not over 1 foot from each change in direction of piping. Hangers shall be adjustable type. Hangers and supports shall be spaced as follows:

1. Iron Pipe. Pipe shall be supported near each hub or hubless joint.
2. Copper Tubing. The maximum spacing between supports shall be as follows:

Normal Pipe Size (In.)	Maximum Span (Ft.)
3/8 thru 3/4	5
1	6
1-1/4	7
1-1/2 and 2	8
2-1/2	9
3	10
4	12

3.11 VERTICAL PIPING

A. Iron vertical piping shall be supported at each floor and at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the

top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.

B. Copper vertical tubing shall be bonded at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.

3.12 FIXTURE SUPPORTS

A. Wall hung fixtures, hanger plates, support arms or mounting lugs shall be fastened to the wall by through bolts where appearance of the bolts is not objectionable. Exposed bolt heads in finished areas shall be hexagonal and painted. Exposed nuts shall be chromium plated hexagonal cap nuts. Washers shall be painted or chromium plated to match bolt heads or nuts.

3.13 THRUST RESTRAINTS

A. Provide all pressure pipelines with concrete thrust blocking at all bends, tees, caps, plugs and changes in direction.

B. All bends, tees, caps, plugs and changes in direction under structures shall have both restrained joints and thrust blocks.

C. Concrete thrust blocks shall be poured against firm, undisturbed ground, with a minimum size as shown on the contract drawings. Where it is not possible to pour thrust blocks against undisturbed ground, thrust blocks shall be poured against backfill compacted to 95 percent modified proctor density. All fittings shall be wrapped in polyethylene prior to placement of concrete thrust blocks. Thrust blocks shall be formed in such a way that joints will be kept free of concrete.

PART 4 MEASUREMENT AND PAYMENT

4.01 PROCESS PIPING, VALVES AND SPECIALTIES

A. General. Process piping, valves and specialties shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Process Piping, Valves and Specialties, Lump Sum. When so provided, payment for process piping, valves and specialties shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Process Piping, Valves and Specialties, Inclusive. When no quantity is provided, process piping, valves and specialties shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

APPENDIX A

ASBESTOS BUILDING ASSESSMENT REPORT

February 24, 2016

Mark Proulx
Water Plant Supervisor
City of Duluth – Water Plant
8130 Congdon Blvd
Duluth, MN 55804

Re: Asbestos Building Assessment
Lakewood Water Plant
Duluth, MN

Dear Mr. Proulx;

Detailed below is the letter report for the asbestos assessment conducted on November 13, 2015 at the Lakewood Water Treatment Plant located at 8130 Congdon Boulevard, Duluth, Minnesota. The purpose of the survey was to identify accessible suspect asbestos containing materials (ACM) and assess potential hazards in accordance with EPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) and the Minnesota Department of Health (Minn. R. 7011.9920) regulations prior to the demolition or remodeling of the HVAC system.

ASBESTOS ASSESSMENT SCOPE OF WORK

Asbestos-containing building materials can generally be grouped into three major types:

- Thermal system insulation
- Surfacing materials
- Miscellaneous materials

Thermal system insulation includes insulating materials on pipes, pipe fittings (valves, tees, etc.), tanks, boiler jacketing, flue and stack insulation, turbine jackets, and similar applications. Surfacing materials include spray or trowel-applied fireproofing and acoustical finishes. Miscellaneous materials include items such as gasket materials, vinyl asbestos floor tile, ceiling tile, adhesive, mastics, and small amounts of packing or caulking material, and roof shingles.

Proper management of ACM depends on whether the material is friable or nonfriable; if nonfriable, whether it is a category I or II; and if a category I, whether it is a construction and demolition material. Nonfriable materials may become friable during grinding, cutting, burning, crushing and similar operation, including some types of building demolition, which may generate and release asbestos fibers. The definitions of asbestos types are as follows:

- Category I nonfriable ACM is defined as packings, gaskets, resilient floor covering and asphalt roofing containing asbestos that cannot be crumbled to powder by hand pressure. Category I

ACM is pliable (not brittle), breaks by tearing rather than fracturing, and does not easily release fibers upon breaking.

