SECTION 15082 – EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Furnish and install all equipment insulation, vapor barriers, jackets, finishes, adhesives, cements and accessories to make a complete and insulated system of all equipment, flanges and accessories as specified herein.

B. All insulation system materials shall conform to the maximum flame spread/smoke developed ratings specified herein.

C. Where equipment has removable heads, then insulation shall have removable insulated covers. Do not cover any equipment nameplates.

D. Insulate the following

1. All equipment and accessories shall be insulated as herein specified.
2. Heat exchangers, expansion and compression tanks, air separators.
3. Flash tanks. Boiler breeching(s).
4. Condensate pump receivers. Deaerator and surge tanks. Blowdown tank.
5. Pressure reducing valves.

1.3 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.

B. Material standards shall be as specified or detailed hereinafter and as follows:

1. ASTM A 666 – Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
2. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Steel and Plate.
3. ASTM B 209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and plate (Metric).
4. ASTM C 177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by
5. Means of the Guarded Hot Plate Apparatus
6. ASTM C 195 – Standard Specification for Mineral Fiber Thermal Insulating Cement.
7. ASTM C 240 – Standard Test Methods of Testing Cellular Glass Insulation Block.
8. ASTM C 449/C 449M – Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
9. ASTM C 518 – Standard Test method for Steady-State Heat Flux Measurements and Thermal Insulating and Finishing Cement.
10. ASTM C 533 – Standard Specification for Calcium Silicate Block and Pipe Terminal Insulation.
11. ASTM C 534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
12. ASTM C 552 – Standard Specification for Cellular Glass Thermal Insulation.
13. ASTM C 553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
14. ASTM C 592 – Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
15. ASTM C 612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
16. ASTM C 921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM D 1056 – Standard Specification for Flexible Cellular Materials – Sponge ore Expanded Rubber.
18. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
19. ASTM E 96 – Standard Test Methods for Water Vapor Transmission Materials.
20. NFPA 225 – Standard Method of Test of Surface Burning Characteristics of Building Materials.
21. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
22. ANSI/ASHRAE 90.1 - Energy Conservation in New Building Design

1.5 SUBMITTALS

A. See Section 15050 and General Conditions for additional requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D. Contractor's Installation Details

1. Submit job specific details and/or drawings indicating methods of insulating specific pieces of equipment such as but not limited to, chilled water pumps, condensate receivers, exposed roof-top piping, etc.

1.6 QUALITY ASSURANCE

A. All insulation materials, finishes, coatings, cements, jackets and other insulation accessories shall have minimum composite or individual fire hazard ratings as well as thickness and "C" values conforming to State Building Codes which control building construction materials that may be used on this project. Where specification requirements exceed the Code requirements, the specification shall govern.

B. Insulation for the equipment shall be composed of materials which are non-combustible and/or provide a fire resistive system of insulation which complies with the applicable Code having jurisdiction. Generally, it is required that fire hazard ratings shall not exceed the following, except as noted:

1. Flame Spread Rating: 25 (No Exceptions)
2. Smoke Developed Rating: 50

C. All fire hazard ratings shall be as determined by NFPA 255 "Method of Test of Surface Burning Characteristics of Building Materials", ASTM E84 or UL 723.

D. All insulation materials herein specified shall be used subject to the manufacturer's temperature limitations and their compatibility with other materials.

E. Installation of all insulation work shall be executed by a qualified Insulation Contractor who is thoroughly experienced in this particular type of work and who has adequate facilities and equipment for installation of all insulation work herein specified and who is familiar with the requirements of the Code enforcing Authorities as to fire hazard rating.

F. The finished installation shall present a neat and workmanlike appearance with all jackets smooth, with all vapor barriers sealed and intact.

1.7 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Conform to local Energy code.

1.8 DELIVERY, STORAGE AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.

B. All materials shall be stored in a dry area free from moisture and debris.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during and after installation for minimum of 24 hours.

