ROANOKE

October 6, 2015

ADDENDUM NO. 1 TO ALL BIDDERS:

Invitation to Bid: ITB # 16-03-08

Description: Berglund Center Pipe Insulation

Dated: September 24, 2015

For Delivery to: Purchasing Division, City of Roanoke, Virginia

Bid Due: October 15, 2015

REFERENCE: SAMPLE CONTRACT, ATTACHMENT B, EXHIBIT 2, SCOPE OF WORK, ADD: Contractor will re-insulate the HVAC system piping in the Berglund Center's Basement Mechanical Rooms as more particularly described below. Contractor will also re-insulate approximately seventy two (72) feet of boiler exhaust flue pipe. **Pipes shall be insulated in accordance with the attached ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC.**

Note: A signed acknowledgment of this addendum should be received at the location indicated on the ITB either prior to the due date and hour or attached to your response. Signature on this addendum does not substitute for your signature on the original bid document. The original bid document must be signed.

Very truly yours,

Scott Arbogast
Buyer
Phone: 540-853-2871

_____
Name of Firm

_____ _____
Signature/Title Date

CITY OF ROANOKE
ITB# 16-03-08
BERGLUND CENTER PIPE INSULATION

ATTACHEMENT TO ADDENDUM NO. 1

ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC

6 PAGES TOTAL

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC

Insulation Requirements in Commercial Buildings for Mechanical and Service Hot-Water Piping

The intent of the pipe insulation requirements is to reduce temperature changes while fluids are being transported through piping associated with heating, cooling or service hot water (SHW) systems, thereby saving energy and reducing operating costs.

Uninsulated piping systems that transport fluids can create water temperature irregularities, which ultimately requires additional heating or cooling and associated energy costs to bring the water to operating temperature. Any piping that carries heated or cooled water, including piping systems with external heating (e.g., heat trace or impedance heating), should be thermally insulated to reduce heat loss or gain, allowing the fluid to be delivered at the intended temperature. The addition of insulation can also improve the comfort of the occupants and reduce energy consumption by reducing heat losses (or gains) as the fluid moves throughout the building.

Both ANSI/ASHRAE/IES Standard 90.1-2010 (90.1-10) and the 2012 International Energy Conservation Code (IECC) requires any piping associated with a heating or cooling system that carries fluids with an operating temperature of 105 °F or more or 60 °F or less to be insulated; 90.1-10 further specifies that the piping associated with constant temperature water storage systems must also be insulated (see "Code Citations" for additional detail).

Any insulated piping in areas exposed to weather is required to be further protected from exposure to sunlight, moisture, and wind—all of which can damage the insulation materials over time, decreasing their effectiveness. This protection must shield the insulation from solar radiation. Additionally, if the piping will be conveying chilled water, Standard 90.1-10 requires that a layer of vapor retardant material be installed on the outside of the insulating material. The 2012 IECC prohibits the use of adhesive tapes as shielding.

Both 2012 IECC and 90.1-10 piping associated with service hot water systems to be insulated to a minimum of not less than 1 inch of insulation having a conductivity not exceeding 0.27 Btu per inch/h x ft² x °F under certain circumstances.

Building Energy Codes

ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC

Pipe Insulation Requirements in Commercial Buildings *(Continued)*

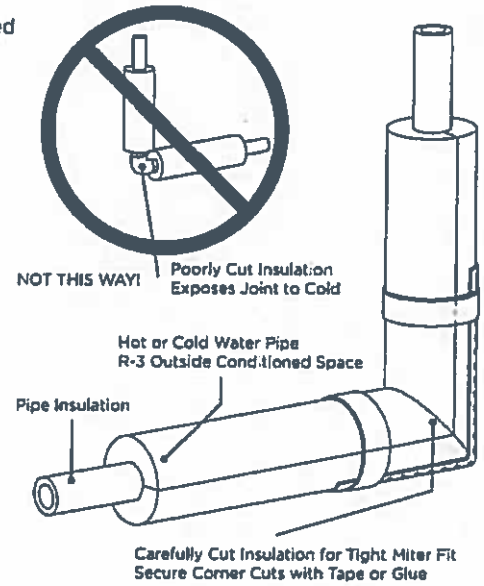
These documents typically cover any piping that moves heated or chilled water. However, neither the 2012 IECC nor 90.1-10 require piping designed to convey fluids over 60 °F and less than 105 °F, or fluids that have not been heated or cooled by equipment using fossil fuels or electricity to be insulated. Standard 90.1-2010 also permits an exception to instances where heat loss or gain will not increase energy usage. Additional exemptions apply to direct buried piping carrying fluids below 60 °F; factory installed piping within heating, cooling, and ventilation equipment; or on strainers, control valves, or the balancing valves connected to piping with a diameter of 1 inch (25mm) or less.