- Category II nonfriable ACM is defined as any material, excluding a category I nonfriable ACM, containing asbestos that cannot be crumbled to powder by hand pressure. This includes rigid exterior siding and boards known by the trade name transite. Category II ACM is not pliable, breaks by fracturing rather than tearing, and does release some asbestos fibers upon breaking.

- Friable ACM is defined as any material containing asbestos that can be crumbled to a powder by hand pressure. Common types of friable ACM included pipe insulation and sprayed on or tiled sound insulation materials. Friable ACM has little structural strength and contains asbestos fibers, which are readily released upon breaking.

On November 13, 2015 MSA Professional Services, Inc. (MSA) representative, Phillip Lockett (Minnesota Asbestos Inspector #AI3601) conducted the inspection for accessible suspect ACM. The following tasks have been completed:

- A walk-through assessment was conducted of the entire HVAC system to be replaced at the Lakewood facility.

- Bulk samples of suspect ACM were not collected from representative areas.

- Equipment slated for removal and replacement was examined for suspected ACM.

- Preparation of this asbestos survey report.

Asbestos Assessment Results

The asbestos assessment was conducted at the Lakewood Water Treatment Plant. MSA evaluated the current HVAC system and reported the findings to the City, (Lakewood WTF HVAC ONR Study (Amended)). The report recommends upgrades to the Ventilation, Air Condition and dehumidification systems in the building in 2015-2016. No suspect ACM areas were observed on the equipment that is recommended for removal or replacement.

Areas of interest that were examined for suspect ACM included: The unit heaters piping insulation to be replaced. The first two feet of pipe insulation needs to be removed and the reinstalled for the heater replacements. All the unit heaters were examined and found to have Fiberglass pipe insulation covering the pipes (Picture 1).

The plenum gaskets were not sampled because they needed to stay in service for several months. These should be considered ACM and handled accordingly when the equipment is replaced (Picture 2).

HVAC supply piping was inspected for suspect ACM. All the supply piping was insulated with Fiberglass insulation (Picture 3 & 4).

The rooftop dehumidification unit will be removed and replaced. MSA removed the protective jacket and inspected the insulation material present. The insulation was fiberglass and not ACM (Pictures 5, 6 & 7).

Asbestos Conclusions and Recommendations

Gaskets are considered Category II non-friable ACM and must be removed prior to demolition activities as those activities would crush the material and could cause it to become friable.

No samples of the insulation were analyzed for possible ACM. All the insulation was fiberglass.

The completion of a Notification of Intent to Perform a Demolition and/or Renovation is required prior to a demolition, renovation or fire burn. The asbestos abatement and/or demolition contractor will need to include a description of how the asbestos-containing materials were handled and disposed.

LIMITATIONS OF ASBESTOS BUILDING SURVEYS/REMARKS

Every effort was made to completely evaluate suspect ACM. Evaluation was based on past experience with similar materials and structures.

The quantity of samples, sample locations, and analyses performed were selected to provide analytical data to document and evaluate current site conditions. The samples were collected from homogeneous material areas and no guarantee is given that the assumed homogeneous area and the sample analyses are consistent throughout the building. Positive confirmation of the homogeneity of the material cannot be confirmed without sampling each ceiling panel, floor tile, floor tile adhesive, etc.; therefore, inferred conditions are based on sample analyses and field observations.

MSA's services were performed in a manner consistent with the level of skill or care ordinarily exercised by those practicing in this locality under similar conditions. Information provided to MSA by individuals familiar with and/or associated with the buildings has been accepted in good faith and is assumed to be accurate.

Any discussion or recommendation contained in this report represents our professional opinions. These opinions are based on currently available information and are arrived at in accordance with currently accepted industrial hygiene practices at this time and location. Other than this, MSA will make no certification or guarantee with respect to the validity of the data collected.

