CITY OF DULUTH
INVITATION TO BID (ENG)

PROJECT NAME/DESCRIPTION: Duluth Steam Valve Replacements

PROJECT NUMBER: N/A

BID NUMBER: 15-0326

Sealed bids will be received by the City Purchasing Agent in and for the Corporation of the City of Duluth, Minnesota, in, Room 100 City Hall, Duluth, Minnesota, 55802, (218) 730-5340 until **2 PM local time Thursday, April 30, 2015** for the above named project. Immediately thereafter, bids will be taken to room [insert conference room 106A City Hall, where they will be publicly opened and read aloud.

NOTICE TO BIDDERS:

1. **A Project Labor Agreement (PLA) will be required for any bid that is over or could virtually go over $150,000.**
2. **Unless a 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. Submit a signed copy from the State of Minnesota when submitting Payment and Performance Bonds.**
3. **A mandatory pre-bid meeting and walk-thru of the site will take place on Thursday April 16, 2015 at 9 AM at Duluth Steam, 1 Lake Place Drive.**

Scope of project: Starting in early August 2015, the Duluth Steam Plant will be shut down for a planned maintenance outage scheduled for a duration of approximately three (3) weeks. During the outage, the plant's three (3) main 225-to-150 psi Pressure Reducing Valves, the Exhaust Steam Unloading Valve and several flanged isolation gate valves will be replaced per the attached specifications and drawings.

Questions pertaining to this project should be directed to: Dan Cebelinski, PE at 218-409-5529.

Each bidder must review the 2011 edition of the City of Duluth Public Works/Utilities Department – Engineering Division Standard Construction Specifications on the city website (www.duluthmn.gov) as these Specifications are incorporated by reference and deemed to be a part hereof this project as if fully incorporated and set forth herein. **(Dismiss if steam is not included in the specification.)**

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, shall be submitted with each bid.

Attention is called to the fact that not less than the minimum prevailing wages must be paid on this project. 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 when possible.

Contractor will comply with all applicable Equal Employment Opportunity laws and regulations.

The City of Duluth is an Equal Opportunity employer.

CITY OF Duluth

REQUEST FOR BID
DATE 4/9/2015
BID # 15-0326

RETURN BY BID OPENING TIME TO:

PURCHASING DIVISION
100 CITY HALL
Duluth, MN 55802
Dennis Sears
PHONE: 218-730-5340
FAX: 218-730-5921

Duluth Steam Valve Replacements

BID OPENING AT 2 PM on Thursday, April 30, 2015

Note: all bids must be written, 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 award where there is a substantial savings to the City, waive informalities and to reject any and all bids. Bidder should state in proposal if bid price is based on acceptance of total order. Sales tax is not to be included in the unit price. Bidder to state freight charges if the proposal F.O.B. is shipping point, freight not allowed. Low bid will not be the only consideration for award of bid. All pages shall be signed or initialed by authorized bidder's representative as indicated at the bottom of the page(s) of the request for bid form.

RETURN BID IN DUPLICATE WITH DUPLICATE DESCRIPTIVE LITERATURE
FOR BID RESULTS, ENCLOSE A SELF-ADDRESSED, STAMPED ENVELOPE WITH BID

BID DEPOSIT REQUIREMENTS: 5% OF BID AMOUNT
Deposit shall mean cash, cashier's check or corporate surety bond payable to or in favor of the City of Duluth.

A PERFORMANCE BOND AND A PAYMENT BOND shall be required of the successful bidder, BOTH in the full amount of the bid.

INSURANCE CERTIFICATE required per attached requirements.
Designated F.O.B. Point:
Engineering Division
Jobsite(s)

Tax: Federal Excise Tax Exemption
Account No. 41-74-0056 K

Vendor Email Address: _____

FREIGHT CHARGE $ _____

NAME: _____
ADDR1: _____
ADDR2: _____
ADDR3: _____

TOTAL BID PRICE # _____
TO INCLUDE ANY ADDITIONAL PAGES.

BY: _____
(Print) (Title)

_____
(Signature) (Tele. #)

PAYMENT TERMS $ _____
F.O.B. POINT $ _____
DELIVERY DATE $ _____

The City of Duluth is an Equal Opportunity Employer.

PRE-BID INFORMATION

CITY OF DULUTH

DATE: 4/9/2015

BID #: 15-0326

Item No.	Spec. #	Qty	U/OM	Item Description	Unit Price	Total Price

Duluth Steam Valve Replacements

City Project Number N/A

A mandatory pre-bid meeting is scheduled for
April 16, 2015 at 9 AM at Steam
located at 1 Lake Place Drive

Delivery Contact: Dan Cebelinski
PE Steam Plant
218-409-5529

_____
(Initial)

CITY OF DULUTH

DATE: 4/9/2015

BID #: 15-0326

************SCHEDULE OF PRICES************

[Project Description]
[Project Description]
[Project Description]
City Project #[Project Number]

Make all extensions and total the bid.

****

Make all extensions and total the bid.

Item No.	Spec. #	Qty	U/OM	Item Description	Unit Price	Total Price
					$ _____	$ _____

TOTAL $ _____

ADDENDUM NO. , DATED _____

ADDENDUM NO. , DATED _____

TOTAL BID IN WORDS:

_____

CONTRACTOR NAME:

_____

THE CONTRACTOR AGREES TO ALL OF THE PROVISIONS CONTAINED IN THE CONTRACT DOCUMENTS. ENCLOSED HEREWITH FIND A CERTIFIED CHECK OR BID BOND IN THE AMOUNT OF AT LEAST 5% OF THE AMOUNT OF PROPOSAL MADE PAYABLE TO THE CITY OF DULUTH AS A PROPOSAL GUARANTEE WHICH IT

(see additional page(s))

_____
(Initial)

IS AGREED BY THE UNDERSIGNED WILL BE FORFEITED IN THE EVENT THE FORM OF CONTRACT AND BOND IS NOT EXECUTED, IF AWARDED TO THE UNDERSIGNED.

The bidder hereby certifies that he/she has received the City of Duluth Public Works/Utilities Department - Engineering Division Standard Construction Specifications 2009 booklet and has incorporated the terms hereof in its bid.

(If Applicable)

SIGNED: _____ FOR

_____

A PARTNERSHIP (OR)

_____

A CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF:

_____

PRESIDENT _____

VICE-PRES. _____

SECRETARY _____

TREASURER _____

ADDRESS(ES) _____

_____

BEING DULY SWORN, DEPOSES AND SAYS THAT THERE ARE NO OTHER PERSONS COMPRISING ABOVE COMPANY OR FIRM THAN THE ABOVE NAMES, AND THAT THERE ARE NO PERSONS OR CORPORATIONS INTERESTED IN THE FORGOING PROPOSALS, EITHER AS PRINCIPAL OR SUBCONTRACTOR, OTHER THAN THE ABOVE NAMES; ALSO THAT THE PROPOSALS ARE MADE WITHOUT ANY CONNECTION WITH ANY PERSON OR PERSONS MAKING ANY PROPOSAL FOR THE ABOVE WORK; THAT THEY ARE IN ALL RESPECTS FAIR AND WITHOUT COLLUSION OR FRAUD; AND THAT NO PERSON ACTING IN ANY OFFICIAL CAPACITY FOR THE CITY OF DULUTH IS DIRECTLY OR INDIRECTLY INTERESTED THEREIN, OR IN ANY PORTION OF THE PROFIT THEREOF.

(see additional page(s))

_____
(Initial)

SUBSCRIBED AND SWORN TO BEFORE ME THIS

DAY OF A.D.,

NOTARY PUBLIC

IMPORTANT NOTE BIDDERS:
PLEASE DISREGARD THE NOTE ON PAGE 1 REGARDING SALES TAX FOR THIS BID. ALL APPLICABLE SALES AND/OR USE TAXES ARE TO BE INCLUDED IN BID PRICING. ALSO, ALL BIDS ARE TO BE F.O.B. JOBSITE. THE BLANK ON PAGE ONE FOR FREIGHT IS TO TO BE LEFT BLANK.

(Initial)

Statement of Work

Duluth Steam Project DUL-PLANT002
Valve Replacements
Duluth, MN 55802

1. **Project Overview:**

   Starting in early August, 2015 the Duluth Steam plant will be shut down for a planned maintenance outage scheduled for a duration of approximately three (3) weeks. During the outage the plant's three (3) main 225-to-150 psi Pressure Reducing Valves, the Exhaust Steam Unloading Valve and several flanged isolation gate valves will be replaced.

   Various additional tasks will be completed during the schedule outage and will require coordination between each contractor onsite.

