District Heat SERVICE LINE STANDARDS

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INTRODUCTION

DU standards of construction shall be utilized for all facilities to be owned, operated and maintained by the utility, to include hookups from the utility facility to the demarcation point.

Generally, utility mains/distribution lines will be constructed by DU or by DU's contractor at DU expense. Thus, these standards will be followed by DU contractors. In rare circumstances, (with prior written approval of the utility), main/distribution facilities may be constructed by the Army's Facility Contractor for the utility, at DU expense. Thus, these standards will be followed by the facility contractor.

DU will be responsible for planning, designing and constructing utility water, wastewater, gas and heat mains and electrical distribution system improvements for new government facilities. This will require close cooperation and utility involvement in the government facility planning process. Without this coordination, facilities constructed will have no utility service.

Hookups from the utility main, whether the utility main is pre-existing or new, will be constructed by the facility contractor for the utility at utility expense and reimbursed to the facility contractor according to the reimbursement schedule found in the hookup standards.

The government, Army, or Corps of Engineer will not be responsible for design, construction, or oversight of any utility owned facilities, whether main/distribution, lines, or hookups.

The government facilities construction contractor will be responsible for construction of the hookup for the utility from the building to the utility main/electrical distributions system facility as described below:

Water: The water hookup from the main to the shutoff valve inside the facility on the customer side of the meter. The utility will provide and install the meter.

Wastewater: The wastewater hookup will be from the collection main to the cleanout, normally located about 5 feet outside the building foundation.

Gas: The gas hookup will be from the gas main to the shutoff valve on the customer side of the meter. The utility will provide and install the meter.

Heat: The heat hookup will be from the heat main, either steam or hot water to the shutoff valve on the customer side of the meter. The utility will provide and install the meter.

Electric: The electric hookup will be from the transformer to the meter socket. The utility will provide and install the meter and the overhead service drop from the transformer to the service entrance mast.

Coordination will be necessary so that the appropriate meters are on hand for the facilities to be constructed.

The utility hookups to be owned by the utility but constructed by the facility contractor for the utility will be reimbursed to the contractor according to the attached schedule. Hookups will be inspected during construction by utility personnel and constructed according to the hookup standards.

The service line standards and utility facility standards are incorporated herein.

Size	Lump Sum	Per Foot
Water Service		
¾”	$ 1750.00	$ 50.00
1”	1750.00	52.00
1- ½”	2000.00	55.00
2”	2000.00	65.00
3”	2500.00	70.00
4”	2500.00	75.00
6”	3000.00	110.00
8”	3500.00	120.00
Wastewater Service		
4”	$ 1500.00	$ 65.00
6”	1500.00	70.00
Steam Heat Service		

2” - S/1”-C	$ 2300.00	$ 200.00
4” - S/1”- C	5400.00	280.00
6” - S/2”- C	9400.00	370.00
8” - S/4”- C	9400.00	450.00
Gas Service		
¾”	$ 2300.00	$ 10.00
2”	400.00	15.00
Electric Service		
1-Ph	$ 2553.00	$ 0.00
3-Ph	4788.00	0.00

Note: Unique siturations will be handled on a case by case basis.

GENERAL

1.1 SCOPE

This Standard covers the acceptable design and construction features for the installation or repair of district heat steam and condensate **service lines**, and will serve as the official inspection guideline prior to connection. Deviation from this Standard is permitted only by written consent of DU.

1.2 DEFINITIONS

In general, the following definitions apply to this Standard:

ADEC ..... Alaska Department of Environmental Conservation

AKDOL ..... Alaska Department of Labor, Mechanical Inspections Division, Boiler and Pressure Vessels

AMR ..... Automatic Meter Reader

ANSI ..... American National Standards Institute

ASME ..... American Society of Mechanical Engineers

ASTM ..... American Society for Testing and Materials

AWS ..... American Welding Society

Army ..... United States Army

BLDG..... Building

BTU ..... British Thermal Unit

CHPP ..... Cental Heat and Power Plant

Customer ..... The Army, its Installer, or other entity making contact with DU for the purpose of obtaining district heat service. The Customer has certain responsibilities and liabilities detailed elsewhere in this Standard.

Designer ..... Any person who engineers or designs equipment or system(s) governed by this Standard.

DPW ..... Directorate of Public Works

DU ..... Doyon Utilities LLC (the Utility), the Doyon Utilities district heat system, and all systems under the control of Doyon Utilities LLC

°F..... Degrees Fahrenheit

FGA..... Fort Greely Alaska

FRP ..... Fiberglass Reinforced Plastic

Ft ..... Foot

FWA ..... Fort Wainwright Alaska

HDPE ..... High Density Polyethylene

HPS..... High Pressure Steam

Hr..... Hour

Hz ..... Hertz

IBC ..... International Building Code

IFC..... International Fire Code

IMC..... International Mechanical Code

Installer..... Any person or entity acting on behalf of the Customer to perform installation, excavation, insulation, or any other work related to complete or partial accomplishment of the repair or new installation of a DU district heat service. The Installer is responsible to the Customer to provide a system which conforms to the requirements of this Standard.

LBS..... Pounds

LPS..... Low Pressure Steam

NDE..... Non-destructive examination

NEC..... National Electric Code

NEMA..... National Electrical Manufacturers Association

PCF ..... Pounds per cubic foot

PPM..... Parts per million

PSI..... Pounds per square inch (pressure)

PVC..... Polyvinyl Chloride

TEFC ..... Totally Enclosed Fan Cooled

UPC ..... Uniform Plumbing Code

Utility ..... Doyon Utilities LLC (DU), the Doyon Utilities district heat system, and all systems under the control of Doyon Utilities LLC

V ..... Volts

VAC ..... Volts, Alternating Current

1.3 AUTHORITY

DU recognizes the most recent IBC, IFC, IMC, UPC and NEC, as adopted and amended by local authorities, as a basis of establishing minimum standards of design and installation.

In the event of conflicts between this Standard and other standards, the LOWER numbered standard below shall govern:

1 Alaska State Statutes, Specifically Title 18, Chapter 60, Article 3.

2 This Standard, as applied to preferential issues as allowed by other codes and regulations.

3 IBC, IFC, IMC, UPC and NEC, as adopted and amended by local authorities.

4 Other recognized standards and codes (Federal and State government regulations may supersede local codes).

5 Recognized good practices of this local area.

1.4 LIABILITY

DU assumes no responsibility or liability that is not required by law concerning the suitability or applicability of this Standard to the requirements of the Customer.

1.5 INTENT

It is not the intent of this Standard to supersede codes or regulations.

This Standard is intended to:

1 provide Customers, Designers and Installers a basic guide for the design and installation of district heat service lines to ensure compatibility with DU’s system; and

2 protect the interests of DU, their Customers, and the Army by imposing uniform requirements for the installation and connection of all district heat service lines.

1.6 OWNERSHIP

The extent of ownership by DU is limited to the district heat distribution mains, service tees, service isolation valves, service lines up to and including the district heat meter (including flanges for installation if required), and Automatic Meter Reader (AMR) equipment.

1.7 RESPONSIBILITY

The Customer is responsible to make application for service with DU.

The Designer and Installer are responsible for meeting the requirements of this Standard and all other applicable codes and regulations (see Article 1.3).

The Customer is responsible for verifying with the Designer and Installer, respectively, that all design and installation work meets the requirements of this Standard and all other applicable codes and regulations – because, ultimately, the Customer is responsible for the proper operation and maintenance of all equipment not owned by DU (see Article 1.6).

The Customer and Installer are responsible to obtain all necessary permits prior to beginning any construction activity.

The Installer is responsible for meeting the requirements of Construction Code of the Occupational Safety and Health Standards and the National Fire Protection Association (NFPA) Code.

The Installer will be held responsible for damage to DU facilities resulting from failure to comply with the requirements of this Standard.

SECTION 2 - PROCEDURE FOR OBTAINING NEW DISTRICT HEAT SERVICE

2.1 INFORMATION TO OBTAIN

Contact the DU office at 714 Fourth Avenue, Suite 201, Fairbanks, AK 99701 (907-455-5100) to obtain information on the availability of district heat service and the location of distribution mains, and to establish the type of connection that will be required. Refer to Section 4 of this Standard for the available service types and configurations.

2.2 SERVICE LINE SIZE

The size of the district heat steam and condensate service lines and meter depends on a variety of factors, including the quantity of energy needed and the intended purpose. The Customer's Designer shall be responsible to determine the quantity of energy needed, in terms of both peak and total annual energy demand, and the size of the service lines.

2.3 PLAN SUBMITTAL AND REVIEW

Submit three (3) sets of all plans and specifications for the proposed new district heat service connection to DU for review and approval. Include a written estimate of the peak and total annual energy demand.