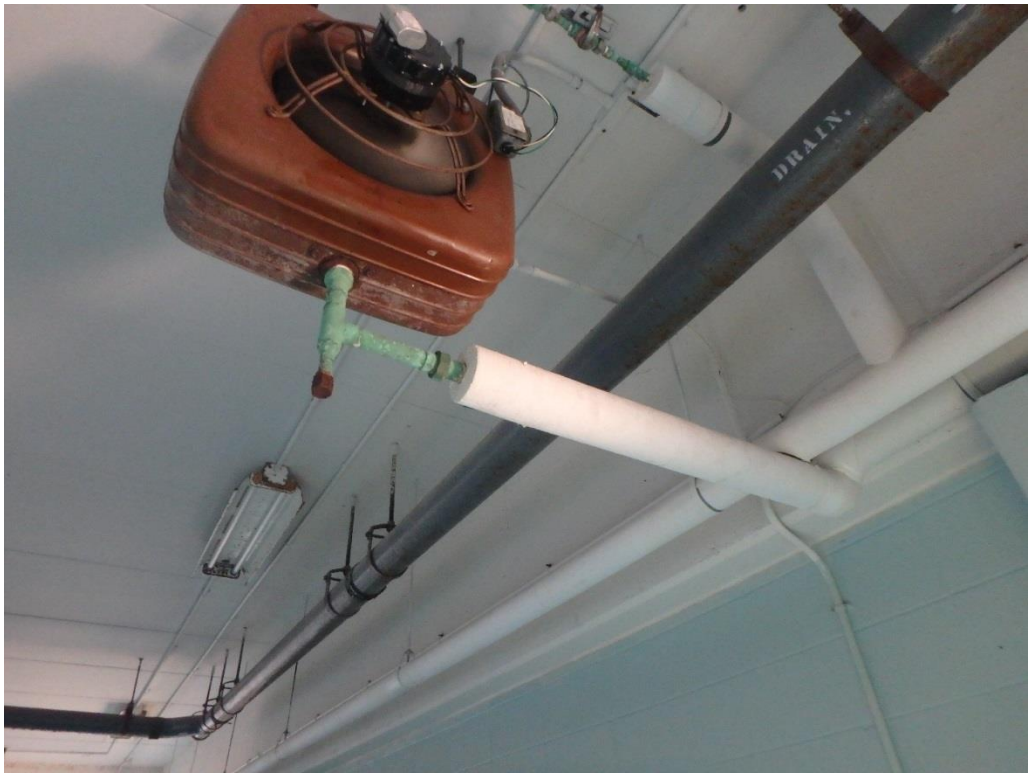
Please contact me if you have any questions regarding the ACM inspection.

Sincerely,

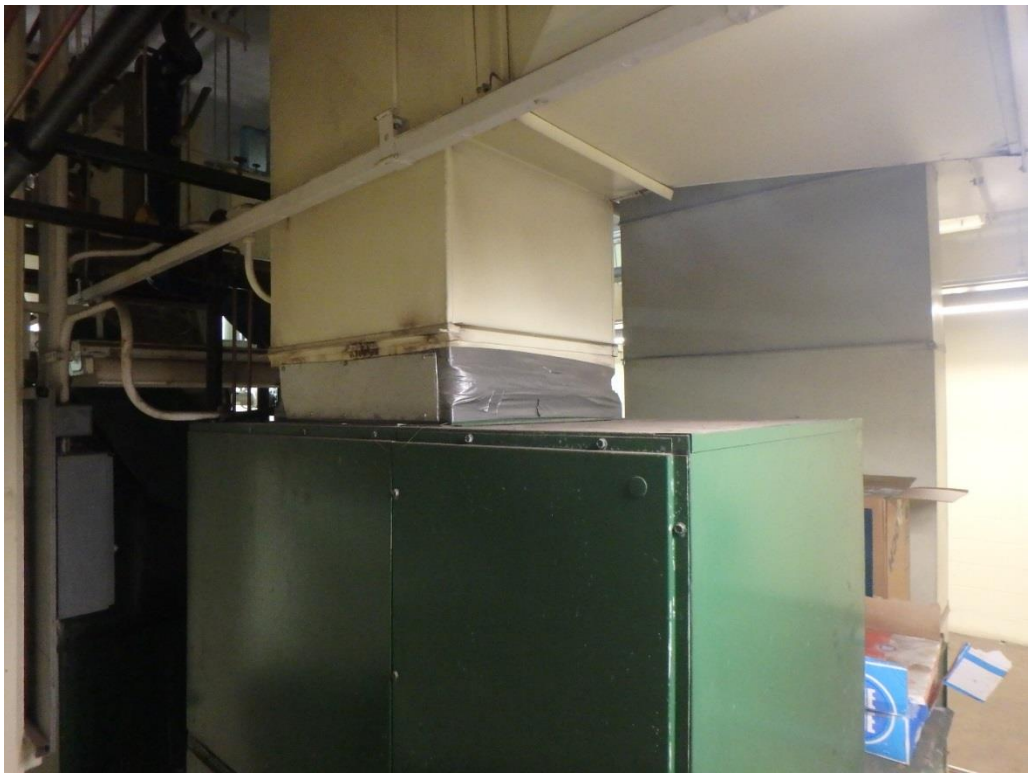
MSA Professional Services, Inc.

