SECTION 33 07 00

**UTILITY INSULATION**

**BASED ON DFD MASTER SPECIFICATION DATED 2/24/2014**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

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

**SCOPE**

This sections includes insulation specifications for utility piping, and associated systems. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 Reference

 Reference Standards

 Quality Assurance

 Description

 Definitions

 Shop Drawings

PART 2 - PRODUCTS

 Materials

 Insulation

 Accessories

PART 3 - EXECUTION

 Installation

 Piping, Valve and Fitting Insulation

 Construction Verification Items

**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Division 7 – Thermal and Moisture Protection

Division 23 – Heating Ventilating and Air Conditioning

Section 33 10 00 – Chilled Water Utilities

Section 33 60 10 – Hydronic & Steam Utilities

**REFERENCE**

Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

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 C303 Density of Preformed Block Insulation

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 E84 Surface Burning Characteristics of Building Materials

MICA National Commercial & Industrial Insulation Standards

NFPA 225 Surface Burning Characteristics of Building Materials

UL 723 Surface Burning Characteristics of Building Materials

**QUALITY ASSURANCE**

Refer to division 1, General Conditions, Equals and Substitutions

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

**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:

1. Underground Pipe Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the DFD Project Representative.

**DEFINITIONS**

Underground piping: concrete box conduit systems, direct-buried steel conduit systems, direct-buried jacketed systems and direct-buried systems. All other areas, including walk-through tunnels, shall be considered as exposed and therefore covered by Division 23 specifications.

**SHOP DRAWINGS**

Refer to division 1, General Conditions, Submittals.

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.

**P A R T 2 - P R O D U C T S**

**MATERIALS**

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 150 or less.

**INSULATION**

Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex or approved equal.

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.

FLEXIBLE FIBERGLASS INSULATION:

Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

Foil-scrim-kraft vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms.

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, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

Piping: White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

Ductwork: Foil-scrim-kraft vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms.

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.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

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.

***If temperatures higher than 1200 degrees F. will be encountered, specify Type II insulation, which is rated to 1800 degrees F.***

ELASTOMERIC INSULATION:

Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

POLYOLEFIN INSULATION:

Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

***This paragraph describes Imcoa insulation which is suitable for interior/exterior use or direct burial.***

PHENOLIC INSULATION:

Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parrallel and 18 psi perpendicular, maximum water vapor permeability 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.

Kraft reinforced foil vapor barrier laminate all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

***This paragraph describes Childers Koolphen K insulation which has the highest insulating value per inch of specified insulations.***

EXTRUDED POLYSTYRENE INSULATION:

Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.

POLYISOCYANURATE INSULATION:

Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 ***(3.0. 4.0, 6.0)***lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 ***(50, 80, 140)***psi parallel and 13 ***(40, 65, 130)***psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

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 100 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 fiber, minimum nominal density of 8 lbs. per cu. ft., thermal conductivity of not more than 0.29 at 200 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.

INSULATION JACKET OR PROTECTIVE COVERING:

See associated underground utility piping specification. ***Reference section.***

**Make sure that the utility piping specification, e.g., chilled water, steam/condensate or hot water, adequately covers this underground piping insulation/and piping covering and corrosion protection requirements .**

INSULATION INSERTS AND PIPE SHIELDS:

As specified in the associated underground utility piping specification. ***Reference section.***

***Again, make sure that insulation protection, e.g., saddles, high density insulation blocks, ect.., are adequately covered in the underground piping specifications.***.

**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 .015 inch for aluminum and .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.

Bedding compounds to be non-shrinking and permanently flexible.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

**P A R T 3 - E X E C U T I O N**

**INSTALLATION**

Install insulation, jackets and accessories in accordance with manufacturers instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

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.

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.

**PIPING, VALVE, AND FITTING INSULATION**

General:

Install insulation with butt joints and longitudinal seams closed tightly. Secure with staples along seams and butt joints.

Install insulation continuous through supports on the exterior of insulation.

Insulation Inserts and Pipe Shields:

Provide insulation inserts and pipe shields at all support locations as applicable for associated utility system. 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.

Mineral Fiber:

Secure each 3’ section with three stainless steel bands evenly spaced and at 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. Cover elastomeric insulation on systems operating below 40 degrees F with vapor barrier mastic.

EXTRUDED POLYSTYRENE AND POLYISOCYANURATE:

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. Fill voids in factory molded or built-up valve and fitting insulation with foamed in place urethane insulation. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, and attached vent and drain lines.

***Protective jackets are required for exterior installations and where insulation is subject to physical abuse.***

Protective Jackets:

See associated underground utility piping specification. ***Reference section.***

**Make sure that the utility piping specification, e.g., chilled water, steam/condensate or hot water, adequately covers this underground piping insulation/and piping covering and corrosion protection requirements .**

Pipe Insulation Schedule:

Provide insulation on new and existing remodeled piping as indicated in the following schedule:

***Where asbestos abatement activities require reinsulation of existing piping not remodeled, expand above description to clarify scope of insulation work.***

***More than one insulation type can be listed for a given service if appropriate. Where insulation conductivity significantly differs from schedule, reference Comm 63.29, Appendix A to determine appropriate thickness. Coordinate insulation entries with associated underground piping utility section.***

**Service Insulation Insulation Thickness by Pipe Size**

**Types 1" and 1-1/4" 2-1/2" 5" to 6" 8" and smaller to 2" to 4" larger**

Hot Water Heating Rigid Fiberglass 1.5" 1.5" 1.5" 1.5" 1.5"

Chilled Water Piping Polyiso w/VB 1.5" 1.5" 1.5" 1.5" 1.5"

Refrigerant Suction

>40oF Elastomeric/Polyol 0.5" 1" 1" 1" 1"

40oF to 20oF Elastomeric/Polyol 1” 1.5” 1.5” 1.5” 1.5”

20oF to -20oF Ext Poly/Polyiso 1.5” 2” 2” 2” 2.5”

-20oF to -60oF Ext Poly/Polyiso 2” 2” 2.5” 2.5” 3”

Cold Water Piping Rigid Fiberglass 0.5" 0.5" 1" 1" 1"

Low Pressure Steam 1.5" 1.5" 2" 2" 3.5"

In Conduits Mineral Fiber 1.5" 1.5" 2" 2" 3.5"

Low Pressure Cond. 1.5" 1.5" 2" 2" 2"

In Conduits Mineral Fiber 1.5" 1.5" 2" 2" 2"

High Pressure Steam 2.5" 2.5" 4" 4" 4"

In Conduits Mineral Fiber 2.5" 2.5" 4" 4" 4"

High Pressure Cond. 2.5" 2.5" 4" 4" 4"

In Conduits Mineral Fiber 2.5" 2.5" 4" 4" 4

Cond. Pump Disch. Rigid Fiberglass 1.5" 1.5" 2" 2" 2"

In conduits Mineral Fiber 1.5" 1.5" 2" 2" 2"

Remote Generator Rigid Fiberglass 1.5" 1.5" 2" 2" 2"

Radiator Piping

The following piping and fittings are not to be insulated (Unless project constraints call for direct bury insulation):

1. Direct buried heavy wall PVC piping.
2. Direct buried fiberglass covered piping.
3. Direct buried HDPE piping.
4. Direct buried ductile iron piping.

# CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 or 01 91 02 in accordance with the procedures defined for construction verification checklists.

END OF SECTION