Allow a minimum of fifteen (15) working days for completion of the Plan Review, then schedule and attend a Plan Review Meeting with DU.

2.4 APPLICATION FOR SERVICE

Contact DU to submit an official Application for Service and schedule an appointment for DU personnel to install the connections on the district heat mains. This should be accomplished as soon as possible, but no less than five (5) working days prior to the intended connect date. Please note that no connections to the district heat system will be allowed after the last regular work day in the month of September.

SECTION 3 - GENERAL REQUIREMENTS

3.1 STANDARDS

Only work, materials, and tools meeting acceptable standards shall be permitted.

All work shall conform to the standards set forth in the most recent editions of the IBC, IFC, IMC, UPC and NEC, as adopted and amended by local authorities.

All work and materials shall be free of defects and leaks.

All materials used shall be new.

3.2 INSPECTIONS

DU shall inspect all district heat service repairs and new installations. For the purposes of this Standard, the following procedures shall be used:

PLAN REVIEW: The Customer and/or Installer will not be permitted to begin work on any district heat service repair or new installation until a comprehensive review of all plans and specifications for the proposed work has been completed by DU.

WELDING INSPECTION: In general, all welding inspection shall be conducted in accordance with the current edition of ASME/ANSI B31.1 Power Piping Code. This code specifies necessary inspection and examination requirements, and references the necessary AWS qualifications for inspection and examination.

NEW SERVICES: A qualified welding inspector must visually examine all welds prior to connection of a new service to the district heat system distribution mains. If non destructive examination (NDE) is required to verify the proper condition of the welded pipe, a qualified NDE inspector will be hired by DU to provide the necessary inspection. All costs associated with inspection will be charged to the Customer.

REPAIRS: The minimum level of inspection for steam lines will be the “soap-bubble” test for repair sections of a steam service line. This examination will occur prior to reenergizing the steam line. The minimum level of inspection of repaired condensate lines will be a visual inspection of each weld.

INTERIOR PIPING: DU personnel will visually inspect interior (indoor) non welded service piping prior to installation of the meter. This inspection shall cover all interior service piping and equipment from the wall through the heat exchanger on the DU side. A qualified welding inspector will visually examine all interior welds up to the connection point of the heat transfer equipment. Contact the appropriate Directorate of Public Works (DPW) Office (FGA, FRA or FWA) for information on any other required inspections outside of the scope of this Standard.

HYDROSTATIC TEST: A hydrostatic test using water is required for new steam and condensate service lines. Test pressure shall be one hundred iffy (150) PSI for two (2) hours for all lines from the point of connection at the main to the first isolation valves inside the Customer’s building. DU personnel must witness such tests.

INSULATION: DU personnel must inspect all underground pipe insulation prior to backfill. The insulation outer coating shall be smooth and even, with no recesses that can hold or trap water. Upon approval of the insulation, the pipe shall be properly backfilled and compacted.

STREET EXCAVATION: Any portion of a district heat service trench that crosses or enters a street, alley or other paved surface shall be backfilled and compacted in conformance with the appropriate DPW requirements (FGA, FRA or FWA). This work must be inspected by the appropriate DPW Office prior to installation of pavement.

INSPECTION AFTER CONNECTION: All district heat services are subject to periodic inspection and review after connection. DU may direct the taking of samples for identification of sources of condensate contamination. Based on the results of the investigation, DU may require the Customer to take corrective measures.

CROSS CONNECTIONS: Cross connections to other sources of water such as wells, building heating systems, or tanks where mixtures of chemicals are stored, or any connections which can allow entry of untreated or contaminated water, or any other fluid, into the DU district heating system, are prohibited.

STATE INSPECTIONS: Pressure Vessels, such as heat exchangers, flash tanks, and pressurized receivers, are generally subject to inspection and acceptance by the State of Alaska Department of Labor, Mechanical Inspections Division, in accordance with the requirements of Title 18, Chapter 60, Article 3-Boilers. The inspection requirement does not apply to unfired pressure vessels "having a volume of less than five cubic feet (5 Ft^2), or less than six inches (6") in diameter, or unfired pressure vessels operating at a pressure of less than fifteen (15) PSI when not located in a place of public assembly." Under this rule the contractor or subcontractor who installs the pressure vessel is responsible to notify the AKDOL within thirty (30) days of the installation. Inspections and certifications are subject to fees as established by the State of Alaska.

3.3 LOCATION OF EXISTING UNDERGROUND UTILITIES

The Customer or his Installer shall be responsible for determining the location of all underground utilities and shall be responsible for any damages to underground utilities caused by the work. Possible underground utilities to be located include, but may not be limited to: telephone lines, cable TV lines, electrical lines (including power for street lights), water and wastewater lines, district heat steam and condensate lines, gas lines, storm drains, etc.

Contact DU for a one (1) time final field locate and ground marking of all DU-owned underground utility features in the area of the excavation. Contact for this field locate must be accomplished at least twenty four (24) hours prior to the actual anticipated time of the beginning of excavation, and before 3 PM of the date of contact. DU requires that a disclaimer of liability be on file before any utility location work can be conducted. The first locate for DU-owned underground utility features is provided without charge. Once a field location has been provided, a fee will be charged if a subsequent locate is requested to reestablish a previously marked feature.

3.4 EXCAVATION AND SITE CONDITIONS

Obtain a Dig Clearance permit from the appropriate DPW Office (FGA, FRA or FWA) prior to beginning excavation for any work on a district heat service repair or new installation.

The Installer is responsible to control the excavation work and to take proper safeguards to protect private and public property as well as to provide a safe workplace. All excavations shall conform to State (AKDOL) and Federal (OSHA) requirements. The Installer shall furnish all necessary construction and safety equipment including, but not necessarily limited to, shoring, de-watering pumps, excavation equipment, ladders, barricades, temporary fencing and signage.

The Installer shall do all excavating, including hand excavation around the main lines as necessary to provide an excavation of sufficient extent to allow safe entry for the installation of all DU materials, equipment and insulation, and to provide adequate space for dewatering. In general, the entire surface of the DU main must be exposed for the entire circumference and for a length of not less than four feet (4’). The soil shall be removed to a minimum distance of twenty four inches (24”) around all surfaces of the main.

The Installer shall take whatever action that is necessary to control and remove all standing and inflowing water from the excavation and properly dispose of it. Connections will not be made in cases of improper excavation, excessive groundwater, or other unsafe conditions. In the event that a DU installation crew is dispatched to the jobsite and the appropriate connections cannot be completed because of an improper excavation, excessive groundwater, or other unsafe conditions, an additional charge, such as those detailed on the schedule presented in the appendix, may be added to the first utility billing.

3.5 DAMAGE TO EXISTING EQUIPMENT OR FACILITIES

If any existing facility or equipment is damaged by action of the Installer or his agent(s), cease work and notify DU immediately. Failure to notify may expose the Installer or his agent(s) to increased liability and civil penalties.

The party causing such damage shall be responsible for all costs incurred to repair the damage and restore the facility or equipment to its prior condition. Any damage to the distribution main(s) will be repaired by DU personnel and may be billed to the Customer or his Installer.

3.6 BACKFILL

Backfill service trench by hand a minimum of twelve (12") inches above the pipes and compact as necessary. Backfill remainder of trench by mechanical means and compact as necessary.

3.7 COMPACTION REQUIREMENTS

Compaction in street right of ways must meet Army standards. Compaction beneath the DU main and to a point twelve (12”) inches above the main shall be ninety five percent (95%) or greater.

3.8 PERFORMANCE REQUIREMENTS

The DU district heat system is billed on a MASS DELIVERED Basis. The steam usage is measured as pounds of steam delivered through the DU district heat meter. The Customer is encouraged to remove as much usable heat as possible before returning the condensate to the system. It is in the Customer’s best interest to return condensate to the system at a temperature no higher than 140°F.

The FWA CHPP provides steam to the FWA district heat system at a nominal temperature and pressure of 100 PSI and 440°F.

The FGA CHPP provides steam to the FGA district heat system at a nominal temperature and pressure of 60 PSI and 260°F.

3.9 SYSTEM CONTAMINATION

The DU district heat system is a closed system that operates on the principal that no material either leaves or enters the utility mains or service piping. The sole product is the energy that is delivered to the Customer.

Systems that allow foreign substances to be returned to the utility mains or service piping contaminate the entire system. Losses of thouands of dollars per hour can result from contamination because of the costs incurred in replacing ruined system fluid. DU reserves the right to refuse district heat service to Customers or facilities that cause contamination, and to require repairs or corrections prior to resuming service.