Phillip Lockett
Asbestos Inspector
PDL/gr

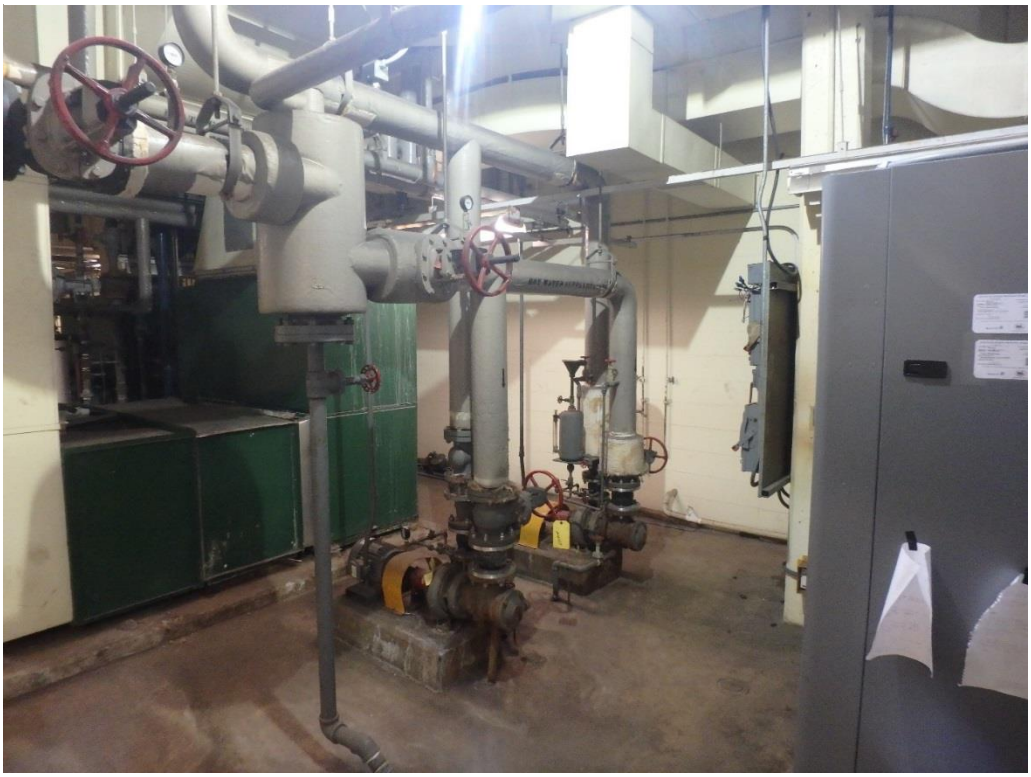
Photograph 1 - Typical unit heater



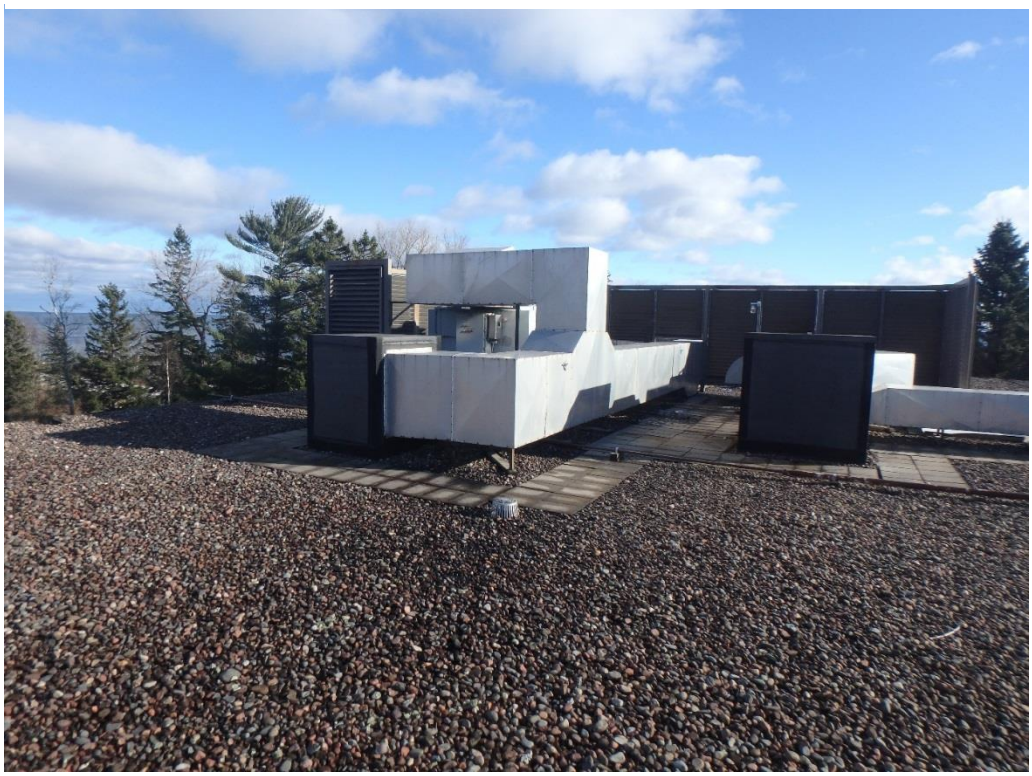
Photograph 2 - Plenum gaskets