2. **Contract Documents**

   a. This Statement of Work and it's attachments comprise the technical requirements for this project:

      1. Attachment 1 - Drawings P-1.0, P-1.1, P-2.0, P-2.1 and P-3.0
      2. Attachment 2 - Technical Specifications
      3. Attachment 3 - Replacement Valve Technical Data and Shop Drawings

3. **Project Description:**

   a. Contractor shall replace existing valves with Duluth Steam - provided replacement valves at existing locations, or propose alternative valve locations and piping modifications if such alternate solutions will improve schedule and reduce cost without negatively impacting system performance. Alternate solutions which allow for prefabrication of sections of piping systems are encouraged.

   b. Specific replacements to be accomplished in this project are:

      1. Pressure Reducing Valves (PRV):

         i. Remove existing 8" PRV (DS-1), 8" gate valves (MS-14 and DS-3) and associated flanges per drawing P-1.0. Remove all existing 10" pipe as shown on P-1.0. Install new 10" PRV (DS-1), 10" gate valves (MS-14 and DS-3), flanges and new pipe per drawing P-2.0. Provide 1" warm-up line with two (2) 1" globe valves as shown on drawing P-3.0.

         ii. Remove existing 8" PRV (DS-2), 8" gate valves (MS-15 and DS-4) and associated flanges per drawing P-1.0. Remove all existing 10" pipe as shown on P-1.0. Install new 10" PRV (DS-2), 10" gate valves

(MS-15 and DS-4), flanges and new pipe per drawing P-2.0. Provide 1" warm up valve with (2) 1" gate valves as shown on drawing P-3.0.

iii. Remove existing 8" PRV (AS-1), 8" gate valve (MS-12) and associated flanges per drawing P-1.0. Install new 10" PRV (AS-1), 10" gate valves (MS-12) and flanges per drawing P-2.0. Provide 1" warm up valve with (2) 1" globe valves as shown on drawing P-3.0.

2. Isolation Valves:
   i. Remove (15) gate valves, (2) butterfly valves and associated flanges as shown on drawing P-1.0 and p-1.1. Weld new flanges to existing piping and install new valves per drawing P-2.0 and P-2.1.

3. Exhaust Steam Unloading Valve:
   i. Remove existing 8" Atmospheric vent valve (AE-22) and associated flanges per drawing P-1.1. Install new 8" Atmospheric vent valve (AE-22) and new flanges per drawing P-2.1.

4. Non-Destructive Testing Requirements (NDE):

a. All welds shall be NDE tested as follows:
   1. All 250 lb steam piping greater than 8" shall be 50% Radiography Testing (RT).
   2. All 150 lb steam piping greater than 10" shall be 50% RT.
   3. 100% of the steam piping shall be Magnetic Particle inspected (MP) unless weld is RT'd.

b. Contractor is responsible for coordinating all NDE testing.

c. If defects are detected in the work of a welder, greater than 10%, the inspection of the work done by that welder shall be expanded at CONTRACTORS expense to 100% RT until 5 consecutive welds are found acceptable.

d. Refer to specifications for further details.

5. Material and Equipment Requirements:

a. With the exception of the material and labor listed in Section 4.b., the Contractor shall supply and include in his bid, the cost of all equipment, material and labor required to complete the project.

b. Material and labor to be provided by Duluth Steam
   1. Insulation removal and abatement (as required)
   2. All three (3) Pressure Reducing Valves
   3. Exhaust Steam Unloading Valve
   4. All replacement gate valves
   5. All steam traps (and associated isolation valves)
   6. Replacement flanges, fasteners and gasket kits
   7. Control wiring, integration and testing of PRV's and unloading valve
   8. Dumpster for disposal of valves and piping.

b. Material, equipment and labor to be provided by Contractor:
   1. Any pipe and/or pipe fittings required
   2. All rigging and temporary supports
   3. Removal of existing valves and flanges
   4. Removal and reinstallation of any interference as required to complete valve replacements
   5. NDT of all welded joints (see specifications)
   6. Insulation of new valves and piping (to include labeling and flow direction arrows)

6. Project Schedule

April 24, 2014 – Bids due

May 1, 2015 – Contract Award

August 1 thru 3, 2015 – Duluth Steam plant secured, lock-outs complete.

August 19, 2015 - Valve Replacement (including insulation) complete

August 20, 2015 – Start-up plant

7. Bid Requirements

The following submissions are required:

a. Firm Fixed Price Bid for Scope of Work described in this document and its attachments.

b. Description of any proposed alternative piping configuration and rational for the proposed alternative solution / piping configuration.

c. List of subcontractors and their respective roles in project.

d. Production schedule to include the following critical project milestones.

   1. Prefabrication start date (as applicable)
   2. Start Demolition
   3. Complete Demolition
   4. Start Piping & Valve Replacement
   5. Complete Piping and Valve Replacement
   6. Complete NDT
   7. Start Re-Insulation
   8. Complete Re-Insulation
   9. Manning Plan (workday / shift schedules and estimated manning per shift)

SECTION 02 05 00
COMMON WORK RESULTS FOR EXISTING CONDITIONS

PART 1 - GENERAL

SCOPE

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

PART 1 - GENERAL
- Reference
- Quality Assurance
- Safety
- Permits
- Construction Limits
- Equipment & Materials Furnished by Others
- Work by Others
- Submittals
- Off Site Storage
- Codes
- Certificates and Inspections

PART 3 - EXECUTION
- Maintenance of Site and Building Access/Egress
- Protection and Continuity of Existing Utilities
- Protection of Existing Work and Facilities

REFERENCE

Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standards

QUALITY ASSURANCE

Provide materials and products as required by individual specification sections.

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

SAFETY

Contractor is solely responsible for worksite safety.

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

PERMITS

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

CONSTRUCTION LIMITS

Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by Duluth Steam.

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

EQUIPMENT & MATERIALS FURNISHED BY OTHERS

The owner will provide all valves, pressure reducing stations, flanges, studs, nuts and gaskets as required to install valves into the existing piping.

Coordinate work under this project with work by Owner and other contractors on the site.

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

Unless otherwise noted, provide 6 copies of each submittal. Submit to Owner unless otherwise directed by Owner Representative at the Pre-Construction Meeting.

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

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

CERTIFICATIONS AND INSPECTIONS
Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the owner in the Contract Documents. Deliver originals of certificates and documents to the owner. Include copies of the certifications and documents in the O&M Manual.

PART 3 - EXECUTION

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

PROTECTION AND CONTINUITY OF EXISTING UTILITIES
Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any sitework.

PROTECTION OF EXISTING WORK AND FACILITIES
Verify the locations of, and protect, any structures, and all other such equipment that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Owner immediately. Contractor is responsible to correct and pay for all damages.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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

SCOPE
This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Pipe Hanger and Support Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Beam Clamps
- Concrete Inserts
- Anchors
- Corrosive Atmosphere Coatings

PART 3 - EXECUTION
- Installation
- Hanger and Support Spacing
- Vertical Riser Clamps
- Anchors

RELATED WORK
Section 23 07 00 - HVAC Insulation

REFERENCE
Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standard

REFERENCE STANDARDS
MSS SP-58 Materials, Design, Manufacture, Selection, Application, and Installation

DESCRIPTION
Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points; see Related Work above.

SHOP DRAWINGS
Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service.

DESIGN CRITERIA
Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

Piping supported by lying on the bottom chord of joists or trusses will not be accepted.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 - PRODUCTS

PIPE HANGER AND SUPPORT MANUFACTURERS
Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

STRUCTURAL SUPPORTS
Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

PIPE HANGERS AND SUPPORTS
HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":
Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

HANGERS FOR STEEL PIPE SIZES 2-1/2" AND OVER:
Adjustable steel yoke, cast iron roll, double hanger. Anvil figure 181.

MULTIPLE OR TRAPEZE HANGERS:
Steel channels with welded spacers and hanger rods if calculations are submitted.

WALL SUPPORT:
Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

VERTICAL RISER SUPPORT:
Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.

FLOOR SUPPORT FOR PIPE SIZES THROUGH 4":
Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

FLOOR SUPPORT FOR PIPE SIZES 5" AND OVER:
Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

INSULATION PROTECTION SHIELDS:
Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, black finish.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8

4960	1
8000	1-1/4

Provide rods complete with adjusting and lock nuts.

BEAM CLAMPS
MSS SP-58 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

CONCRETE INSERTS
Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

ANCHORS
Use welding steel shapes, plates, and bars to secure piping to the structure.

CORROSIVE ATMOSPHERE COATINGS
Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

Corrosive atmospheres include the following locations:
- All Exterior locations

PART 3 - EXECUTION

INSTALLATION
Install supports to provide for free expansion of the piping. Support all piping from the structure using concrete inserts, beam clamps, wall brackets, or floor stands. Fasten wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Piping shall be supported independently from all other trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

HANGER AND SUPPORT SPACING
Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"

Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"

VERTICAL RISER CLAMPS
Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

ANCHORS
Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

SCOPE
This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Quality Assurance
- Continuity of Existing Services
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing
- Equipment Furnished By Others
- Submittals
- Operating and Maintenance Data

PART 2 - PRODUCTS
- Sealing and Fire Stopping

PART 3 - EXECUTION
- Demolition
- Cutting and Patching
- Coordination
- Sleeves and Openings
- Sealing
- Agency Training

REFERENCE
Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standards

REFERENCE STANDARDS
Abbreviations of standards organizations referenced in other sections are as follows:

ABMA	American Boiler Manufacturers Association
AGA	American Gas Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CGA	Compressed Gas Association
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.

ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE
Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

SLEEVES AND OPENINGS
Sleeves and openings shall be the responsibility of the Contractor. Provide sleeves at all pipe penetrations through walls.

SEALING
Sealing of sleeves/openings between piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening.