3.10 SCOPE OF DOYON UTILITIES PERSONNEL WORK

DU personnel will complete all service lines to distribution main connections. This, together with the inspection of all materials and work, will constitute the scope of DU personnel work unless specific arrangements have been made in writing for DU to perform other work.

3.11 CONNECTION OF SERVICE LINES TO DISTRIBUTION MAINS

Connections to the district heat system distribution mains will be made during normal DU working hours. No person, other than DU personnel, shall cut or bore any holes in a district heat system distribution main or attempt to install a connection. DU will furnish and install the connections to the mains.

Alaska Statutes require a forty-eight (48) hour notice prior to connection to the main; however, based on workflow, DU can normally support a twenty-four (24) hour notice.

SECTION 4 - SPECIFIC REQUIREMENTS

4.1 SERVICE CONNECTION TYPES

Refer to the Figures 1 and 2 for the basic types of service connections available from DU.

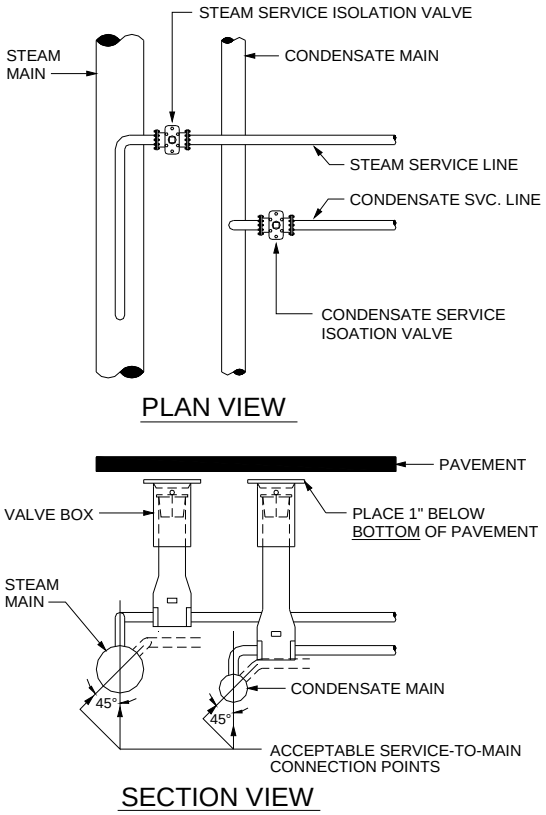

Fig.1 - Direct Bury Steam Service Connection

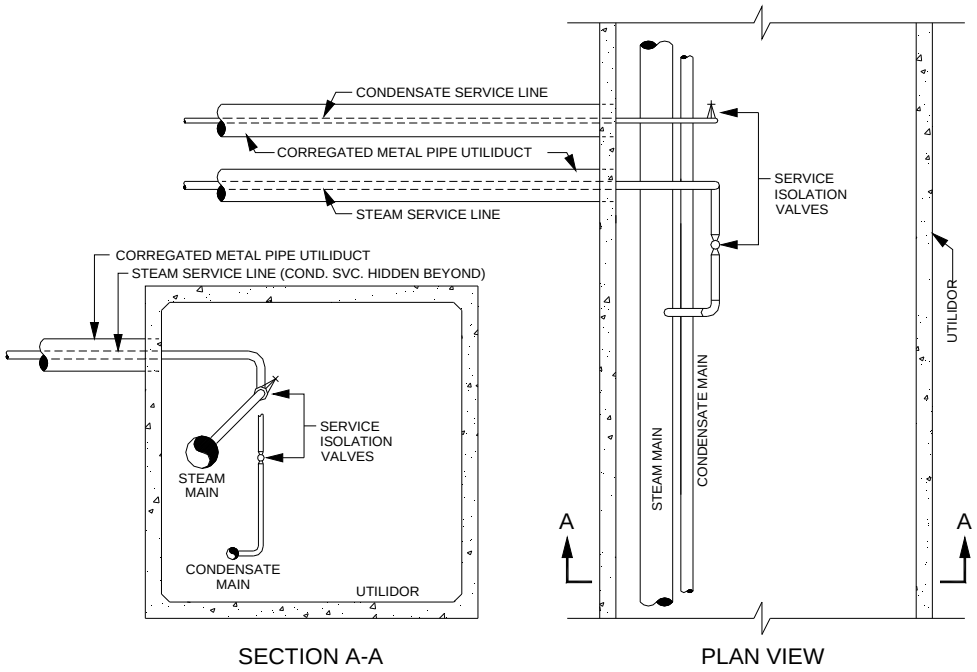

Fig. 2 - Utilidor Steam Service Connection

District heat service pipe sizes are dependent upon Customer's requirements and shall be sized in accordance with energy demand, by the Customer's Designer or Installer, prior to application for service, and shall be clearly stated on the plans and the service application form. Piping sizes are commonly one inch (1"), one and one-half inches (1-1/2"), two inches (2"), three inches (3"), and four inches (4").

All district heat connections and associated equipment shall be designed and constructed so that all DU fluids that enter the Customer's premises are metered and returned, uncontaminated, to the DU system. No person or system may remove DU fluids for process use, space heating, thawing, food handling, humidification, or any other purpose.

Steam connections are normally direct bury type, unless originating from a utilidor. Steam connections are accomplished by welding branch connections to the steam supply main and condensate return main. A shutoff valve will be installed in each service lateral to serve as the point of connection and control for the service. The point of connection for the steam service line is the weld or flange at the outlet of the first valve on the customer side of the steam meter. The point of connection for the condensate service line is the weld or flange at the outlet of the first valve inside the customer's building.

This Standard is not intended to restrict the Designer, Installer, or Customer from selecting and installing more sophisticated or higher quality systems than detailed in this Standard. Alternatives to those features described as the minimum requirements on the following pages will be considered provided the party requesting the deviation from the Standard can demonstrate that no reduction in useable life, reliability, control, or safety will result from the use of alternate equipment.

4.2 MATERIAL STANDARDS

The proper selection of materials will provide a heating system that is reliable over the long term and, therefore, most affordable over the life of the system. DU recommends that the Customer and Installer select the best materials that can be afforded. Materials specified in this Standard are either that specified by code or local ordinance, or the MINIMUM recommended by DU.

Stainless steel is considered "better" than steel because it is less susceptible to corrosion.

Carbon steel is considered "better" than cast iron because it is tougher and less susceptible to corrosion and brittle failure.

Bronze is less susceptible to corrosion and is tougher than cast iron, but it is restricted in its use because it is not generally used in equipment operated at elevated temperatures (i.e., steam service), and may be subject to dezincification under certain conditions.

Galvanized metal pipe and equipment is not recommended.

Use of dissimilar metals in a piping system is discouraged because it contributes to accelerated corrosion at elevated temperatures and can rapidly deteriorate heat exchanger tubes, which can release steam into the space (hazardous to occupants and property) and/or allow contamination into the condensate stream (potentially damaging to the district heat system).

4.3 PIPE MATERIAL

Pipe material shall be type AISI A106 (preferred), or AISI A53 (allowed) steel, seamless. Pipe thickness shall be Schedule 40 for steam piping and Schedule 80 for condensate piping.

Use of bronze bodied valves and equipment is restricted to low pressure condensate drains, instrument connections, and low pressure piping. Copper pipe shall not be used for condensate drains.

4.4 PIPE FITTINGS

Underground valves and fittings shall be socket weld or butt weld type steel. Butt weld fittings shall be the same pipe schedule as the pipe. Socket weld fittings shall be three thousand (3,000) PSI Class conforming to ANSI B16.22.

Flanged connections are only authorized for connecting above ground pipe and fittings. Flanged fittings may be weld neck, socket, or slip on type, and shall be raised face one hundred fifty (150) PSI Class, conforming to ASTM A105 and ANSI B16.5.

Screwed or threaded connections are only authorized for connections of interior aboveground piping of two inches (2”) diameter or less, and are limited to low pressure drip legs, trap connections, instrument connections, and low pressure condensate or hot water piping. Screwed fittings shall be three thousand pound (3,000 LBS) forged steel conforming to ASTM Specification A105 and ANSI B16.11.

Butt welded fittings shall conform to ANSI B16.9. The material shall conform to A234 WPB. The wall thickness of the butt welding fittings shall conform to the schedule of the connecting pipe.

Welding tees shall be used for all socket welded piping and for all field fabricated branch tees in butt-weld end piping.

Welding outlet fittings shall be Bonney Forge “Weld-O-Let” or approved equal.

4.5 UNDERGROUND VALVES

Underground service shutoff valves at the point of connection at the main are normally provided by DU.