PART 2 – PRODUCTS

2.1 GENERAL

A. MANUFACTURERS ACCEPTABLE FOR PRODUCT TYPES INDICATED CONTINGENT UPON PRODUCTS' COMPLIANCE WITH THE SPECIFICATIONS

1. Insulation:

a. Manville Corporation.
b. Owens-Corning Fiberglass Corporation.
c. Certainteed Corporation.
d. Knauf
e. Armacell

2. Mastics and adhesives:

a. Childers Products Company.
b. H. B. Fuller Company, Foster Products Division.
c. 3M Company Adhesives, Coatings and Sealers.
d. Ruston Plant.
e. Chicago-Mastic
f. Insul-Coustic
g. St. Clair Rubber
h. Vimasco
i. Baldlwin-Ehret-Hill

3. PVC fitting covers:

a. Manville, Corporation.
b. Ceel-Co.

c. Certainteed, Corp.
d. Cell Co. Plastics

4. Reusable covers

a. Insulation Technology, Inc
b. Advance Thermal Corp
c. Pacor
d. Berry Soft Pack Fabricators

2.2 MATERIALS AND COMPONENTS

A. Calcium Silicate Block Insulation

1. Calcium silicate block insulation shall be Owens-Corning, Kaylor or Manville Thermo-12. Insulation shall have a density of 11 lbs./cu.ft., a thermal conductivity of 0.37 at 200°F mean temperature, and shall be suitable for application on surfaces which reach 1200°F.
2. All block insulation shall be applied in layers not exceeding 1 1/2 inches thick. Insulation shall be secured with wire and covered with 1/2 inch thick finishing cement. All corners of insulation shall be protected by metal corner beads.
3. Nameplates and inspection stamps shall not be covered. 26 gauge galvanized metal collars shall be provided at manhole and openings for controls and nameplates and stamps and the covering shall be neatly finished thereto.

B. Insulkote

1. Insulkote ST as manufactured by Manville, shall be applied on dry cement (no primer is required). Hexagonal wire mesh reinforcement shall be used. Troweling should be done firmly to make sure the coating is thoroughly forced through the mesh. Material shall not be applied in thicknesses greater than 1/8 inch. Application to a greater thickness may cause slumping while there is still solvent in the coating.
2. Wire mesh reinforcement shall be provided.
3. Insulation material and application shall be in strict accordance with the manufacturer's procedures and recommendations.

C. Rigid Fiberglass Board Insulation

1. Rigid fiberglass board insulation shall be equal to Owens-Corning Fiberglas 25 with ASJ having an approximate density of 6 lbs./cu.ft. and an approximate thermal conductivity of 0.25 at 75°F.
2. Equipment having sharp bend shall have the insulation scored as required to conform to the curved surfaces to provide a neat and workmanlike appearance when finished.
3. All insulation edges and joints shall be sealed with a fire retardant vapor barrier adhesive, reinforced with a vapor barrier tape similar to that of the board facing. Tape shall be 3 to 5 inches wide as recommended by the particular manufacturer.

D. Molded Closed Cell Foam

1. Molded closed cell foam insulation shall be Armacell Armaflex 2000, self-seal white, flexible foam elastomeric thermal insulation of expanded closed cell structure. Insulation shall be rated for 200°F and thermal conductivity of 0.27 per inch thickness at 75°F mean temperature.

2.3 INSULATION FACING

A. Code ASJ: All service jacket composed of high intensity white chemically treated Kraft paper reinforced with fiberglass yarn and mesh and laminated to aluminum foil with a fire retardant adhesive. Longitudinal laps and butt strips shall be a minimum of 3 inches.

B. Code FSKL: 0.35 mil aluminum foil reinforced with fiberglass yarn reinforcing scrim and laminated to chemically treated fire resistive Kraft paper having a minimum 35 pound per inch width tensile strength when tested in accordance with ASTM D 828. Water vapor permeability 0.04 perms. Longitudinal laps and butt strips shall be a minimum of 3 inches.

2.4 ADDITIONAL INSULATION JACKET

A. ADJ-3b: 0.020 inch thick embossed aluminum jacket confirming to ASTM B-209 with a 1 mil factory applied polykraft moisture barrier. Longitudinal joints shall be placed at the side of the pipe facing downward at either the 4 o'clock or 8 o'clock position so as to shed water. Aluminum fitting covers, two piece elbows, tees, valve and flange covers, etc., with a 1 mil polykraft or acrylic vapor barrier.

B. ADJ-4: 20 mil PVC jacket suitable for all types of paint. Similar to Manville Zeston 25/50.

C. ADJ-6 A finish jacket of an Asbestos-free and woven as high temperature, heat-resistant fabric. Lagging Cloth having a treated weight of 24 oz./sq.yd. Material shall be suitable for a sustained operation at 1100°F.

2.5 ADHESIVES

A. Code ADH-1: Fibrous adhesive, non-flammable, quick setting adhesive for calcium silicate. Similar to Childers CP-97, 98.

B. Code ADH-2: Fast-drying vinyl base coating and lagging adhesive. Similar to Childers CP-50A HV2.

C. Code ADH-3: Fast-drying neoprene base adhesive for lap joints of foil-faced facing applied over pipe insulation. Similar to Childers CP-82.

