PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
   1. Section 22 00 10 - General Requirements
   2. Section 22 00 20 - Plumbing Scope of Work
   3. Section 22 05 07 - Design Conditions
   4. Section 22 10 00 - Domestic Water Systems
   5. Section 22 13 00 - Sewage and Drainage System
   6. Section 22 21 23 - Pumps
   7. Section 22 30 00 - Plumbing Equipment

1.2 SUMMARY

A. Furnish and install thermal insulation as specified herein and as indicated on the Drawings.

1.3 REFERENCE STANDARDS

A. All thermal insulation shall be designed, manufactured and tested in accordance with the following latest applicable standards:
   1. ASTM B209, C34, C177, C355, C533, C547, C552, C585, E-84 and E-96
   2. NFPA 225
   3. UL 723
   4. Council of American Building Officials Report No. NER - 332
   5. ADA

B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this Project.

1.4 SUBMITTALS

A. The following submittal data shall be furnished according to the General Conditions and Section 22 00 10 and shall include, but not be limited to:
   1. Thermal Insulation* complete with materials, thermal properties, adhesives, installation details, etc. Certification required as specified herein for flame spread and smoke developed.
   2. Factory Test Reports

B. All items or equipment listed above with asterisks (*) shall be certified by the manufacturer using Manufacturer Certification “MCA” as set forth in Section 22 00 10. See Section 22 00 10 for certification requirements.

1.5 WARRANTY

A. Comply with the requirements of the General Conditions and Section 22 00 10.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. If they comply with these Specifications and have the same thermal properties, density, fire rating, etc., as the types specified herein, products by the following manufacturers will be acceptable.
   1. Adhesives and mastics shall be as manufactured by Armstrong, Childers, Foster Products Corporation, Johns Manville or 3M.
   2. Aluminum jacketing shall be as manufactured by Childers, Pro-Tec-T-Kotes, Inc., RPR Products Inc. (Houston, TX) or Johns Manville.

3. Calcium silicate non-asbestos insulation materials shall be as manufactured by Owens-Corning, Pabco or Johns Manville.
4. Cellular glass insulation materials shall be as manufactured by Pittsburgh Corning, ICA-H Block or approved equal.
5. Elastomeric piping insulation materials shall be as manufactured by Armstrong, Rubatex or Nomaco.
6. Glass fiber insulation materials shall be as manufactured by Certain Teed, Knauf, Owens-Corning, Johns Manville, or Manson.
7. Polyurethane foam insulation materials shall be as manufactured by Dow Plastics - Trymer 2000, Dupont, or approved equal.
8. PVC insulated fitting covers shall be as manufactured by Knauf (Proto), Foster Products Corporation (Speedline), or Johns Manville.
9. High temperature blanket type insulation materials shall be as manufactured by Calsil, Nelson Fire-Master High Temp FSB Flameshield Blanket, or Johns Manville Firetemp Wrap SL.

2.2 GENERAL

A. All insulation exposed within return and supply air plenums shall have a composite (insulation, jacket or facing and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard rating as tested by Procedure ASTM E84, NFPA 225, UL 723 and UBC Standard 8-1 not exceeding:
   1. Flame Spread 25
   2. Smoke Developed 50

   Accessories, such as adhesives, mastics and cements, shall have the same component ratings listed above. All insulation materials, together with adhesives and finishes, shall be submitted for review. It shall be certified in writing that all products to be used on this Project comply with the above criteria. All products or their shipping cartons shall bear labels indicating that flame and smoke ratings do not exceed above requirements.

2.3 THERMAL INSULATION FOR PIPE, VALVES, FITTINGS, AND ACCESSORIES

A. Insulation Materials (see Plumbing Piping Insulation Schedule: Table):
   1. Type A: ASTM C547 glass fiber pipe insulation with thermal conductivity (k factor) not exceeding 0.23 (Btu x In) / (Hr x Ft2 x ºF) at 75ºF mean temperature. Insulation shall be jacketed with white reinforced all service vapor retarding jacketing. Vapor barrier mastic shall be Foster 30-80 or Childers CP-35. Adhesive shall be Foster 85-75 or Childers CP-82. At the Subcontractor's option, self-sealing lap jacketing with adhesive release strips on both the lap and the jacket may be used. No exposed staples will be allowed. Fiberglass insulation shall be installed in all areas where the piping system is exposed within return and supply air plenums.
   2. Type B: Armstrong Type AP Armaflex or Rubatex R-180-FS 25/50 rated flexible elastomer pipe insulation. Insulation shall have a thermal conductivity (k factor) of not more than 0.28 (Btu x In) / (Hr x Ft2 x ºF) at 75ºF mean temperature when tested by ASTM C177 and a water vapor permeability of 0.20 or less when tested by ASTM C355 water method. Adhesive shall be Armstrong 520 or Rubatex R-373.