All other underground valves shall be one hundred fifty (150) PSI Class non rising stem gate valves with cast or forged carbon steel body, 500°F maximum working temperature, butt weld end connections, 416 SS stem with two Inches (2”) operating nut, two part stem packing consisting of chevron packing rings and backup “O” rings suitable for steam service, iron bonnet gasket, and solid type semi steel sedge; Kerotest Manufacturing Corporation, Valve No. 1WS5HTP, no substitutions.

4.6 ABOVEGROUND VALVES

Service line and accessory valves for steam and condensate pipe sizes over two inches (2”), installed inside the Customer’s facility, shall be one hundred fifty (150) PSI Class bolted bonnet OS&Y type gate valves with cast or forged carbon steel body-ASTM A216 Grade WCB, flanged connections, ASTM A182-F6 internals and trim, and solid wedge.

Valves eight inches (8”) or larger in size shall be furnished with a one inch (1”) OS&Y steel bodied bypass valve.

Service line valves and accessory valves for condensate piping two inches (2”) and smaller, installed inside the Customer’s facility, shall be bronze body-ASTM B62, two hundred (200) PSI Class, with union inside screw bonnet, solid wedge, and chrome steel alloy internals.

4.7 CONTROL VALVES

Customer heating control systems can range from the very simple to the complex. The following are the minimum requirements of DU for controls that will offer the greatest reliability and compatibility with the DU system under most circumstances. Sophisticated systems should be designed by a qualified licensed engineer, and shall be reviewed and approved by DU as a condition of service.

1 Temperature control valves shall be carbon steel body remote sensing type consisting of a bulb sensor, a sensing line and the control valve. Temperature control valves shall be designed to properly control temperature to within one percent (1%) of setting temperature. The remote sensing bulb shall be mounted in accordance with the manufacturer's instructions.

2 Pressure control valves shall be carbon steel body pilot operating type consisting of a pilot valve, a sensing line, and a control valve. Pressure control valves shall be downstream pressure sensing type controlling pressure to within five percent (5%) of setting pressure. Installer shall provide for adequate drainage of condensate upstream of the pressure control valve so that the valve will malfunction due to water fouling.

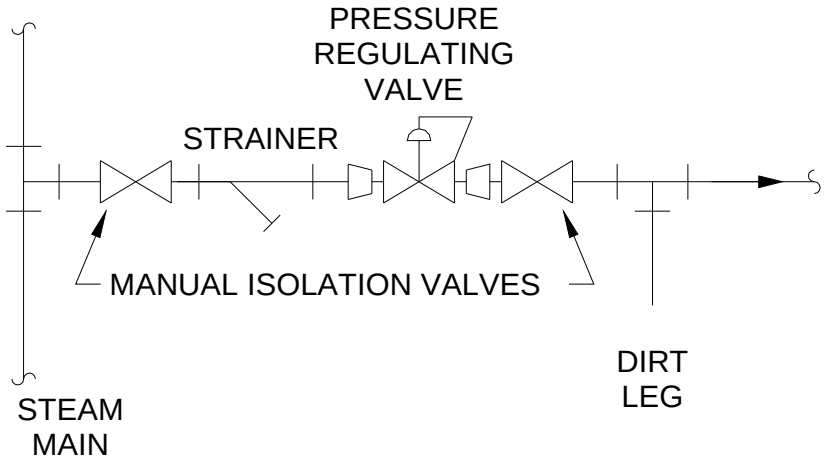

Fig. 3 - Steam Regulator Station

4.8 RELIEF VALVES

Each pressure control valve shall be accompanied by a suitable pressure relief valve installed downstream of the control valve discharge, sized and installed to meet the requirements of the capacity, overpressure, and blow-down requirements of the ASME Section VIII of the boiler and pressure vessel code. The relief valve shall feature a carbon steel body, with stainless steel internals. End connections shall be screwed for up to two inches (2") and flanged for over two inches (2"). Discharge piping shall be designed and installed to permit proper removal of discharged steam to a safe location. Discharge piping shall be installed with a proper drain to allow removal of trapped liquid away from the valve seat.

4.9 HEAT TRANSFER EQUIPMENT

In general, all heat transfer equipment should be located in a single mechanical room. Each item of heat transfer equipment shall be individually valved to permit disconnection or isolation of that piece of equipment without requiring the deactivation or isolation of other equipment. If heat energy is demanded in other parts of the building, the Designer and Installer shall provide for a secondary hydronic energy delivery loops to provide the necessary energy transfers from the mechanical room to the Customer's space.

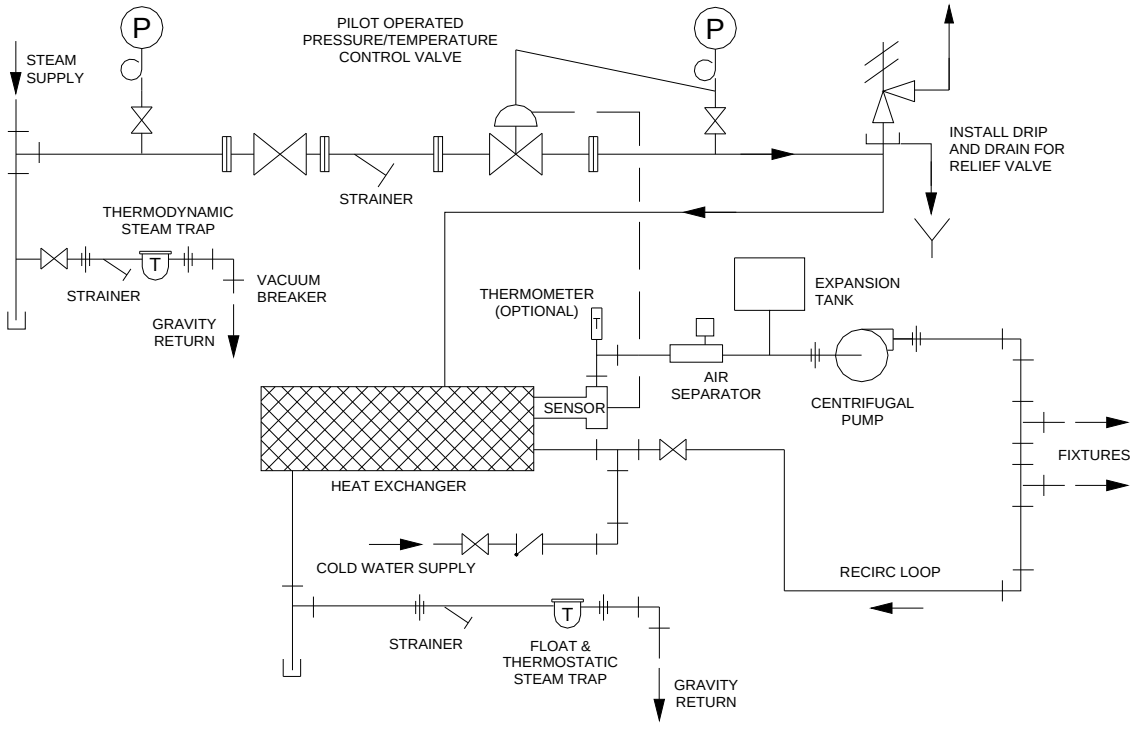

Fig. 4 - Basic Steam Heat Transfer Equipment Schematic

The Designer and Installer shall also take whatever measures necessary to prevent galvanic corrosion of the heat transfer equipment by judicious selection of materials and installation methods.

Heat transfer equipment shall be sized and constructed to deliver all required heat energy to the Customer without subjecting the DU district heat system to loss or contamination.

All heat exchangers shall be constructed of a carbon steel shell, with stainless steel or nickel alloy heat transfer surfaces.

Heat exchangers subject to the jurisdiction of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1, shall bear the ASME “U” stamp certifying that design construction is conducted in compliance with the ASME Code.

Heat exchangers may be shell and tube, or plate and frame type at the Customer’s discretion. Plate and frame heat exchangers shall be sized, configured, and installed to operate in the counter flow direction. Heat exchangers for potable water heating shall employ a suitable double wall construction to meet the requirements of the UPC section 1003(f), as interpreted by the 1989 IAPMO Interpretations Committee.

Humidifiers that use district heat as a source of energy shall operate on the principle of removing heat only from the district heat system and using that heat to generate vapor from potable water. Systems that operate using district heat system steam to directly humidify building air are expressly prohibited by DU.

Flash tanks are generally accepted as one way to recover steam heat at low pressure from a trapped high pressure line. The recovered steam is then redirected into the low pressure part of the Customer’s steam system. In this way, the condensate is further cooled, resulting in greater energy recovery from the delivered steam. Flash tanks subject to the jurisdiction of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1, shall bear the ASME “U” stamp certifying that design construction is conducted in compliance with the ASME Code.