D. Code ADH-4: Adhesive for use in adhering fiberglass board or blanket insulation to pipe and equipment. 3M Company Insulation Adhesive No. 35 or 38 non-flammable adhesive.

2.6 CAULKING COMPONENTS

A. Code CC-1: For use with foam glass and/or joint sealant applications. Flexible elastomeric vapor barrier sealant. Similar to Childers CP-76.

2.7 MASTICS

A. Code MAS-1: Vapor barrier mastic made with an elastomeric resin. For indoor use. Similar to Childers CP-30.

B. Code MAS-2: A non-water vapor barrier asphaltic emulsion coating, breathing type, for above ground installations. Similar to Childers CP-10.

C. Code MAS-3: Vapor barrier mastic made with an elastomeric resin. For outdoor use.

2.8 TIE WIRE

A. Tie wire for securing insulation in place shall be type 304 stainless steel annealed steel wire of gauge and proper spacing as recommended by the insulation manufacturer. Wire shall be drawn up tightly enough to become embedded in the insulation and the ends of the loop twisted, bent over, and pressed into the insulation so as to leave no ends protruding.

2.9 BANDING

A. 3/8 inch x 0.02 inch type 304 stainless steel for pipe insulation.

B. 3/4 inch x 0.02 inch type 304 stainless steel for additional insulation jackets.

2.10 WIRE MESH

A. Wire mesh shall be one inch by No. 20 BGW hexagonal mesh galvanized.

B. Expanded metal: Expanded metal shall be 1/2 inch Hi-Rib metal lath of copper bearing steel.

2.11 TAPE

A. Lead foil tape, where specified, shall be 3M Company Lead Foil Tape No. 422, 4 mil thick, acrylic adhesive, 2 inch wide.

B. Vinyl plastic tape, silver gray, flame resistant, vapor barrier sealant tape on rigid and flexible insulation material for warm or cold air ducts. Similar to 3M Company Duct Sealing Tape No. 474.

C. Aluminum foil tape, dead soft aluminum foil, point seal on stick pin, metal patching, moisture barrier, heat reflecting and general sealing on aluminum facing foil. Similar to 3M Company Aluminum Foil Tape No. 425.

2.12 STAPLES

A. Staples shall be 304 or 316 S.S. outward clinching insulation staples.

2.13 INSULATING CEMENT

A. Insulating cement shall be a mineral-fiber (wool) ASTM C 195 base material having essentially the same insulating characteristics as the adjacent insulation. Similar to PABCO High Temperature Insulating Cement. Insulating cement shall be applied in layers to a maximum thickness of 1/2 inch at one time. Each layer shall be allowed to dry thoroughly before subsequent layers are applied.

2.14 FINISHING CEMENT

A. Finishing cement ASTM C 449 shall be diatomaceous silica thermal insulating materials with a suitable proportion of heat resistant binder, hydraulic setting insulating cement capable of withstanding maximum temperature of 700 degrees Fahrenheit. When mixed with water it shall be a plastic mix suitable for trowel applications and shall present a hard, smooth and durable surface after drying. Similar to PABCO No. 127.

B. Combination insulating and finishing cement:

C. Similar to Ryder One Coat or equal.

2.15 WELDING STUDS

A. Welding studs shall be capacitor type split pin or TCP tipped insulation pins with speed clips. Similar to Nelson Stud Welding Spec. 28.

2.16 ACCESSORIES AND FASTENING MATERIALS

A. Corner angles on insulation of equipment in finished areas shall be formed of 28 gauge, 1 inch by 1 inch aluminum adhered to heavy Kraft paper having 2 inch by 2 inch by 2 inch wings to protect external corners under cloth jackets.

2.17 REMOVABLE/REUSABLE INSULATION COVERS

A. Pressure reducing valves operating above 200°F shall be insulated with reusable insulation covers as described in this specification.

B. The materials, construction techniques and methods of application described in this specification are for conservation of heat, ease of maintenance and personnel protection.

C. Reusable insulation covers shall be custom built and shall conform to the shape of the fitting or valve being insulated.

D. Identification of reusable covers shall be by means of a permanently attached, stainless steel tag secured to the outer surface of the cover. The identification legend, which shall be mechanically embossed on the tag, shall locate the fitting the cover was designed for. It shall also contain information adequate to reorder the cover from the manufacturer.