Plan Review (HVAC)

1. Verify that the piping is an integrated component of a heating or cooling system and does not fall under the exceptions as laid in Section C403.2.8 of the 2012 IECC or Standard 90.1-10, Section 6.4.4.1.3.
2. Verify the operating temperature of the fluids to be transported and the nominal pipe or tube size to determine the proper insulation thickness as described in Section C403.2.8 of the 2012 IECC or Standard 90.1-10, Section 7.4.3.
3. Verify if the piping will be exposed to sunlight or weather; if so, determine what shielding will be installed to protect the piping insulation.

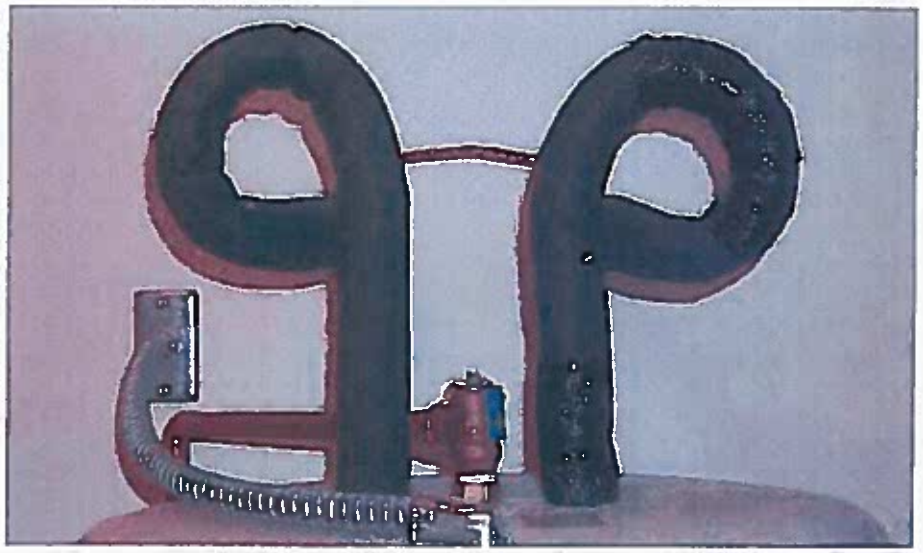
Plan Review (SHW)

1. Verify that the piping associated with service hot water will be insulated.



ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC

Pipe Insulation Requirements in Commercial Buildings *(Continued)*



Inspection

1. Verify that the piping has been insulated to the specified thickness for the fluid operating temperature and pipe thickness.
2. Verify that the installed insulation conductivity is within the acceptable range for the fluid operating temperature and pipe size in accordance with Section C403.2.8 of the 2012 IECC.
3. Verify that any necessary weather and sunlight insulation shielding has been properly installed. Adhesive tapes are not an accepted shielding material under the 2012 IECC.

Code Citations

2012 IECC, Section C403.2.8
HVAC System Piping Insulation
All piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.2.8.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between 60 °F (15 °C) and 105 °F (41 °C).
4. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
5. Strainers, control valves, and balancing valves associated with piping 1 inch (25 mm) or less in diameter.
6. Direct buried piping that conveys fluids at or below 60 °F (15 °C).

ANSI/ASHRAE/IES Standard 90.1-2010 & 2012 IECC

Pipe Insulation Requirements in Commercial Buildings *(Continued)*

Section C403.2.8.1 Protection of Piping Insulation

Piping insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, and shall provide shielding from solar radiation that can cause degradation of the materials, adhesives tape shall not be permitted.

Table C403.2.8
Minimum Pipe Insulation Thickness (thickness in inches)[a]

Fluid Operating Temperature Range and Usage (F)	Insulation Conductivity		Nominal Pipe or Tube Size (inches)				
	Conductivity Btu · in./(h ft² · °F)[b]	Mean Rating Temperature, °F	<1	1 to 1 1/2	1 1/2 to <4	4 to <8	<8
>350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251-350	0.29-0.32	200	3.0	4.0	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140	0.21-0.28	100	1.0	1.0	1.5	1.5	1.5
40-60	0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
<40	0.20-0.26	75	0.5	1.0	1.0	1.0	1.5

[a] For piping smaller than 1 1/2 inch (38 mm) and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch (25 mm) shall be permitted (before thickness adjustment required in footnote b) but not to a thickness less than 1 inch (25 mm).