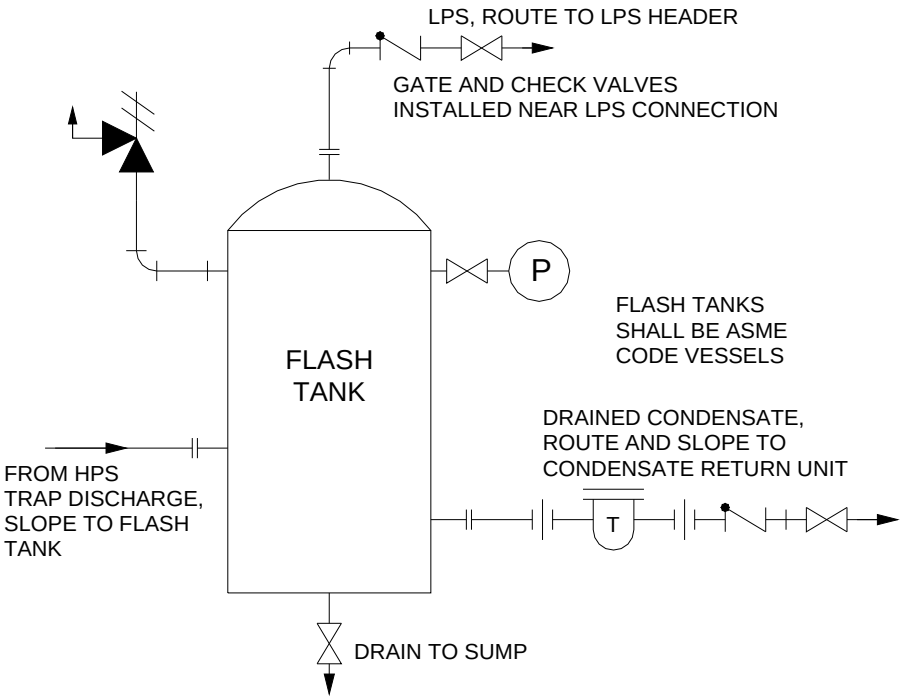

Fig. 5 - Steam Flash Tank

4.10 STEAM TRAPS

Steam traps are manufactured in a variety of types and sizes, and are generally selected in accordance with the recommendations of the heat transfer equipment manufacturer, and the trap manufacturer. Traps shall be selected to release sub-cooled liquid to minimize flashing in the condensate return system. Traps are recommended to be of carbon steel (ASTM A-216 WCB) construction with stainless steel internal components. Cast iron (ASTM A-278) bodied traps are acceptable, however should be restricted to low pressure service. Bronze bodied traps are not acceptable.

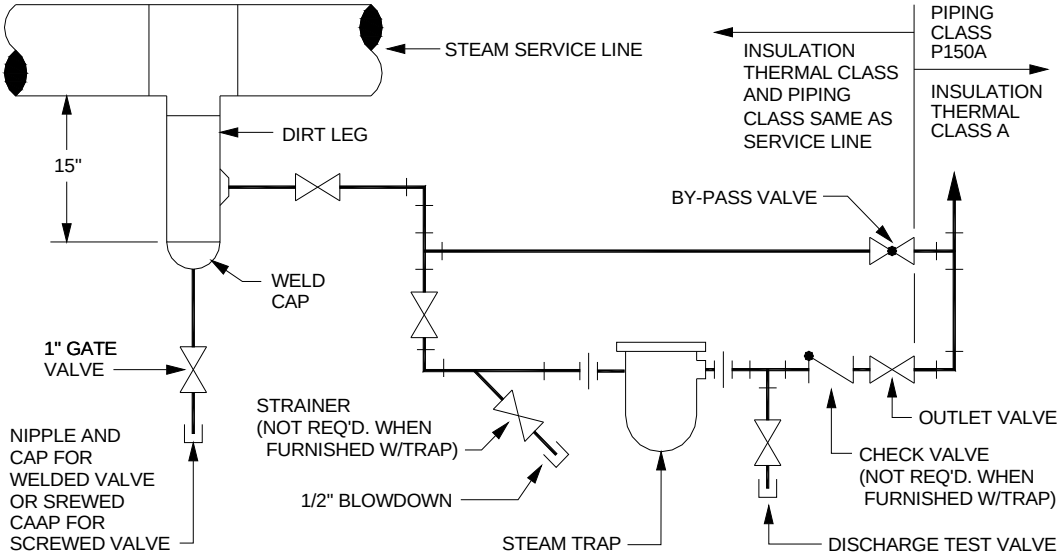

Fig. 6 – Recommended Steam Trap Piping

Steam traps shall be installed at each point of use and shall be selected and sized for the particular application. Traps that are integral with the body of the heat transfer equipment, and supplied by the original equipment manufacturer shall be installed with a shutoff valve placed at the outlet of the trap. In-line traps shall be installed complete with a strainer, suitable for preventing dirt and debris from entering the trap orifices and chambers, isolation valves upstream and downstream, and unions both upstream and downstream to allow easy removal for maintenance and replacement.

The first drip leg trap on the steam supply line entering the building shall be drained to the manifold serving the master trap so that the condensate removed from the entering steam is metered.

4.11 STRAINERS

Strainers shall be installed with each trap or control valve, or upstream of any equipment that is recommended by the manufacturer. Strainers shall be Y-type and sized to pass the full flow of the equipment that is protected by the strainer. Strainers may be either carbon steel, or cast iron bodies, but shall be specified to match the material specification of the protected equipment. End connections may be either flanged, or screwed, but shall be specified to match the end connections of the protected equipment. The strainer shall be specified with a removable type 304 stainless steel screen that will retain particles larger than five one-hundredths inch (0.050”). Each strainer shall be furnished with a blow-down connection, and shall be installed with a blow-down valve.

4.12 VACUUM BREAKERS

Wherever steam is condensed inside equipment such as heat exchangers, normally operating at or above atmospheric pressure, a vacuum breaker is recommended to prevent water hammer or damage from freezing. Vacuum breakers are listed as options for heating coils, traps, and heat exchangers, by the original equipment manufacturer.

4.13 INSULATION

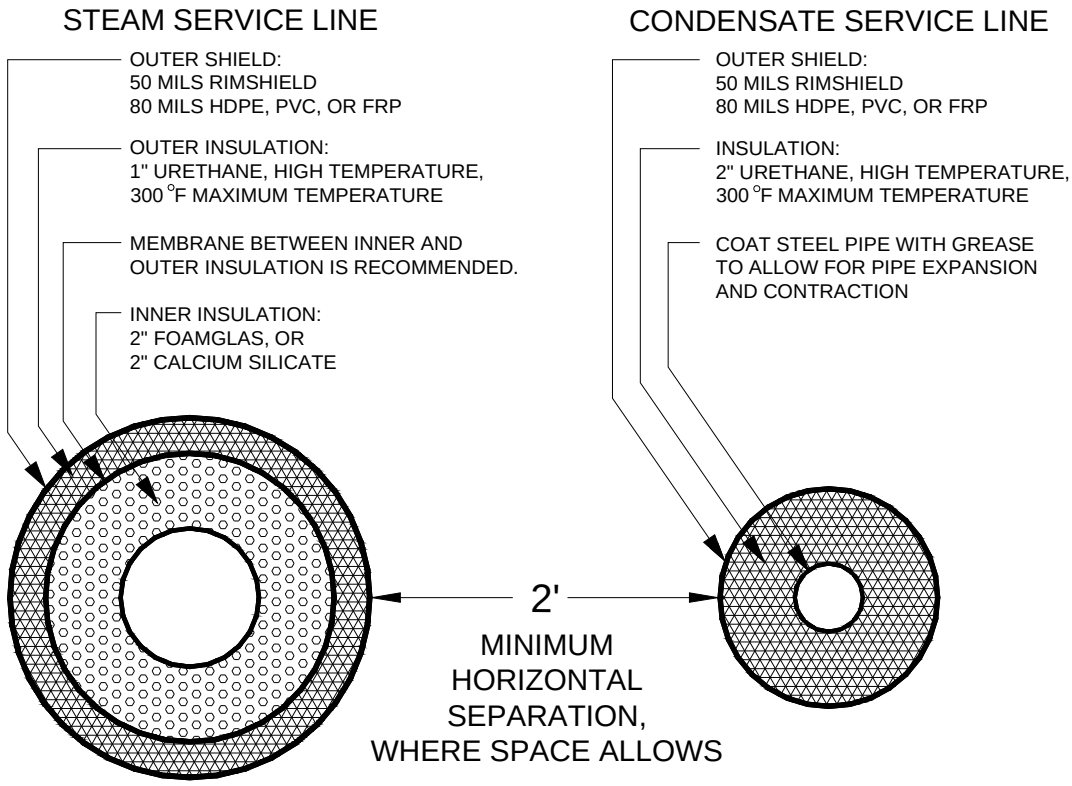

Fig. 7 – Direct Bury District Heat Service Insulation

All underground district heat service piping shall be insulated. Each steam and condensate pipe shall be separately insulated and coated to minimize the possibility of a damaged line damaging an adjacent line. The insulation system shall comprised of a first layer of material suitable for the temperature level of the service piping, and a second layer suitable to attain the temperature performance of the insulation system. The insulation system shall be covered with an impermeable and corrosion resistant outer shell. The insulation system shall be designed to provide a maximum heat loss of sixty (60) BTU/Hr/Ft on the hottest pipe, based on a five feet (5') depth of bury, and a soil temperature of +20°F.