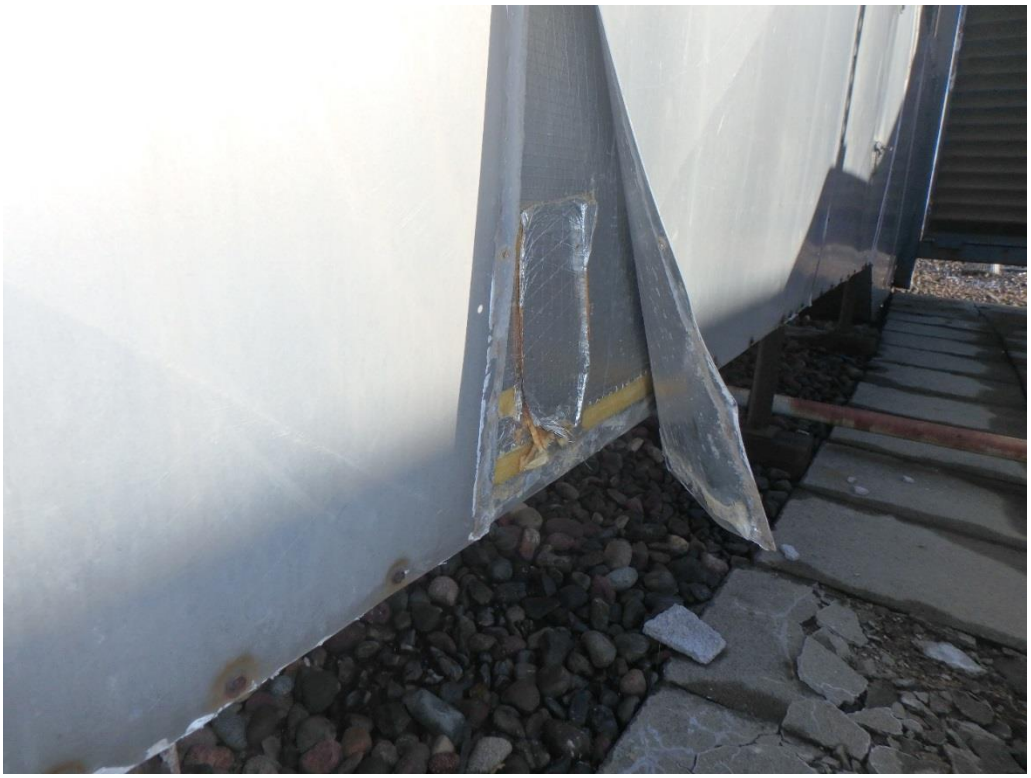
Photograph 3 - Typical water supply piping



Photograph 4 - Roof top dehumidifier



Photograph 5 - Roof top dehumidifier insulation



Photograph 6 - Roof top dehumidifier insulation