EQUIPMENT FURNISHED BY OTHERS
Duluth steam will provide all valves, flanges, bolt kits and gaskets required for valve and flange replacement. Duluth steam will provide asbestos abatement and reinsulating of existing piping. Contractor shall provide all rigging, welding, miscellaneous piping

SUBMITTALS
Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

Submit sufficient quantities of shop drawings to allow the following distribution:
- Operating and Maintenance Manuals 2 copies

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:
1. Records of tests performed a to certify compliance with system requirements
2. Certificates of inspection by regulatory agencies
3. Valve schedules
4. Lubrication instructions, including list/frequency of lubrication
5. Copies of all approved shop drawings.
6. Manufacturer's wiring diagrams for electrically powered equipment
7. Temperature control record drawings and control sequences
8. Parts lists for manufactured equipment
9. Warranties
10. Additional information as indicated in the technical specification sections

PART 2 - PRODUCTS

SEALING

NON-RATED PENETRATIONS:

Pipe Penetrations:
At pipe penetrations of non-rated walls, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. Use none hardening grout in concrete walls. For non-

rated drywall, plaster or wood walls where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

Sleeves:
Sleeves shall be schedule 40 black steel pipe cut to fit penetration with minimum ½" annular space around sleeve for caulk, grout etc.

PART 3 - EXECUTION

DEMOLITION
Perform all demolition as shown on the drawings and marked in the plant to accomplish new work. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work.

All pipe, wiring and associated conduit, insulation, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the owner. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

COORDINATION
Verify that all devices are compatible for the surfaces on which they will be used. If devices provided by owner do not match existing systems, notify owner immediately.

SLEEVES AND OPENINGS
Pipe penetrations through existing floors: Core drill sleeve opening large enough to insert schedule 40 sleeve, extend sleeve 2 inches above the floor and grout area around sleeve with hydraulic setting, non-shrink grout. Size sleeve to allow insulated pipe to run through sleeve and paint the sleeve.

Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

SEALING AND FIRE STOPPING
FIRE AND/OR SMOKE RATED PENETRATIONS

NON-RATED PENETRATIONS:
At all interior walls and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

PENETRATIONS SUBJECT TO WATER INTRUSION:
For penetrations (both rated and non-rated) in floors subject to water intrusion or in rooms housing electrical equipment (but not within walls) provide one of the following:

- Pipe penetration where steel pipe sleeve is used extend steel sleeve 2" above the floor.
- Pipe penetration where cast in place fire stopping device/sleeve is used, extend device/sleeve 2" above the floor (provided it meets the device's UL listing).
- Pipe penetration where there is no steel sleeve or cast in place fire stopping device/sleeve, provide 2"x 2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8"on center. Seal corners water tight with urethane caulk.

END OF SECTION

SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

SCOPE
This section contains specifications for steam and condensate heating piping for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- High Pressure Steam (Over 15 psig)
- High Pressure Steam Condensate (Steam pressure over 15 psig)
- Unions and Flanges
- Gaskets

PART 3 - EXECUTION
- Preparation
- Erection
- Welded Pipe Joints
- Steam and Steam Condensate
- Unions and Flanges
- Gaskets
- Piping System Non-Destructive Leak Tests

RELATED WORK
Section 23 05 15 - Piping Specialties
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 07 00 - HVAC Insulation

REFERENCE
Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standards

REFERENCE STANDARDS

ANSI B16.5	Pipe Flanges and Flanged Fittings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

SHOP DRAWINGS

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

TYPE F STEEL PIPE:
Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

TYPE E OR S STEEL PIPE:
Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

QUALITY ASSURANCE

Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING
Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA
Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

WELDER QUALIFICATIONS
Welding procedures, welders, and welding operators for all steam system piping at service pressures above 15 psig to be qualified complying with the provisions of the latest revision of ANSI/ASME B 31.1-Power Piping or Section IX of the ASME Boiler and Pressure Vessel Code for boiler external piping.

Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.

The Owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project.

PART 2 - PRODUCTS

HIGH PRESSURE STEAM (Over 15 psig)
Instrument impulse tubing on heating plant boilers and transmitters: ½" O.D. 316 stainless steel tube, 0.062" thick wall, Swageloc or equal with stainless steel "Gageable" tube fittings.

2" and Smaller in heating plants and below grade distribution systems: ASTM A106, Grade B, standard weight (schedule 40) black steel pipe ASTM A105 grade II/ANSI B16.11, welded forged steel fittings.

2 1/2" and Larger in heating plants and below grade distribution systems : ASTM A106, Grade B, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

HIGH PRESSURE STEAM CONDENSATE (Steam pressure over 15 psig)
Instrument impulse tubing on heating plant boilers and transmitters: ½" O.D. 316 stainless steel tube, 0.062" thick wall, Swageloc or equal with stainless steel "Gageable" tube fittings.

2" and Smaller in heating plants and in below grade distribution systems: ASTM A53, type E or S, extra strong (schedule 80) black steel pipe with ASTM A105 grade II/ANSI B16.11, welded forged steel fittings.

2-1/2" and Larger: ASTM A53, type E or S extra strong (schedule 80) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 extra strong, seamless, carbon steel weld fittings.

STAINLESS STEEL PIPING
2" and Smaller: ASTM A312 or A376, Schedule 40, seamless stainless steel, type 304 pipe with ASTM A182, Gr. F304, 3000 lb socket-weld fittings.

UNIONS AND FLANGES
2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use ANSI B16.18 cast copper alloy unions on copper piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 300 psi.

2-1/2" and Larger: ASTM A181 grade I or A105, grade III hot forged steel weld neck flanges, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment. Slip on flanges are not allowed without written approval.

Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Use star washers when required for grounding.)

GASKETS
Steam Systems and high pressure steam condensate systems: Spiral wound gasket with external ring to prevent gasket blowout, ASME B16.20. Suitable for use with flat face and raised face flanges. 304 stainless steel/non-asbestos filler/carbon steel outer guide ring,. Filler to be graphite or PTFE on low pressure systems, 900 degree F graphite or ceramic on high pressure steam. Flexitallic Style CG, Leader Style SR, Garlock Flexseal or approved equal.

PART 3 - EXECUTION

PREPARATION
Remove all foreign material from interior and exterior of pipe and fittings.

ERECTION
Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

All pipe shall be installed with adequate space to fully insulate the pipe, minor alignment offsets to provide adequate spacing for the pipes shall have no additional cost to the project.

Mitered ells, notched tees, and orange peel reducers are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

WELDED PIPE JOINTS
Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

All welds shall be painted/primed with high temperature paint rated for 500°F minimum continuous working temperature.

ANCHORS AND GUIDES
All anchor and guide steel shall be plumb, square and level to the pipe being supported or anchored. Skewed or sloppy anchors or guides shall be removed and reinstalled plumb, square and level to the pipe at no additional cost to the project.

THREADED PIPE JOINTS
Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

STEAM AND STEAM CONDENSATE
Pitch mains down 1 inch in 40 feet in the direction of flow. Pitch terminal equipment runouts down 1 inch in 2 feet for proper condensate drainage.

Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper condensate drainage. Concentric fittings may be used for changes in vertical pipe sizes.

Make branch connections and runouts at the top of the main or 45 degrees from the top. Condensate connections may be made in the horizontal plane in limited space situations.

UNIONS AND FLANGES
Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Concealed unions or flanges are not acceptable.

GASKETS
Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.

Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5. Retighten bolts after 24 hours of operation at system pressure and temperature.

PIPING SYSTEM NON-DESTRUCTIVE LEAK TESTS (RADIOGRAPHIC (RT) or Magnetic Particle (MT) TEST
Use Radiographic (RT) or Magnetic Particle (MT) testing as follows:

1. 100% of all welds that are not RT'd shall be MT'd
2. All 250 LB steam piping greater than 8" shall be 50% RT'd
3. All 150 LB steam piping greater than 10" shall be 50% RT'd
4. Pipe that requires radiographic testing per ASME code

Weld test criteria shall be in accordance to ASME B31.1 current version.

RADIOGRAPHY OF PIPING WELDS
The CONTRACTOR shall schedule, pay for and preform any additional weld weld radiography for all weld repairs in accordance with this Specification.

The procedure shall include, but not be limited to, the requirements of ANSI B31.1; the American Society for Mechanical Engineers (ASME) Sec V Nondestructive Examination, Art. 2, Para. T281; and this Specification.
In addition to the requirements of ANSI B31.1 and ASME Sec V, the following shall apply:

1. Type 4 film shall not be used.
2. Fluorescent screens shall not be used
3. One film shall be used for each radiographic exposure.

4. The procedure shall be submitted to the Engineer for review and release prior to such examinations.

EXAMINATION PROCEDURE

The surface condition of finished welds shall be suitable for proper radiographic examination.

Welds shall be visually inspected prior to radiography.

Welds shall be repaired if any of the following discontinuities are observed:

1. Cracks
2. Surface Porosity
3. Excessive weld reinforcement greater than specified in ANSI B31.1, table 127.4.2
4. Lack of surface penetration
5. Incomplete penetration when interior surface is accessible
6. Undercut shall not exceed 1/32" and shall not encroach on the minimum required section thickness
7. Weld overlap and craters
8. Radiography of fabrication welds shall be performed in accordance with the written procedure.