INSULATION PRODUCTS:

CELLULAR GLASS (PREFERRED): This system is preferred for steam systems, because of the low permeability of the cellular glass foam to steam, or water if the system becomes damaged. The insulation needs to be selected to provide the necessary heat transfer limit, and to also limit the interface temperature between the insulation materials to the high temperature limit of the Urethane foam, usually 300°F for high temperature foam. Cellular glass pipe insulation shall be closed cell in structure, rigid, impervious of moisture, meeting ASTM C552-88, preformed in shapes and sizes to completely enclose the piping, fittings, and valves, such as Pittsburgh Corning Corporation's "Foamglas" or approved equal. Cellular glass insulation jacketing shall be a flexible self sealing protective foam shall be as manufactured by Pittsburg-Corning, and shall be installed with the manufacturers standard asphalt coating.

In order to achieve the thermal performance required for steam and condensate service this insulation will be installed in conjunction with urethane foam and coating.

CALCIUM SILLCATE (ALTERNATE): This system can be used for underground piping in lieu of cellular glass, provided that moisture can be effectively kept out of the insulation envelope, because it is not considered to be as moisture resistant as cellular glass. Calcium silicate shall be rigid, preformed, asbestos free, heavy density conforming to ASTM C 533, such as Owens-Corning Kaylo or approved equal.

In order to achieve the thermal performance required for steam and condensate service, this insulation will be installed in conjunction with urethane foam and coating.

MINERAL FIBER (ALLOWED, BUT NOT RECOMMENDED FOR UNDERGROUND PIPE): This system has been used in the Fairbanks area since the mid 1970's and offers superior thermal performance. However, the lifespan of this system can be drastically reduced due intrusive water permeating the fiber layer and deteriorating the external urethane shell, resulting in subsequent severe damage to the total insulation system. Use of this insulation system will be authorized by DU only after consultation with the Customer and discussion of risks and alternatives.

Mineral fiber pipe insulation shall be heavy density, conforming to ASTM C 547 Class 2 for use up to 650°F, complete with all-service jacket, self sealing lap, such as made by Owens-Corning ASJ/SSL-11 or approved equal. Circumferential self sealing butt laps shall be used where necessary.

Mineral fiber block insulation used for tanks, receivers, and exchangers shall be six (6) PCF fiberglass block conforming to ASTM C 612, Class 3 for use up to 850°F, with factory applied all service jacket. Insulating cement shall be mineral fiber thermal insulation cement in accordance with ASTM C 195.

In order to achieve the thermal performance required for steam and condensate service at reasonable cost, this insulation has been normally installed in conjunction with urethane foam and coating.

URETHANE FOAM: Urethane Foam shall be rigid closed cell two component spray type for use up to 300°F, such as PDL 4034-2.5, or approved equal.

WATERPROOF URETHANE COATING: The external surface shall be coated with a two component elastomer polyurethane, fifty (50) mils in thickness, such as PDL Rimshield 11, or approved equal.

PREINSULATED PIPING SYSTEMS: Pre-insulated piping systems are available in a variety of configurations, and can offer many advantages over field or shop fabricated systems. If the Customer requires a pre-insulated system, the desired system shall meet the minimum requirements stated elsewhere in this Standard, and a meeting shall be held between the Customer, the Installer, and DU to identify and resolve issues that may exist which would affect the compatibility of the proposed system with the DU district heat system. Prior to the meeting, the Customer must obtain the following information from the pipe system supplier:

Pipe Description: _____

Pipe Diameter: Supply: _____ Return: _____

Pipe Manufacturer: _____

Pipe Material Specification*: _____

Insulation System Description: _____

Insulation Material Specification*:

(Inner): _____

(Outer): _____

Outer Covering (Type): _____

Calculated Heat Loss: (BTU/HR/FT) _____

*Note: All spec. descriptions shall be both generic name of material and ASTM, ANSI or AISI spec. number to which the product conforms.

INSULATION INSTALLATION:

Install insulation in accordance with the manufacturer's recommendations. No insulation shall be applied to joints, fittings, or valves until all testing is complete.

Installation of Rigid Insulation and Jacketing:

1 Piping sections may be completely pre-insulated in the shop and transported and installed in the field with joint insulation installation in the field. Such pipe must be clearly marked "TOP" on the final product prior to loading and transport to prevent accidental improper support positioning at installation.

2 Apply to clean, dry piping, fittings and valves.

3 Use pre-formed insulation except where formed pieces are unavailable from the manufacturer. The insulation nominal inside diameter shall match the piping nominal outside diameter.

4 Miter insulation or use preformed fittings sections for all elbows.

5 Insulate valves, flanges and fittings with a combination of block and preformed insulation as required.

6 Support insulation with factory applied integral self sealing jacketing or sixteen gauge stainless steel wire on twelve inch maximum centers.

7 The insulation jacketing shall be wrapped in a snug, wrinkle free manner. The jacket shall overlap itself to seal both horizontally and circumferentially.

8 Insulate valve bonnets to stuffing box bolts or bonnet nut. Fill irregular surfaces with insulating cement and finish similar to other pipe insulation.

9 Provide insulation supports at twelve feet maximum between supports for vertical pipe insulation. Supports shall have ½" maximum insulation cover.

10 Circumferential jacket seams shall be sealed by overlapping an adjacent self sealing jacket.

11 No insulation or jacketing shall be applied during periods of precipitation or to damp or wet piping.

12 Special oversized insulation techniques may be required by the insulation manufacturer at bends or loops. If required, the oversize insulation nominal inside diameter shall be no less than one inch larger than the piping outside diameter. Piping support within the oversized section shall conform to the manufacturer's recommendations. On vertical sections, insulation batts, six inches (6") in length shall be secured to the pipe by use of two strands of sixteen gauge (16 ga.) stainless steel wire so as to provide the necessary centering of the oversized insulation.

Installation of Urethane Foam Insulation:

1 Urethane foam material shall be applied according to the manufacturer's instructions.

2 Urethane foam material shall be spray applied to the rigid insulation jacketing, clean pipe, valves and fittings, structures free of loose dirt, debris, or other foreign material. Field applied foam shall overlap previously installed foam by a minimum of six inches.

3 No foam shall be applied during periods of precipitation or to damp or wet surfaces, or in contact with standing or flowing water.

4 Uncoated pre-insulated (shop fabricated) pipe shall be protected by covering with a drape that will prevent insulation damage due to sunlight until installed in the trench. Insulation damaged during installation shall be reinsulated.

5 Prior to application of urethane foam to condensate or hot water piping, the piping surface shall be thoroughly coated with high temperature grease such as Shell Darina.

6 Urethane foam insulation shall be completely coated by a fifty (50) mil thickness of polyurethane coating specified above.

4.14 INTERIOR PIPING:

Uninsulated interior piping is a major cause of excessive heating of interior spaces. DU recommends that all fittings, tanks, exchangers, and pipes be insulated with a suitable insulating material sufficient to limit the interior ambient temperature of the air to no more than 100°F.

Interior piping shall be insulated with dense preformed mineral fiber or calcium silicate insulation. The insulation shall be properly covered with a protective layer of reinforced treated paper, canvas cloth, or sheet metal.

Mineral fiber block insulation used for tanks, receivers, and exchangers shall be six (6) PCF fiberglass block conforming to ASTM C 612, Class 3 for use up to 850°F, with factory applied all service jacket. Insulating cement shall be mineral fiber thermal insulation cement in accordance with ASTM C 195.

4.15 INSTALLATION METHODS

GENERAL:

Underground piping shall be installed with a minimum of four feet (4') of soil cover. If four feet (4') of soil cover cannot be provided, DU may authorize less cover provided that one inch (1") of additional insulation is furnished for all piping not located below pavement (i.e., street, alley, parking lot, etc.). All piping located below pavement shall have a minimum of four feet (4') of soil cover.

All underground pipes shall be suitably supported during installation, providing adequate support to prevent sags and to maintain proper grade.

All underground pipes shall be suitably anchored to restrict movement of the pipe during startup and shutdown to that allowed by expansion joints or loops.