[b] For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows: $T=r(1+t/r)^{K/k}-1$

Where:
T = minimum insulation thickness,
r = actual outside radius of pipe,
t = insulation thickness listed in the table for applicable fluid temperature and pipe size,
K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu × in/h × ft² × °F) and
k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

[c] For direct-buried heating and hot water system piping, reduction of these thicknesses by 1 1/2 (38 mm) shall be permitted (before thickness adjustment required in footnote b but not to thicknesses less than 1 inch (25 mm).

ASHRAE Standard 90.1-2010, Section 6.4.4.1 HVAC System Pipe Insulation

Insulation required by this section shall be installed in accordance with industry-accepted standards (see Informative Appendix E). These requirements do not apply to HVAC equipment. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, but not limited to the following:

a. Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
b. Insulation covering chilled-water piping, refrigerant suction piping, or cooling ducts located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which shall be sealed.

ASHRAE Standard 90.1-2010, Section 6.4.4.1.3 HVAC System Pipe Insulation

Piping shall be thermally insulated in accordance with Tables 6.8.3A and 6.8.3B.

Exceptions:

1. Factory-installed piping within HVAC *equipment* tested and rated in accordance with Section 6.4.1.
2. Piping that conveys fluids having a design operating temperature range between 60F and 105F, inclusive.
3. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electricity (such as roof and condensate drains, domestic cold water supply, and natural gas piping).
4. Where heat gain or heat loss will not increase energy usage (such as liquid refrigerant piping).
5. In piping 1 in. or less, insulation is not required for strainers, control valves, and balancing valves.

2012 IECC, Section C404.5 Service Hot Water Heating Pipe Insulation

For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft² × F (1.53 W per 25 mm/m² × K). The first 8 feet (2438 mm) of piping in non-hot-water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7mm) of material having a conductivity no exceeding 0.27 Btu per inch/h × ft² × F (1.53 W per 25 mm/m² × K).

Exception:

Heat-traced piping systems shall meet the insulation thickness requirement per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft² × F (1.53 W per 25 mm/m² × K).

ASHRAE Standard 90.1-2010, Section 7.4.3 Service Hot-Water Pipe Insulation

The following piping shall be insulated to levels shown in Section 6, Table 6.8.3:

a. recirculating system piping, including the supply and return piping of a circulating tank type water heater.

b. the first 8 ft of outlet piping for a constant temperature nonrecirculating storage system.

c. the inlet pipe between the storage tank and a heat trap in a nonreciculating storage system.

d. pipes that are externally heated (such as heat trace or impedance heating).

Table 6.8.3A Minimum Pipe Insulation Thickness
Heating and Hot Water Systems[a,b,c,d] (Steam, Steam Condensate, Hot Water Heating and Domestic Water Systems

Fluid Operating Temperature Range (°F) and Usage	Insulation Conductivity		Normal Pipe or Tube Size (in)				
	Conductivity Btu·in./(h·ft²·°F)	Mean Rating Temperature, °F	<1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8
			Insulation Thickness (in)				
>350 °F	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251°F – 350°F	0.29-0.32	200	3.0	4.0	4.5	4.5	4.5
201°F – 250°F	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141°F – 200°F	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105°F – 140°F	0.22-0.28	100	1.0	1.0	1.5	1.5	1.5

a For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows: $T = r\{(1 + t/r)^{K/k} - 1\}$ where T = minimum insulation thickness (in.), r = actual outside radius of pipe (in.), t = insulation thickness listed in this table for applicable fluid temperature and pipe size, K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu·in./h·ft²·°F); and k = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

b These thicknesses are based on energy *efficiency* considerations only. Additional insulation is sometimes required relative to safety issues/surface temperature.

c For piping smaller than 1-1/2" and located in partitions within *conditioned spaces*, reduction of these thicknesses by 1" shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses below 1".

d For direct-buried heating and hot water *system* piping, reduction of these thicknesses by 1.5" shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses below 1".

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