If defects are detected in the work of a welder, the inspection of the work done by that welder shall be expanded at CONTRACTOR expense, to comprise of a total at least three additional joints. These tracers may be taken anywhere on the project where there are exposed and accessible welds previously made by the welder.

If any joint in the expanded inspection is rejected, further radiography shall be conducted to provide 100 percent coverage of work previously done by that welder, until five joints in succession are satisfactory.

When all joints in the expanded inspection are satisfactory, the inspection shall revert to the random sampling indicated above.

RECORDS AND SUBMITTALS

Copies of the following documents shall be submitted to the engineer for review and release

1. Radiography procedure
2. Personnel Certifications
3. Radiographic reader sheets, including film interpretations
4. One Radiographic film of each weld location
    a. Included with the films shall be all radiographic films containing discontinuities requiring repair.
    b. All radiographic films, including tracer and repair films, taken on the piping systems are the sole property of Owner.
5. Each document and film shall contain, but not limited, to the following identifying information:
    a. Client Name (Owner)
    b. Identification of the piping system (project number)
    c. Date of Radiography
    d. Manufacturer's name or symbol
    e. Weld Identification number
    f. Welder Identification
    g. Signature of Interpreter
    h. Examination Procedure Number

MAGNETIC PARTICLE EXAMINATION OF PIPING WELDS

The Contractor is responsible for all costs associated with Magnetic Particle (MT) testing.

PROCEDURE REQUIREMENTS

The MT examination shall be performed in accordance with a detailed written procedure. The procedure shall be submitted to the engineer for review and release prior to such examinations.

The procedure shall include, but not limited to, the requirements of ANSI B31.1; The American Society for Mechanical Engineers (ASME) Sec V-Nondestructive Examination, and this specification.

In addition to the requirements of ANSI B31.1 and ASME the following shall apply:

1. Shot or sand blasting shall not be used on the surface prior to examination.
2. Cleaning solvents and penetration families shall be certified by the manufacturer to contain not more than one percent (1%) by weight of sulfur, nor more than one percent (1) residual total halogens.
3. Intermixing of penetration families will not be permitted.
4. Fluorescent penetration examination is not allowed.

EXAMINATION PROCEDURE

The surface condition of finished welds shall be suitable for proper MT examination.

All welds shall be visually inspected prior to MT examination.

Welds shall be repaired if any of the following discontinuities are observed:

1. Cracks
2. Surface porosity
3. Excessive weld reinforcement greater than specified in ANSI B31.1, Table 127.4.2
4. Lack of surface penetration
5. Incomplete penetration when ID surface is accessible
6. Undercut shall not exceed 1/32" and shall not encroach on the minimum required section thickness
7. Weld overlap or craters.

Repairs of all defects disclosed by MT examination shall be re-examined in accordance with this Specification.

If defects are detected in more than 10% of the work of a welder, the inspection of the work done by that welder shall be expanded at CONTRACTOR expense, to comprise of 100% radiography examination. Radiography of 100% of the welds shall continue until five joints in succession are satisfactory.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

SCOPE
This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Operation and Maintenance Data
- Environmental Requirements

PART 2 - PRODUCTS
- Materials
- Insulation Types
- Adhesives, Mastics, Sealants, and Reinforcing Materials Jackets
- Insulation Inserts and Pipe Shields
- Expansion Joint and Valve Insulation Blankets
- Accessories

PART 3 - EXECUTION
- Examination
- Installation
- Protective Jacket Installation
- Piping, Valve and Fitting Insulation
- Piping Protective Jackets
- Removable Insulation Blankets
- Pipe Insulation Schedule

RELATED WORK
Section 23 05 00 - Common Work Results for HVAC
Section 23 22 13 - Steam and Condensate Heating Piping
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

REFERENCE
Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standards

REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C240	Cellular Glass Insulation Block
ASTM C302	Density of Preformed Pipe Insulation
ASTM C272	Water Absorption of Core Materials for Sandwich Constructions
ASTM C303	Density of Preformed Block Insulation
ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
ASTM C612	Mineral Fiber Block and Board Thermal Insulation

ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1728	Standard for Aerogel Insulation
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

DESCRIPTION

Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- Pipe Insulation
- Valve Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions.

SHOP DRAWINGS

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

ENVIRONMENTAL REQUIREMENTS

Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 - PRODUCTS

MATERIALS

Manufacturers: Armacell, CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa, Johns Manville, Knauf, Owens-Corning, , Pittsburgh Corning, , VentureTape or approved equal.

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less.

INSULATION TYPES
Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, 0.25 at 125 degrees F, 0.27 at 150 degrees F, 0.29 at 200 degrees F, 0.32 at 250 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

SEMI-RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

CALCIUM SILICATE INSULATION:
Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F,. Material to be visually coded or marked to indicate it is asbestos free.

CELLULAR GLASS INSULATION:
Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 90 psi, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

MINERAL WOOL INSULATION:
Rigid preformed mineral wool, minimum nominal density of 8 lbs. per cu. ft., thermal conductivity at mean temperature of not more than 0.25 at 125 degrees F, 0.27 at 150 degrees F, 0.29 at 200 degrees F, 0.32 at 250 degrees F, minimum compressive strength of 3 psi, maximum wicking of 1%, maximum water adsorption of 1% by volume, rated for service of -120 degrees F to 1200 degrees F.

Pipe insulation shall be performed in two (2) half cylinder sections. Cut V-groove sheet insulation is not acceptable. Provide three (3) stainless steel bands for each section of insulation.

AEROGEL INSULATION:
Flexible sheet with a minimum nominal density of 11 lbs. per cu. ft., thermal conductivity of not more than 0.146 at 100 degrees F, 0.19 at 200 degrees F, 0.22 at 250 degrees F, material shall be hydrophobic, and rated for service range of -40 degrees F to 1200 degrees F.

ADHESIVES, MASTIC, SEALANTS, AND REINFORCING MATERIALS
Products shall be compatible with surfaces and materials on which they are applied, and shall be suitable for use at operating temperatures of systems to which they are applied.

FIBERGLASS INSULATION ADHESIVE:
Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.

VAPOR RETARDING MASTIC:
Below ambient equipment/piping, mastic must be anti-fungal and shall meet ASTM D 5590 with 0 growth rating (AF), water vapor permeance shall be less than 0.013 perms at 43 mils dry film thickness per ASTM E 96 Procedure B: Foster 30-80AF Vapor Safe Mastic or equal.

WEATHER BARRIER BREATHER MASTIC:
Above ambient equipment/piping. permeance shall be greater than 1.0 perms at 1/16" dry film thickness per ASTM E96. Foster 46-50 Weatherite, Childers Vi-Cryl CP-10/CP-11, Vimasco WC-5.

LAGGING ADHESIVE / COATINGS:
Indoors applications used in conjunction with canvas/glass cloth: Foster 30-36, Childers CP-50 AMV1, Vimasco 713.

meet ASTM D 5590 with 0 growth rating (AF): Foster 30-36 AF Seal Fas, Childers CP-137 AF Chil-Seal.

REINFORCING MESH:
Foster 42-24 Mast A Fab, Childers Chil Glas #10 or Pittsburgh Corning PC 79.

METAL JACKETING SEALANT FOR ALL ALUMINUM JACKETING:
Foster 95-44 Elastolar, Childers CP-76 Chil-Byl, Pittsburgh Corning 727.

INSULATION JOINT SEALANT: (cellular glass, polyisocyanurate, phenolic)
Used on all below ambient piping to prevent moisture ingress. Foster 95-50 Flextra, Childers CP-76 Chil-Byl, Pittsburgh Corning CW Sealant.

JACKETS
PVC FITTING COVERS AND JACKETS (PFJ):
White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, installed outdoors. Jacket thickness to be minimum .03"outdoors for piping 12" and smaller, .04" outdoors for piping 15" and larger.

PROTECTIVE METAL JACKETS (PMJ):
0.016 inch thick aluminum or 0.010 inch thick stainless steel with safety edge for indoor installations and 0.024 inch thick aluminum or 0.016 inch thick stainless steel with safety edge for outdoor installations.

FABRIC REINFORCED MASTIC JACKETS (FMJ):
Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer's recommended procedure for 2 coat application.

INSULATION INSERTS AND PIPE SHIELDS
Manufacturers: B-Line, Pipe Shields, Value Engineered Products.

Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/premanufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2" and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/premanufactured product described above.

Wood blocks will not be accepted.

EXPANSION JOINT AND VALVE INSULATION BLANKETS
Manufacturers: Advance Thermal Corporation, TANI Division B.D. Schiffler, or approved equal. Site fabricated blankets are not acceptable.

Blanket shall be 17 ounce per square yard PTFE coated fiberglass fabric which is designed for wet and dry steam applications to 550°F. Equal to Advance Thermal Corp. Steamguard-2. Jacket shall have PTFE coated fabric on both exterior and interior. Wire mesh interior is not acceptable.

The Blankets shall be installed to shed water and have a 3-inch wide cinchable rain flap on each end.

All seams shall be sewn twice with double locked stitching. One seam shall be sewn with 3-ply Nomex and the other with 3-ply stainless steel. Hog rings and staples shall not be used.

The insulation shall be a 2-inch thick, compressed "E" glass fiber with no chemical binders, held in place with 12 gauge stainless quilt pins which do not puncture the inner surface of the blanket.