All underground pipes shall be installed with sufficient provision for expansion and contraction so that the pipe will not be subjected to excessive stress during startup and shutdown.

All service piping shall be designed and installed so that a continuous grade for drainage from the building back to the main is maintained.

All underground pipes shall utilize sufficient sealant and waterproofing at wall penetrations to protect the pipe and jacketing from intrusive water, and to prevent water from passing from the outside to inside the premises.

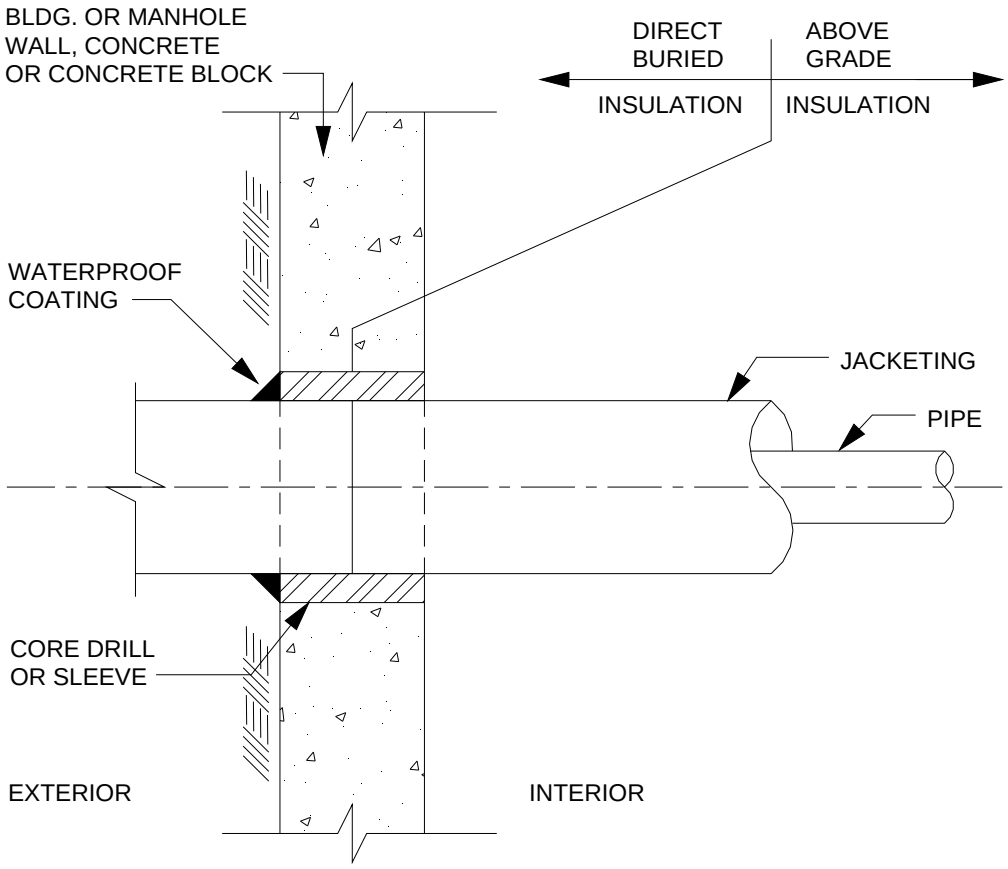

Fig. 8 - Pipe Wall Penetration

WELDING: All underground pipes shall be welded unless otherwise authorized in advance by DU. The minimum standards for the welding of steel pipe shall be those established by the ANSI standard code for Pressure Piping B31.1. All welding shall be performed in accordance with modern welding practice by experienced personnel. Welders shall be certified to the contractor's approved ASME welding procedures. Welding procedures must be qualified in accordance with ASME Section IX and submitted to DU prior to welding.

This procedure specification shall cover the Shielded Metal-Arc Welding of groove and fillet welding of carbon steel pipe and fittings in the horizontal and vertical fixed positions.

Base metals which are to be welded shall be wrought or forged materials conforming to the following:

Material	ASME Specifications
Carbon Steel Pipe	SA-106, Grade A
Carbon Steel Pipe Flanges	SA-181, Grade 1
Plate	SA-36
Butt Welding Fittings	SA-106, Grade A

Welding may involve any of the above materials singly or in combination with each other.

Filler metal shall be material which is deposited by welding electrodes and shall conform to ASME SFA 5.1, Class E6010.

Preparation of the Welding Groove:

1 The ends of the pipe to be welded shall be beveled. Beveling shall be by machine (preferred) or flame cutting provided that the surfaces are thoroughly cleaned from scale and oxidation per ANSI B31.1, Chapter 5, A.1.

2 Surfaces for welding shall be cleaned and shall be free from paint, oil, rust or scale before welding, except that a light coat of rust preventative preservative, which will not be detrimental to the finished weld, may be used.

3 Before welding, the piping or other equipment shall be carefully aligned so no part is offset with respect to the adjacent part by more than twenty percent (20%) of the pipe thickness. This alignment must be preserved during welding. All pipe materials to be welded shall be preheated to a minimum temperature of 50°F.

4 If tack welds are used, they shall be of the same quality and shall be made by the same procedure as the completed weld; otherwise the tack welds shall be removed during the welding operation.

5 Weld metal shall not project within the pipe beyond limits allowed by ANSI B31.1.

6 All welds that fail visual or NDE inspection shall be ground out and re-welded.

7 All weld areas and damaged coating areas shall be cleaned and coated with Scotchkote No. 306.

PIPE BENDS: Pipe bends may be used in all piping two inches (2”) and smaller in lieu of fittings. The bend radius shall not be less than five pipe diameters. Thinning at the bends shall not exceed six percent (6%) of wall thickness. Buckling, flattening, or other malformation of the bent pipe is not acceptable.

TAPS: Taps or socket welded piping branches two inches (2”) and smaller shall be made by welding extra heavy half couplings to the pipe, or by providing build up welded bosses and drilling and tapping same after welds are completed. Taps shall be made before piping is fitted into place. Burning or drilling of holes is not permitted after the piping has been fitted.

Taps for instrumentation wells and sockets shall be made in a location that permits easy installation of instruments for convenient observation and access from floor or platform elevations. Taps shall be located and spaced so that adjacent instruments and devices will in no way interfere with each other. Wells, sampling nozzles, and other required devices shall be installed in accordance with the manufacturer'' requirements.

ATTACHMENTS: Welded attachments for pipe hangars, insulation and instrumentation shall be shop fabricated with piping, and heat treated as necessary. Insulation support angles shall be furnished on vertical runs of pipe which require heat treatment of welds, and shall be spaced not more than twelve feet between supports.

PIPE SLEEVES: Pipes shall be routed through walls, floors, and roofs through steel pipe sleeves, except where framed openings have been specifically provided for pipes. Pipe sleeves shall be fabricated from standard weight steel pipe or from one quarter inch thick rolled steel plate and galvanized after fabrications. Oval cross section sleeves shall be provided wherever necessary to accommodate transverse movement of pipe due to thermal movement. The minimum radial clearance between the sleeve and the outer surface of the insulated pipe shall be one inch.

4.16 SEPARATION

Where possible, maintain a minimum horizontal separation distance of two feet (2’) between the surfaces of the outer insulation shields of adjacent, underground district heat service lines throughout their entire length.

Where possible, maintain a minimum horizontal separation distance of four feet (4’), center-to-center, between a district heat service line (steam or condensate) and a water or sewer service line, or other utilities.

Where possible, maintain a minimum vertical separation of twelve inches (12”) between the bottom or top of the outer insulation shield on a district heat service line (steam or condensate) and the top or bottom surface of any crossing sewer main, sewer service line, or storm drain line.

Where possible, district heat services serving separate facilities, but installed in the same ditch shall have a minimum horizontal separation distance of four feet (4’). This is to provide adequate protection from accidental damage during future repair to either service.

4.17 COMMISSIONING

PRESSURE TESTING: Prior to connection to the DU district heat distribution mains, all new or repaired piping and equipment shall be pressure tested with water. The test pressure shall be one hundred fifty (150) PSI for a minimum duration of two (2) hours. Install caps, blind flanges, or plugs as necessary at the ends of each test section. Testing against closed valves is not recommended. All pipe and fittings shall be free of any drips or leaks during visual inspection. The pipe shall be maintained at the test pressure for at least two (2) hours during which time pressure readings to the nearest one (1) PSI shall be noted at fifteen (15) minute intervals. If no perceptible pressure loss is recorded during the test interval, and no visual evidence of leakage exists, the pressure test will be considered acceptable.