2.4 THERMAL INSULATION FOR EQUIPMENT

A. Insulation Materials (see Equipment Insulation Schedule: Table):
   1. Type A: Armstrong Armaflex II or Rubatex R-180-FS 25/50 rated flexible elastomeric sheet insulation (ASTM C34). Insulation shall have a thermal conductivity (k factor) of not more than 0.28 (Btu x In) / (Hr x Ft2 x ºF) at 75ºF mean temperature when tested by ASTM C177 and a water vapor permeability of 0.20 perm-inch or less when tested by ASTM C355 Water Method. Adhesive shall be Armstrong 520 or Rubatex 373. The insulation shall be finished with two (2) coats of Armstrong WB Armaflex finish or Rubatex 374 coating.
   2. Type B: Hydrous calcium silicate non-asbestos block, similar and approved equal to Schuller Thermo-12 Gold as required to provide the specified minimum thickness. The insulation shall have an average thermal conductivity (k factor) not to exceed 0.44 (Btu x In) / (Hr x Ft2 x ºF) at a mean temperature of 300ºF. Block shall be held in place with 1/2" x 0.15" galvanized steel bands on 12" centers. Point up with an approved equal insulating cement. Cover with expanded metal lath. Attach metal lath with wiring to bands and lace all edges. Finish with 1/4" thick cement troweled over the metal lath to form a smooth surface. Final finish shall be suitable for painting. At the Subcontractor's option and as approved by the Engineer and the authorities having jurisdiction, lightweight, non-asbestos, high temperature inorganic ceramic fiber blanket duct wrap similar and approved equal to Nelson Firestop

Products, Flameshield Blanket ("FSB") with Nelson Firestop Putty ("FSP"), or Johns Manville Firetemp Wrap SL and other accessory products including but not limited to tapes, banding materials and insulation pins, as required for a complete system may be provided for kitchen exhaust ducts in lieu of the hydrous calcium silicate insulation system specified above. Duct Wrap shall be a two (2) hour fire resistive enclosure system, shaft enclosure, with zero (0) clearance to combustibles when used with a listed and approved through penetration fire stop system complying with ASTM E 119/UL 263, ASTM 136, ASTM E 814/UL 1479, ASTM 84/UL 723, and UL 1978. The insulation system shall be installed in accordance with all manufacturer requirements and recommendations as well as the requirements of the applicable codes, rules, regulations and standards.

3. Type C: Factory insulated.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. The complete thermal insulation installation shall be in accordance with the manufacturer's written standards and recommendations and as indicated by the Contract Documents.

B. No insulation shall be applied until the surfaces of equipment to be insulated are thoroughly cleaned and until pipes and equipment to be insulated have been hydrostatically tested and proven tight by the Subcontractor and accepted by the Engineer. Any leaking pipes or equipment shall be brought to the attention of the Subcontractor who shall cause these conditions to be corrected. All surfaces shall be thoroughly dry before application of any insulation.

C. The execution of the insulation work shall be in strict accordance with the best practices of the trade and with the Specifications herein.

D. The insulation shall be handled and applied in a manner that will not adversely affect its structural or insulating properties.

E. The installation instructions provided by the insulation material manufacturer of all materials specified in this Section shall be followed when installing these materials. Where these Specifications are in conflict with manufacturer's instructions, such conflicts shall be brought to the attention of the Engineer for a decision.

3.2 INSTALLATION OF THERMAL INSULATION FOR PIPE, VALVES, FITTINGS, AND ACCESSORIES

A. All pipes, valves, fittings, flanges, specialties, etc., including system trim items such as gauge cocks, thermometer wells, etc., shall be insulated as specified herein. Unless specified elsewhere in this Section, equipment such as meters, automatic air vents, circulating pumps, etc., shall be insulated as specified for the adjoining piping.