Blankets shall be designed to allow access to the expansion and ball joints packing cylinder plungers for repacking without removing the blanket.

Removable expansion joint blanket shall be constructed to allow the pipe and rigid insulation to expand/contract with the pipe. Blanket shall have a close fit without sagging or gaps.

Blanket shall allow for normal operation of the valve or joint without removing the cover.

Valve blankets shall come in two pieces and cover the valve yoke (if applicable).

Blankets shall have D-ring, hook and loop or buckle securing straps. Pins and wire or spring and ring securement is not acceptable.

Blankets shall have a stainless steel identifying plaque on the exterior identifying equipment information.

ACCESSORIES
All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be 0.015 inch for aluminum and 0.010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing used with lagging adhesive shall have a minimum untreated weight of 6 oz./sq. yd.

Joint sealants and metal jacketing sealants to be non-shrinking and permanently flexible.

PART 3 - EXECUTION

EXAMINATION
Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

INSTALLATION
All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

All pipe insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor retarding jacket shall be maintained continuous through all penetrations.

PROTECTIVE JACKET INSTALLATION

PVC FITTING COVERS AND JACKETS (PFJ):
Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor retarding jacket is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor retarding jacket, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

PROTECTIVE METAL JACKET (PMJ):
Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the jacket. Locate seams on bottom for exterior applications. Seal laps with 1/8" bead of metal jacketing sealant to prevent water entry.

FABRIC REINFORCED MASTIC JACKETS (FMJ):
Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating in accordance with manufacturer's recommendations. All seams shall overlap not less than 2".

PIPING, VALVE, AND FITTING INSULATION
GENERAL:
Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints.

On systems requiring a vapor retarding jacket, seal off all raw ends of insulation and butt joints with vapor retarding mastic at intervals of not more than 20 feet on piping. Coat staples, longitudinal and transverse seams with vapor retarding mastic and on systems requiring vapor retarding jacket, coat insulated elbows, fittings, and valves with vapor retarding mastic.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor retarding jacket is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor retarding jacket, extend insulation and vapor retarding jacketing/coating around riser clamp.

Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

INSULATION INSERTS AND PIPE SHIELDS:
Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES:
Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

MINERAL FIBER:
Secure each 3' section with three metal bands snip off excess and turn ends over into insulation to prevent exposed sharp edges. Stagger joints where more than one layer is used.

AEROGEL INSULATION:
Secure each 3' or larger sections with stainless steel bands evenly spaced at 12" and at ends. For elbows use 16 gauge stainless steel or annealed copper tie wires evenly spaced. Twist wire ends, snip off excess and turn ends over into insulation. Stagger joints where more than one layer is used.

ELASTOMERIC AND POLYOLEFIN:
Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

EXTRUDED POLYSTYRENE AND POLYISOCYANURATE:
Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9"-12" on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of elastomeric joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before applying protective covering. For piping service below 0^{o}F, use two layers of insulation with inner and outer butt and longitudinal joints staggered and offset 90 degrees. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6" from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

PIPING PROTECTIVE JACKETS
In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:

Provide a protective PVC (PFJ) or Fabric Reinforced Mastic (FMJ) jacket for the following insulated piping:
- All piping within Steam Plant.

Provide a protective metal jacket (PMJ) for the following insulated piping:
- Steam piping and fittings located exposed outdoors.

REMOVABLE INSULATION BLANKETS: (EXPANSION SLIP JOINT AND VALVES 2-1/2" AND LARGER)
Provide removable reusable insulated cover on all new and existing expansion slip joints, ball joints and valves.

Install blankets to be field removable without tools.

Blankets shall be installed to allow the normal expansion and contraction associated with these systems, without crushing or damaging the blanket.

Expansion Joint blankets shall extend over the adjacent rigid insulation to allow for pipe expansion.

Blankets shall be installed without sagging or gaps.

Blankets shall be installed to shed water.

Steam system will not be allowed to turn on until removable jackets are installed.

PIPE INSULATION SCHEDULE:
Provide insulation on new and existing piping as indicated in the following schedule:

SERVICE	INSULATION	JACKET	INSULATION THICKNESS BY PIPE SIZE				
			< 1"	1" to < 1-1/2"	1-1/2" to < 4"	4" to < 8"	8" and Larger
High Pressure Steam (120 psig or greater)	Rigid Fiberglass	ASJ	4"	4.5"	4.5"	5"	5"
In Building	Mineral Wool	PMJ/PFJ	4"	4.5"	4.5"	5"	5"
	Aerogel	PMJ	1.6"	2"	2.6"	2.8"	2.8"
Outside	Mineral Wool	PMJ	4"	4.5"	4.5"	5"	5"
	Aerogel	PMJ	1.6"	2"	2.6"	2.8"	2.8"
High Pressure Cond. In Building	Mineral Wool	None	2"	2"	2.5"	3"	3"

High Pressure Cond. Outside	Mineral Wool	PMJ	2"	2"	2.5"	3"	3"
Valves and Exp. Joints	Ceramic Fiber	Blanket	2"	2"	2"	2"	2"

The following piping and fittings are not to be insulated:

- Steam Traps
- Piping unions for systems not requiring a vapor retarding Jacket

END OF SECTION

SECTION 02 41 13
DEMOLITION

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the demolition of site work and such features as required in these specifications and on the drawings. Included are the following topics:

PART 1 - GENERAL
- Reference
- Submittals
- Safety
- Permits
- Disconnection of Services
- Removal/Salvaging of Items
- Owner Salvaged or Removed Materials

PART 2 - MATERIALS
- Equipment

PART 3 - EXECUTION
- Protection of Existing Work and Facilities
- Demolition

REFERENCE

Applicable provisions of the 2015 City of Duluth, Minnesota Construction Standards.

SUBMITTALS

For services requiring removal or abandonment in-place, submit materials documenting completion of such work.

Submit record drawings of any substantial modifications to oringial scope.

SAFETY

Verify that all pipes have been abandoned or disconnected and associated hazards mitigated, prior to beginning any demolition.

Take all necessary precautions while dismantling piping to avoid asbostoes or any other hazards that may be present.

Maintain a clean and orderly site. Remove debris at end of each workday.

Burning of debris is not permitted.

If hazardous materials are not anticipated, but encountered, terminate operations and contact the Owner immediately. Follow all applicable local, state and federal regulations pertaining to hazardous materials.

PERMITS

Unless otherwise noted, Contractor shall be responsible for obtaining and paying for all permits necessary to complete demolition work.

DISCONNECTION OF SERVICES

Prior to starting removal and/or demolition operations be responsible and coordinate disconnection of all existing piping, alarm systems and other services.

Disconnect all services in manner which insures continued operation in facilities not scheduled for demolition.

Disconnect all services in manner which allows for future connection to that service.

Disconnect services to equipment at unions, flanges, valves, or fittings wherever possible.

REMOVAL/SALVAGING OF ITEMS
Carefully remove all items that are scheduled to be salvaged. All materials removed shall be turned over to the owner regardless of salvaging materials. Owner will dispose of all waste material.

Secure salvaged items to allow for future movement; provide pallets, skids and other devices as necessary. Secure all loose parts.

Provide crates, padding, tarps and other measures necessary to protect salvaged items during storage. Store items in secure location, safe from vandalism, weather, dust and other adverse elements.

Where salvaged items are indicated to be turned over to Owner, deliver to location on property where designated by Owner.
Where indicated to be incorporated into new work, store the salvaged item in secure location until trade responsible for re-installation mobilizes his equipment and storage facilities to the site, or otherwise accepts responsibility for the salvaged item.

PART 2 - MATERIALS

EQUIPMENT
Use Contractor's normal equipment for demolition purposes and which meets all safety requirements imposed on such equipment.

PART 3- EXECUTION

PROTECTION OF EXISTING WORK AND FACILITIES
Take all measures necessary to safeguard all existing work and facilities which are outside the limits of the work.

Furnish and install fencing or other barriers as shown on the plans or as otherwise necessary to protect existing features.

Verify the locations of, and protect, any buildings, structures, utilities, paved surfaces, utilities, and all other such facilities that are intended to remain or be salvaged.

Make such explorations and probes as necessary to ascertain any required protection measures that shall be used before proceeding with demolition.

Provide and maintain adequate catch platforms, warning lights, barricades, guards, weather protection, dust protection, fences, planking, bracing, shoring, piling, signs, and other items required for proper protection. Provide protection for workmen, public, adjacent construction and occupants of existing building(s).

Report damage of any facilities or items scheduled for salvaging to the Owner.

Repair or replace any damaged facilities that are not scheduled for demolition.

Explosives shall not be used for demolition.

Protect surrounding area from dust. Control rodents, and other vermin associated with demolition operations.

DEMOLITION

Remove all equipment, fixtures and other materials scheduled for salvage prior to beginning demolition operations.