E. Reusable covers shall be similar to Insulation Technology, Inc., Heat Holder LD-1000, 2 inch thick fiber glass mat insulation. LD-1000 shall be an off-white color, have non-combustible wool with long, resilient, inorganic glass fibers, and shall be bonded with a thermosetting resin. Insulation shall be encased in an inner and outer jacket of 550T Teflon impregnated fiberglass fabric suitable for temperatures up to 500°F. Fabric shall weigh a minimum of 14 oz./sq.yd. and have a nominal thickness of 0.013 inch. Fabric shall also pass UL 214 Flammability Test. Fabric color shall be gray.

F. Covers shall be sewn simultaneously with (2) parallel rows of double sewn seams of (10) stitches per inch. Stainless steel quilting pins and hooks shall be included on each cover.

G. Covers shall be installed after adjacent pipe and fitting insulation and jacketing is in place. Covers shall be overlapped a minimum of 2 inches on pipe insulation. Once in place, covers shall be tightened by Velcro straps sewn into each cover.

H. For chilled water pumps, a vapor barrier shall be provided.

PART 3 – EXECUTION

3.1 INSTALLATION OF INSULATION

A. All insulation shall be applied by experienced Insulating Contractors in accordance with best Trade practice.

B. Do not cover vent petcocks, grease fittings or other maintenance points on equipment unless identified on the insulation with removable access panels or covers.

C. No equipment nameplates shall be covered. The insulation shall be cut back and a 26 galvanized "picture frame" installed to accept the abutting edges of the insulation to leave the nameplate data exposed to view.

D. Test, inspect and clean all surfaces to be insulated before applying insulation.

E. Take all possible precautions to protect work of other Trades. Provide protective covering as required to accomplish this end. This Trade shall be responsible for returning all equipment and material to its original new condition and appearance where damage occurs due to his neglect.

F. All equipment and accessories shall have been tested and approved prior to installation of insulation.

G. All equipment surfaces, where subject to condensation or heat loss on the outside, shall be insulated.

H. All surfaces to be insulated shall be clean, dry and free from rust and scale when insulation is being applied. Insulation shall be dry at the time of installation and before and during the process of finished application.

I. Butt ends will not be allowed. However, where required and approved by Architect, jacket material shall be pasted over exposed ends and banded to give a neat and finished appearance. Exposed insulation material will not be permitted.

J. Surfaces or insulation shall be smooth, even and true to line with jackets drawn tight and smoothly secured. Scrap pieces of insulation shall not be used as filler pieces.

K. The methods of application of insulation, finishes, adhesives, cements, accessories are generally specified under the material headings of these specifications. Where not specifically detailed, it is intended that they are equal or exceed the manufacturer's published recommendations, existing at time of bid openings, subject to the approval of the Architect.

L. Butt covering neatly to walls, floors, ceiling. Apply band at end and position so band covers gap between surface and insulation where exposed.

M. Fastenings: Provide where required to securely hold insulation.

N. Thickness of insulation shall not be compromised due to interferences, improper installation or any other reason.

PART 4 – SCHEDULES

4.1 EQUIPMENT INSULATION SCHEDULE

Service	Type Insulation and Thickness (Inches)	Facing	Additional Jacket
All Expansion, Compression Tanks and Air Separators	Calcium Silicate Block 1		ADJ-6
Flash Tanks and Condensate Tanks,	Calcium Silicate Block 3		ADJ-6
Hot water pumps	Fiberglass 3		Same as piping
Breeching	Calcium Silicate Block 3		ADJ-3b
Humidifier Steam Kettles, Blowdown Tanks; Heat Exchangers	Calcium Silicate Block 3		ADJ-6
Deaerator and surge tank	Calcium Silicate Block 3		ADJ-6
Tanks	Calcium Silicate Block 3		ADJ-6
Boiler feed system	Calcium Silicate Block 3		ADJ-6
Blowdown Tanks	Calcium Silicate Block 3		ADJ-6
Blowdown separator	Calcium Silicate Block 3		ADJ-6
Chilled Water Pumps	Armaflex 3	Formed Covers w/Velcro Fastening	ADJ-4
Pressure Reducing Valves	Custom Cover Fiberglass Mat 2	Heat-Holder LD-1000	
Other	Fiberglass 3	FSKL	ADJ-4

A. HVAC Insulation Schedule Notes

1. Refer to jacket specifications for finish covering to be installed on calcium silicate insulation in finished areas.
2. Where "Finishing Cement" finishes are scheduled, refer to specifications for Cement herein for materials, method of application, thickness, etc.

END OF SECTION