FLUSHING: After successfully pressure testing the system, the pipes and fittings shall be filled with a five percent (5%) solution of trisodium phosphate, allowed to stand for two hours, and then flushed clear using potable water. DU will provide a suitable potable water connection if one is not available on-site. Following the potable water flush, the system shall be slowly filled with steam or hot water as appropriate, and continuously drained to remove residual contamination.

TIE INS: Tie in welds will be visually inspected at a minimum, but are subject to NDE examination at the option DU.

CONDUCTIVITY TEST: Immediately after energizing the installed piping, the Installer shall withdraw a sample of condensate from the connected piping drain and submit the sample to DU for contaminant testing. The sample shall not contain more than ten (10) micro-ohms of conductivity, or two one-hundredths (0.02) PPM of iron. The Installer shall flush the piping from inside the Customers facilities until the contamination is reduced to the necessary limits.

4.18 VALVE BOXES

Each underground valve shall be made accessible by installation of a valve box. DU will furnish valve boxes for each service connection valve. The valve box shall be installed by the Installer during backfill and repaving. The status of valves shall be checked by both the Installer and DU prior to final adjustment of the valve box. Field swing ties shall also be taken at this time. Upon completion of the final checks, the valve box shall be plugged, and the valve box top shall be set to one inch (1") below final grade (before pavement) and then paved over to prevent intrusion of surface water.

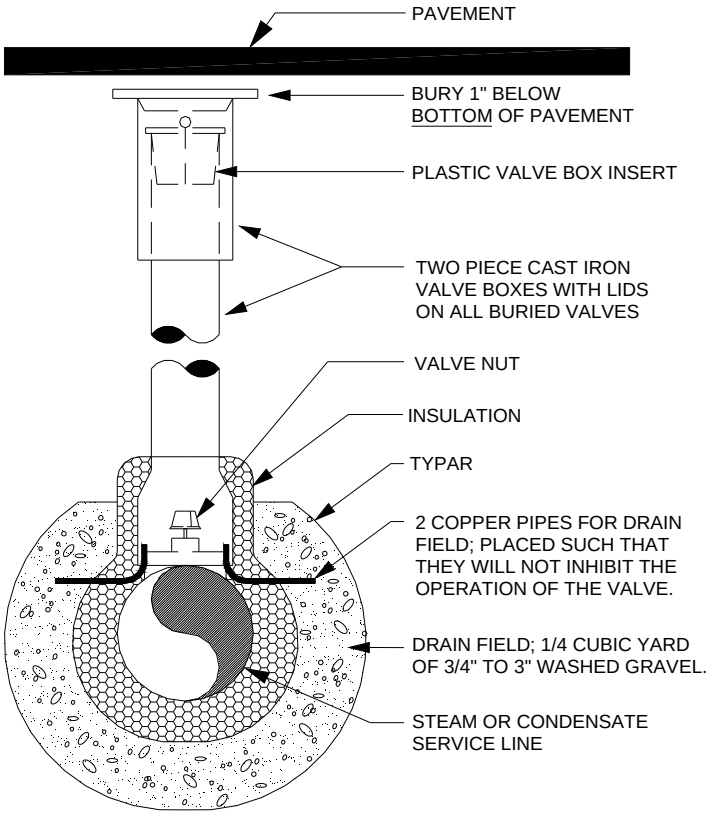

Fig. 9 - Valve Box Detail

4.19 CONDENSATE RECEIVER AND PUMP(S)

Provide and maintain a condensate receiver and pump(s) for steam services as follows:

1. If the elevation of any part of the steam supply or condensate return system run is lower than the main at the point of connection; or:

2. if the condensate pipe size exceeds two inches (2"); or

3. if the connection for service will be to a main that is pumped by DU; or

4. if continued experience demonstrates that the service does not drain properly for whatever reason.

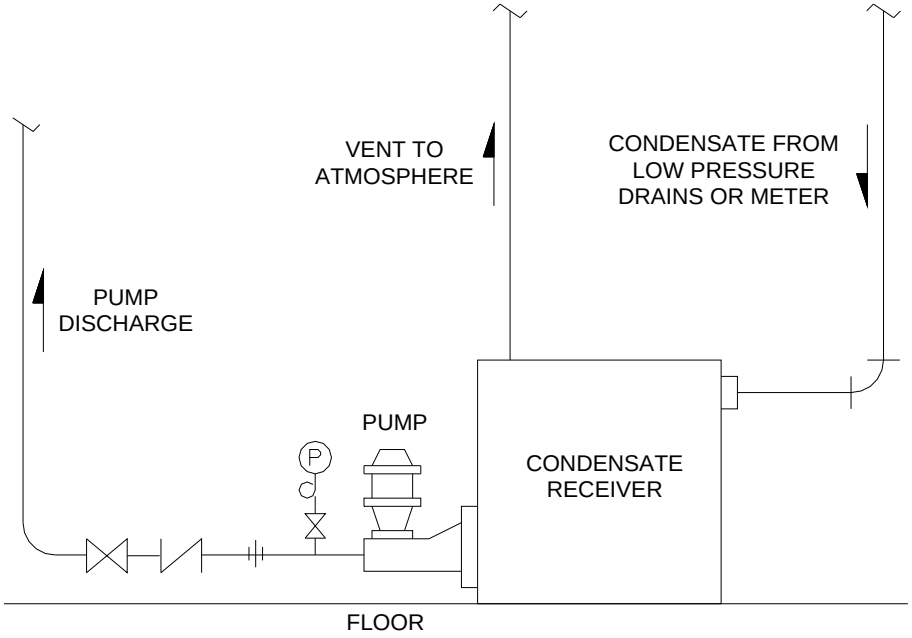

Fig. 10 - Condensate Receiver and Pump

Condensate receiver and pump(s) installation is subject to approval by DU. Pump(s) shall be installed downstream of condensate meter. The pump and receiver shall be sized to provide removal of all condensate not less than two hundred percent (200%) of the peak design flow of the heating system.

Condensate Pumps and Receivers shall be designed and built to pump 200°F water to a pressure of seventy feet (70') of head, and conform to the following requirements:

1. The receiver tank shall be a non-coded steel tank with phenolic resin lining, and connections for inlet, overflow, drain and atmospheric vent.

2. The pumps shall be flooded suction, centrifugal pumps with bronze impellers, renewable liners, and stainless steel shafts.

3. If the receiver is to have duplex pumps, the controls shall feature a mechanical alternator to select first one pump then the other, and arranged to start the second pump if the first pump cannot handle the peak flows.

4. Provide a float switch to activate pump(s) on high water level and deactivate on low water level. Float settings shall be by external adjustment that is clearly visible.

5. Provide a NEMA 4 enclosure and a control panel with magnetic starters mounted and wired, suitable for the motor(s) supplied. Power supply shall be a single source 208VAC single phase, 60Hz, unless otherwise required by the Customer.

6. Electric motors shall be vertical, 208VAC, single phase, 60Hz, high efficiency type, TEFC, with a 1.15 service factor with integral-thermostatically controlled motor winding heater, 120V. Nameplate rating without service factor shall not be less than required pump input at any condition from shutdown to maximum permitted flow.

7. Provide a bronze bodied check valve at the discharge of each pump.

4.20 GROUNDING

The NEC requires that interior heating and water pipes be incorporated into the building grounding circuit. DU district heat piping is, however, effectively isolated from the ground by the insulation and coatings surrounding the underground pipe so that proper grounding is not provided. Provide a dedicated grounding system in accordance with the NEC as amended by local authorities, and connect all piping to that approved building electrical grounding system.

4.21 DISTRICT HEAT METER

[Diagram to follow at a later date.]

Fig. 11 – District Heat Meter

The district heat meter shall be installed in an accessible location, and as shown herein. The meter size will be based on projected peak heating load, as established by the heat exchanger sizing. Meter dimensions shown shall be maintained by the Customer and Installer so as to allow DU personnel proper installation space for the meter.

A meter bar is available from DU for the proper spacing of the meter during construction. The Customer shall notify DU at the earliest possible date that meter installation can be completed.

4.22 AUTOMATIC METER READER (AMR)

Provide a conduit of one-half inch (1/2”) I.D. steel with minimum two inch (2”) radius bends for the AMR device, in accordance with the requirements of the NEC as amended by local authorities. The referenced conduit run shall extend from the district heat meter location to the location selected for the AMR device. The referenced conduit shall be installed with a one hundred pounds (100 LBS) strength pull string for pulling the meter wire. DU will provide the meter wire. The AMR provides the most convenient method of reading meters because DU personnel do not need to gain access each month to the district heat meter location inside the building. In new construction, the opportunity to plan and install the conduit for the remote meter reading device during construction allows this feature to be incorporated into the design without unwanted disruption of the vapor barrier or other unwanted penetrations.