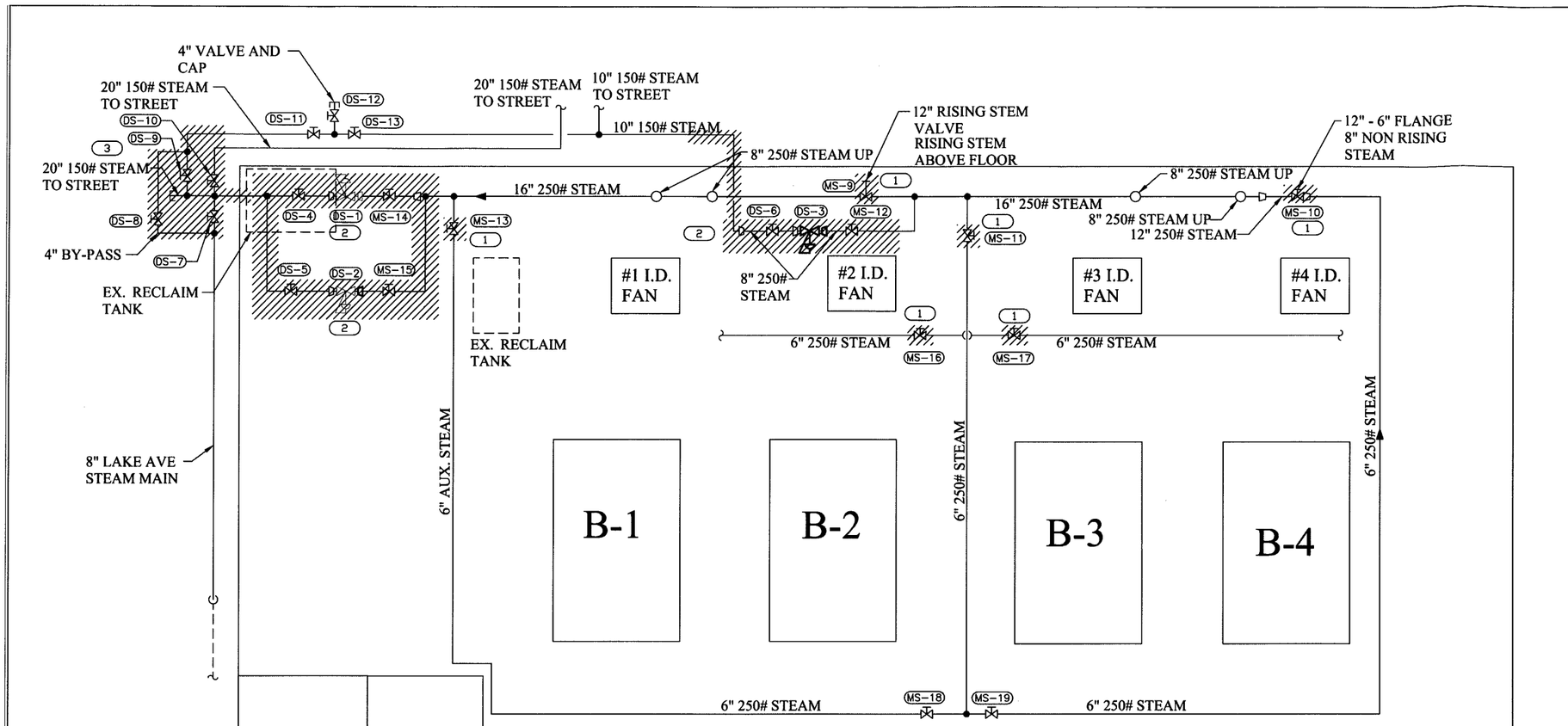
Dismantle each structure in an orderly manner to provide complete stability of the structure at all times. Provide bracing and shoring where necessary to avoid premature collapse of structure.

Conduct demolition operations and the removal of rubbish and debris in such a way that a minimum of nuisance dust is caused. Constantly sprinkle rubbish and debris with water if necessary to keep nuisance dust to a minimum.

Where necessary to prevent collapse of any construction, install temporary shores, underpinning, struts or bracing. Do not commence demolition work until all temporary construction is complete.

During the execution of the work, provide, operate, and maintain all pumping equipment, suction and discharge lines in a number of capacity as required to keep all cellars and pits free of water from any source whatsoever at all times.

END OF SECTION



PIPING SCHEMATIC
HIGH PRESSURE STEAM - LOWER LEVEL

GENERAL NOTES:

A. INSULATION REMOVAL SHALL BE COMPLETED BY OTHERS PRIOR TO WORK STARTING.

B. CONTRACTOR IS RESPONSIBLE FOR ALL RIGGING AND TEMPORARY SUPPORTS TO COMPLETE WORK SHOWN. TEMPORARY SUPPORTING OF EXISTING PIPE NOT SHOWN ON PLAN IS ALSO THE RESPONSIBILITY OF THE CONTRACTOR.

C. COORDINATE WITH ALL OTHER TRADES AND OWNER TO ELIMINATE ANY CONFLICTS AND SCHEDULING ISSUES DURING OUTAGE.

D. CONTRACTOR IS RESPONSIBLE FOR ALL REMOVAL AND REINSTALLATION OF ALL INTERFERENCES.

PLAN NOTES:

1. REMOVE EXISTING VALVE AND FLANGES.
2. REMOVE EXISTING ISOLATION VALVES, PRESSURE REDUCING VALVES AND PIPING REQUIRED TO ACCOMMODATE NEW MODIFICATIONS AS SHOWN ON DRAWING P-2.0.
3. REMOVE EXISTING OUTGOING VALVES AND ASSEMBLY. MODIFY EXISTING SUPPORT STRUCTURE TO ACCOMMODATE NEW PIPE LAYOUT.

1 **LOWER LEVEL DEMO PLAN**
NO SCALE

DULUTH STEAM
SERVICE PROVIDED BY EVER-GREEN ENERGY
ONE LAKE PLACE DRIVE - DULUTH, MINNESOTA 55802
218-720-3601 - FAX 218-720-3600

SHEET TITLE: **LOWER LEVEL DEMO PLAN**

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.

Signature: _____

Typed or Printed Name: _____

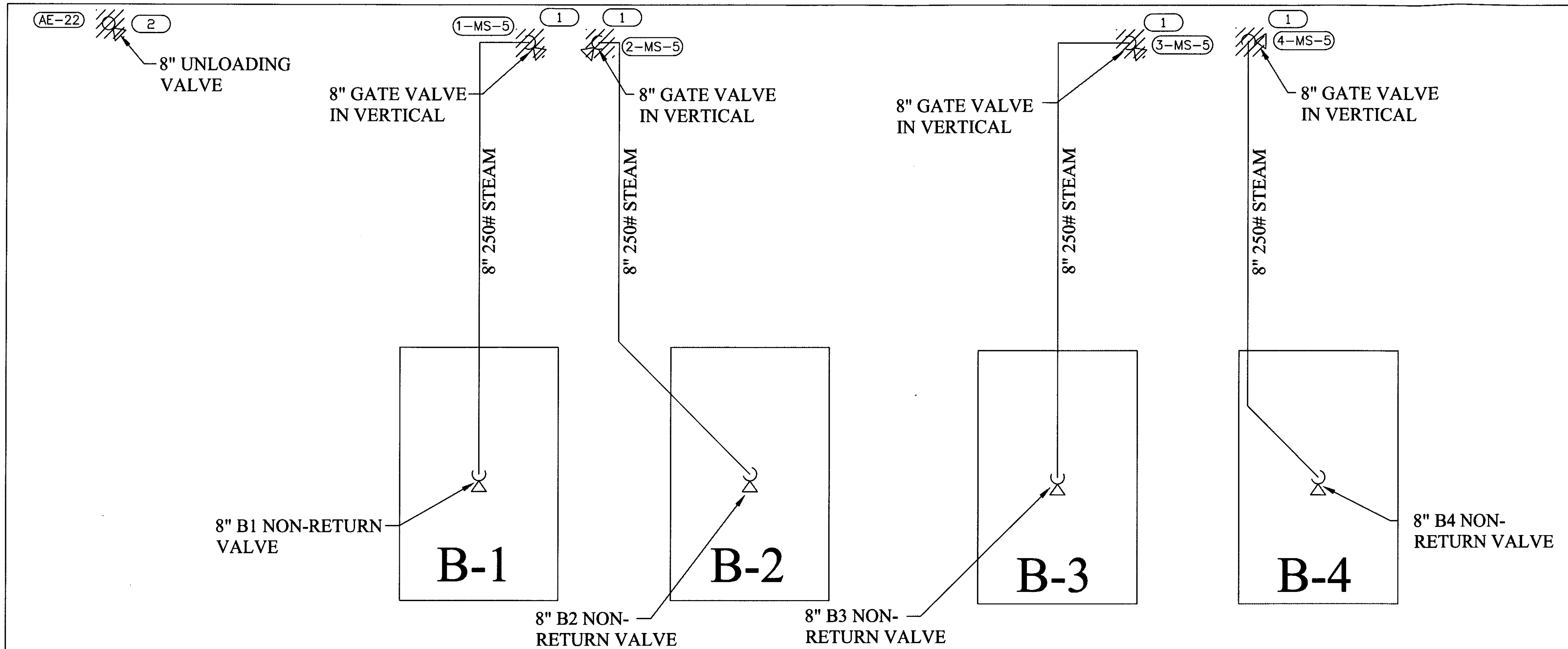
Date: _____ Reg. No.: 47511

Sheet: **P-1.0**

Project: DUL-PLANT-001

Date: 4/1/2015

Scale: NTS



PIPING SCHEMATIC
HIGH PRESSURE STEAM - MAIN LEVEL

GENERAL NOTES:

A. INSULATION REMOVAL SHALL BE COMPLETED BY OTHERS PRIOR TO WORK STARTING.

B. CONTRACTOR IS RESPONSIBLE FOR ALL RIGGING AND TEMPORARY SUPPORTS TO COMPLETE WORK SHOWN. TEMPORARY SUPPORTING OF EXISTING PIPE NOT SHOWN ON PLAN IS ALSO THE RESPONSIBILITY OF THE CONTRACTOR.

C. COORDINATE WITH ALL OTHER TRADES AND OWNER TO ELIMINATE ANY CONFLICTS AND SCHEDULING ISSUES DURING OUTAGE.

D. CONTRACTOR RESPONSIBLE FOR REMOVAL AND REINSTALLATION OF ALL INTERFERENCES.

PLAN NOTES:

1. REMOVE EXISTING GATE VALVE AND ASSOCIATED FLANGES.

2. REMOVE EXISTING 8" ATMOSPHERIC VENT (EXHAUST STEAM UNLOADING VALVE) AND ASSOCIATED FLANGES.

1 UPPER LEVEL DEMO PLAN
NO SCALE

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SERVICE PROVIDED BY EVER-GREEN ENERGY
ONE LAKE PLACE DRIVE · DULUTH, MINNESOTA 55802
218-723-3601 · FAX: 218-723-3600

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Typed or Printed Name: ______
Date: ______ Reg. No.: 47511

Sheet: P-1.1

Project: DUL-PLANT-001
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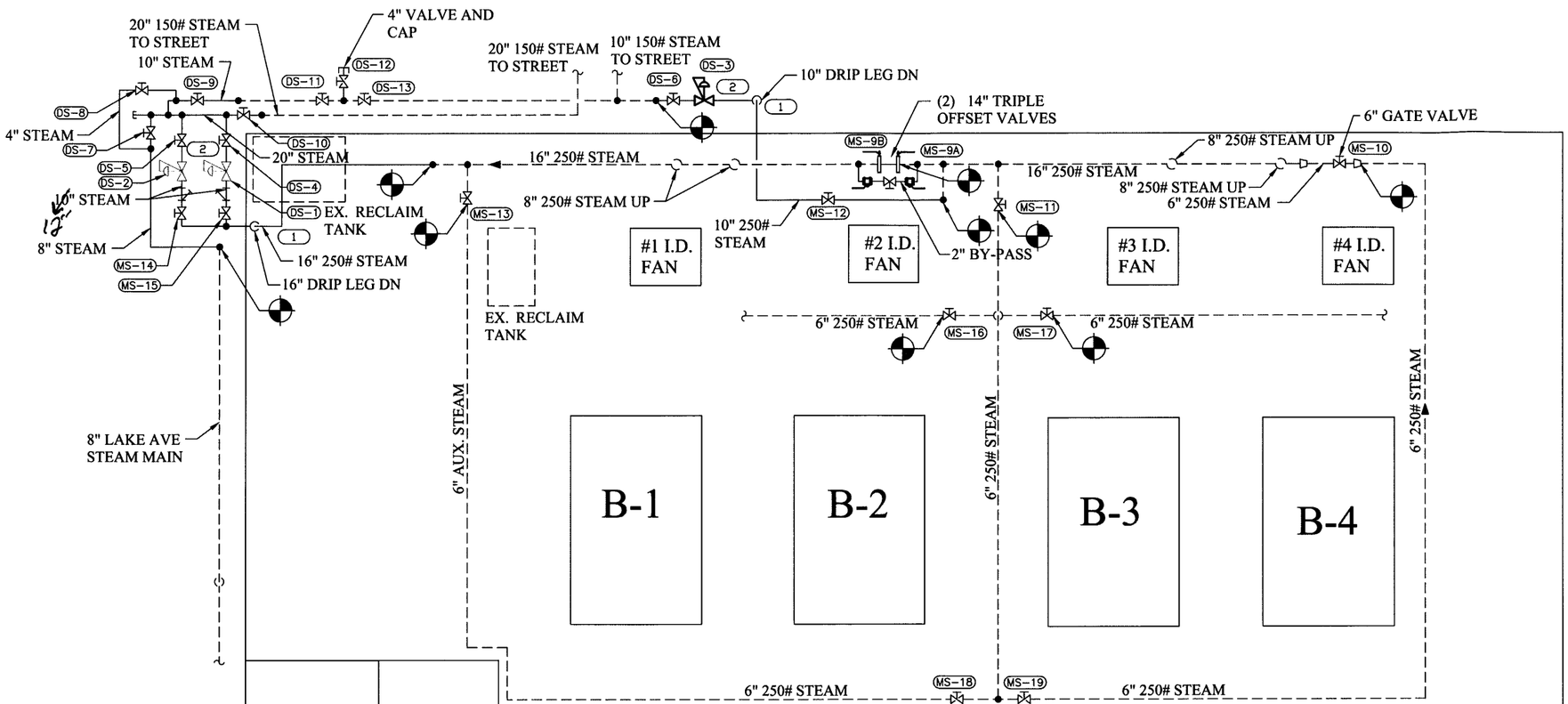

PIPING SCHEMATIC
HIGH PRESSURE STEAM - LOWER LEVEL

GENERAL NOTES:

A. THE CONTRACTOR IS REQUIRED TO PROVIDE ALL NECESSARY SLEEVES AND OPENINGS REQUIRED FOR PIPE PENETRATIONS THROUGH THE WALL.

B. THE CONTRACTOR IS REQUIRED TO PROVIDE THE REQUIRED PIPE BRACKETS, HANGERS AND SUPPORTS.

C. REFER TO VALVE SCHEDULE FOR VALVE DETAILS.

D. PROVIDE ALL MODIFICATIONS NECESSARY TO ACCOMMODATE NEW VALVES AND FLANGES.

E. INSTALL ALL VALVES AND PRV'S PER MANUFACTURER'S RECOMMENDATIONS. DO NOT INSTALL VALVES WITH STEMS AT AN ANGLES OR HORIZONTAL UNLESS WRITTEN PRIOR APPROVAL FROM THE OWNER IS OBTAINED.

PLAN NOTES:

1. PROVIDE DRIP LEG AND TRAP(S) AS SHOWN AND SIZED PER RISER DIAGRAM AND DETAILS.

2. CONTRACTOR TO MOUNT OUTGOING VALVES IN AN ACCESSIBLE LOCATION. VERIFY LOCATION WITH OWNER PRIOR TO INSTALLATION.

1 **LOWER LEVEL NEW PLAN**
NO SCALE

DULUTH STEAM
SERVICE PROVIDED BY EVER-GREEN ENERGY
ONE LAKE PLACE DRIVE · DULUTH, MINNESOTA 55802
218-722-3801 · FAX 218-722-3600

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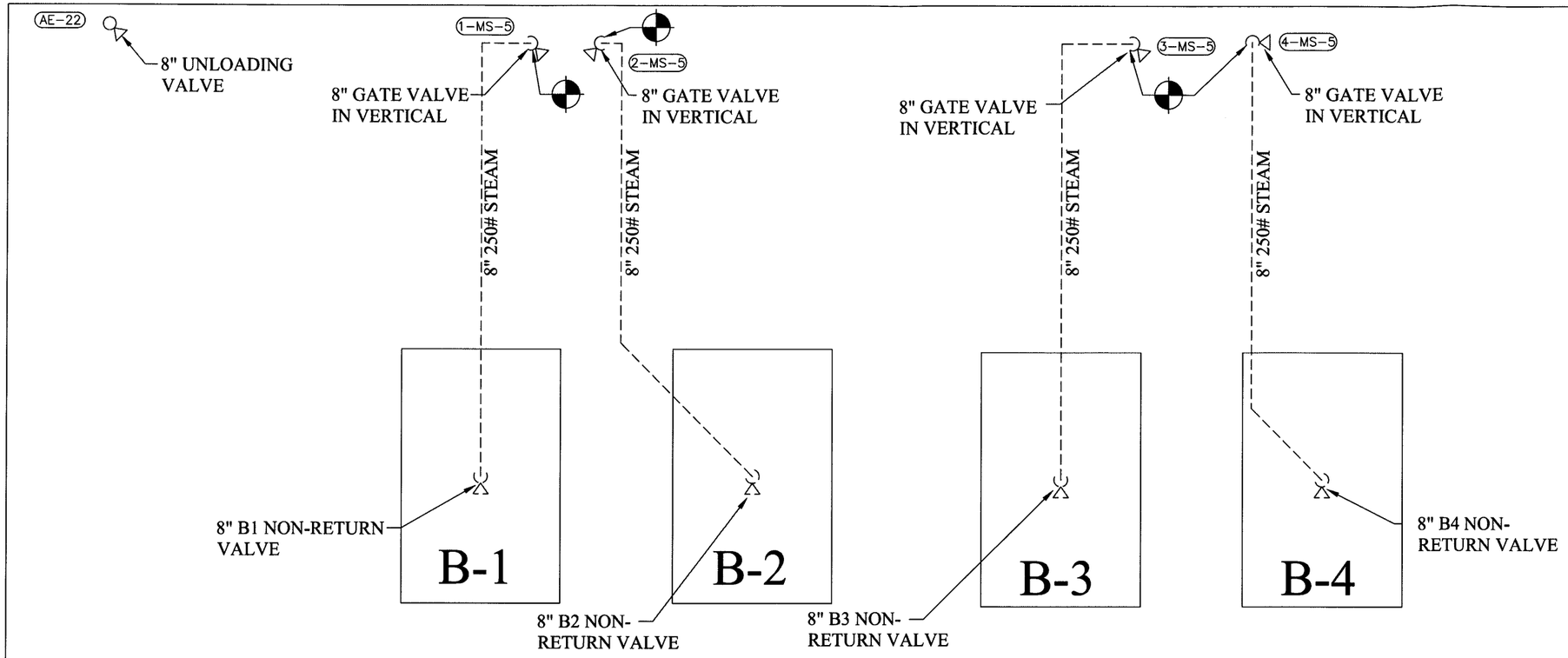
Typed or Printed Name: _____
Date: _____ Reg. No.: 47511

Sheet: **P-2.0**

Project: DUL-PLANT-001
Date: 4/1/2015
Scale: NTS



PIPING SCHEMATIC
HIGH PRESSURE STEAM - MAIN LEVEL

GENERAL NOTES:

A. THE CONTRACTOR IS REQUIRED TO PROVIDE ALL NECESSARY SLEEVES AND OPENINGS REQUIRED FOR PIPE PENETRATIONS THROUGH THE WALL.

B. THE CONTRACTOR IS REQUIRED TO PROVIDE THE REQUIRED PIPE BRACKETS, HANGERS AND SUPPORTS.

C. REFER TO VALVE SCHEDULE FOR VALVE DETAILS.

D. PROVIDE ALL MODIFICATIONS NECESSARY TO ACCOMMODATE NEW VALVES AND FLANGES.

1 **UPPER LEVEL NEW PLAN**
NO SCALE

DULUTH STEAM
SERVICE PROVIDED BY EVER-GREEN ENERGY
ONE LAKE PLACE DRIVE - DULUTH, MINNESOTA 55802
218-722-3601 - FAX: 218-723-3600

SHEET TITLE: **UPPER LEVEL NEW PLAN**

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Sheet: **P-2.1**

Project: DUL-PLANT-001
Date: 4/1/2015
Scale: NTS

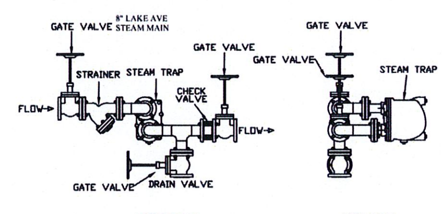
Tag number	Valve Type	Pressure Class	Location/serves	Pipe Size	Valve Size	Notes
			Plant Valves			
1-MS-5	Gate Valve	300 LB Flange	Upper Level/Boiler 1	8"	8"	
2-MS-5	Gate Valve	300 LB Flange	Upper Level/Boiler 2	8"	8"	
3-MS-5	Gate Valve	300 LB Flange	Upper Level/Boiler 3	8"	8"	
4-MS-5	Gate Valve	300 LB Flange	Upper Level/Boiler 4	8"	8"	
MS-9A	Triple Offset Butterfly	300 LB Flange	Lower level/Main steam header	16"	14"	Replaces 12" gate valve. Add/Alt to install 16" Butterfly
MS-9B	Triple Offset Butterfly	300 LB Flange	Lower level/Main steam header	16"	14"	Replaces 12" gate valve. Add/Alt to install 16" Butterfly
MS-10	Gate Valve	300 LB Flange	Lower level/Main steam header	6"	6"	Modify piping to accommodate 6" valve. Reduce 12" to 6".
MS-11	Gate Valve	301 LB Flange	Lower level/Aux steam	6"	6"	
MS-12	Gate Valve	300 LB Flange	Lower Level/10" outgoing valve	10"	10"	
MS-14	Gate Valve	300 LB Flange	Lower Level/20" outgoing valves	12"	12"	
MS-15	Gate Valve	300 LB Flange	Lower level/20" outgoing valves	12"	12"	
MS-16	Gate Valve	300 LB Flange	Lower level/Aux steam	6"	6"	
MS-17	Gate Valve	300 LB Flange	Lower level/Aux steam	6"	6"	
AE-22	Globe valve	300 LB Flange	Mezzanine/Atmospheric vent	8"	8"	

Tag number	Valve Type	Pressure Class	Location/serves	Pipe Size	Valve size	Notes
			District Valves			
DS-1	PRV	300 LB Flange	Outgoing PRV station	12"	10"	
DS-2	PRV	300 LB Flange	Outgoing PRV station	12"	10"	
DS-3	PRV	300 LB Flange	Outgoing PRV station	12"	10"	
DS-4	Gate Valve	300 LB Flange	Plant outgoing valve	12"	12"	
DS-5	Gate Valve	300 LB Flange	Plant outgoing valve	12"	12"	
DS-6	Gate Valve	300 LB Flange	Plant outgoing valve	10"	10"	
DS-7	Gate Valve	300 LB Flange	Plant outgoing valve	8"	8"	
DS-8	Gate Valve	300 LB Flange	Plant outgoing valve	4"	4"	
DS-9	Gate Valve	300 LB Flange	Plant outgoing valve	10"	10"	
DS-10	Gate Valve	300 LB Flange	Plant outgoing valve	20"	20"	

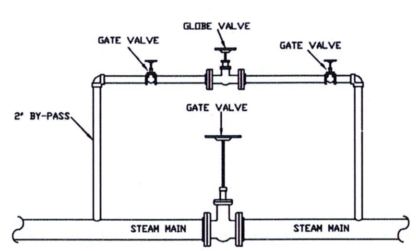
NOTES:

1. VALVE SCHEDULE IS FOR REFERENCE ONLY. SMALL VALVES UNDER 4" ARE NOT LABELED OR LISTED.

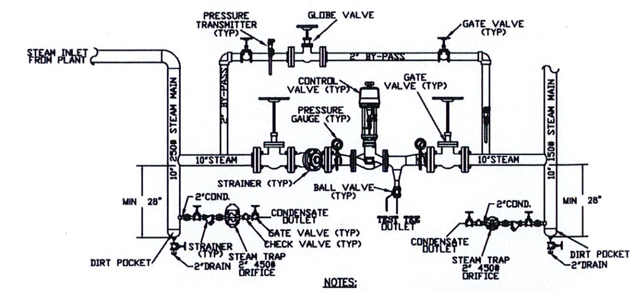
5 VALVE SCHEDULE
NTS



4 TYPICAL TRAP STATION DETAIL
NTS



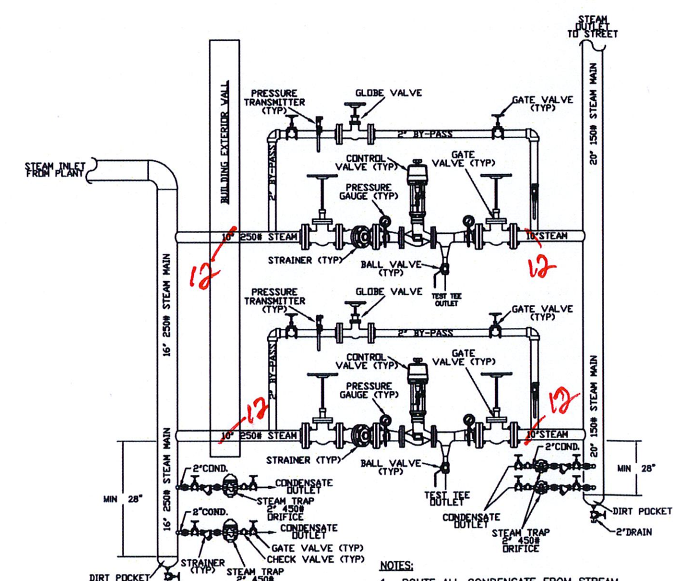
3 WARM-UP VALVE DETAIL
NTS



NOTES:

1. ROUTE ALL CONDENSATE FROM STREAM TRAPS INTO EXISTING RECLAIM TANK INSIDE BUILDING.
2. DRAWING IS DIAGRAMMATIC ONLY.
3. INSTALL TRAPS AT ALL LOW POINTS. LOW POINTS NOT NECESSARILY DICTATED ON DETAILS AND DRAWINGS.

2 SINGLE PRV STATION (10" MAIN)
NTS



NOTES:

1. ROUTE ALL CONDENSATE FROM STREAM TRAPS INTO EXISTING RECLAIM TANK INSIDE BUILDING.
2. DRAWING IS DIAGRAMMATIC ONLY.
3. INSTALL TRAPS AT ALL LOW POINTS. LOW POINTS NOT NECESSARILY DICTATED ON DETAILS AND DRAWINGS.

1 DOUBLE PRV STATION (20" MAIN)
NTS

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ONE LAKE PLACE DRIVE · DULUTH, MINNESOTA 55802
218-723-3601 · FAX: 218-723-3600

SHEET TITLE:
MECHANICAL DETAILS AND SCHEDULE SHEET

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Sheet: P-3.0

Project: DUL-PLANT-001

Date: 4/1/2015

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