B. Prefabricated sectional insulation for straight pipes shall fit the respective type of pipe indicated on Drawings. Longitudinal laps and 3" wide butt strips of the insulation jacket shall be adhered neatly in place with the specified adhesive. The use of staples will not be acceptable.

C. A protection saddle or shield similar to Buckaroo Insulation Saddles with galvanized finish shall be provided by the Subcontractor at each hanger or support as specified in Section 22 10 00 titled "Domestic Water Systems". Pittsburgh Corning 8.5# cellular glass blocking (ASTM C552) or ICA H-Block (20 lbs./cu. ft. density) shall be installed between the pipe and the protection shield to prevent crushing of the insulation. Insulation blocking shall be not less than the same length and circumference as the pipe protection shield. The blocking material shall be finished to match adjoining pipe insulation.

D. Fittings, flanges, valves, mechanical couplings and specialties shall be insulated with preformed covers or shop fabricated covers the same thickness as the adjoining pipe insulation. All insulation not covered with insulation jacketing shall be thoroughly sealed with the specified mastic coating. Preformed glass fiber covers, which comply with the 25/50 fire and smoke ratings may be used on all systems for grooved pipe fittings as manufactured by Pro-Tec-T-Kotes Inc., Knauf Proto PVC fittings or approved equal. At the Subcontractor's option, PVC fitting covers with fiberglass inserts, which comply with the 25/50 fire and smoke ratings may be used on all systems if approved by the authorities having jurisdiction.

E. All joints and fittings shall be sealed with the specified mastic. Where required, oversized pipe sections or board type insulation may be used to fabricate and install insulation around pipe specialties. All void space must be firmly filled with flexible insulation to support oversized pipe insulation.

F. All applications of the specified mastic coating shall be applied reinforced with white 10 x 20 glass fabric.

G. Piping insulation exposed to weather or as specified elsewhere by the Drawings shall be covered with 0.016" thick smooth aluminum jacket (ASTM B209). Provide 1/2" wide aluminum bands applied on 12" centers. Jacket shall have a 2" overlap at each joint. Jacket seams shall be located on the bottom side of all horizontal piping.

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3.3 INSTALLATION OF THERMAL INSULATION FOR EQUIPMENT (TYPE A)

A. Insulation shall be applied directly to the contoured surfaces of the equipment unless specified otherwise. The entire surface of the equipment shall be coated with adhesive.

B. Insulation shall be applied to all equipment in such a manner as to allow removal of access plates, manholes, casing sections, etc., without destroying the insulation. Insulation on split case pumps shall allow removal of the upper section without destroying the insulation.

C. Unless specifically specified herein, equipment such as water meters, automatic air vents, flow meters, backflow preventers, etc., shall be insulated as specified for the respective piping system.

3.4 FACTORY OR LABORATORY PERFORMANCE TESTING

A. All thermal insulation shall be tested in accordance with the latest reference standards listed herein and all applicable industry standards.

3.5 PLUMBING PIPING INSULATION SCHEDULE

SYSTEM		PIPE SIZE	INSULATION TYPE	MINIMUM INSULATION THICKNESS
1	Domestic Refrigerated Water Piping	ALL	A or B	½"
2	Horizontal storm and areaway drain piping and undersides of roof drains and areaway drains, except where located in garage parking areas	ALL	A*	½"
3	Waste lines from Drains receiving cooling coil condensate, except where these lines are located in the AHU room	ALL	A	½"
4	Waste lines from drinking fountains with refrigerated water to the junction with the riser.	ALL	A or B	½"
5	Exposed lavatory waste and hot water supply piping in accordance with state and local handicap requirements and the Americans with Disabilities Act	ALL	A	½"
6	Domestic Hot Water Piping	ALL	A B	1" ½"
7				

* At the subcontractor's option, Type A ductwork insulation may be used.

3.6 EQUIPMENT INSULATION SCHEDULE

SYSTEM	INSULATION TYPE	MINIMUM INSULATION THICKNESS

	SYSTEM	INSULATION TYPE	MINIMUM INSULATION THICKNESS
1	Air Accumulating Tank	A	1”
2	By-Pass Filter Tank	A	1”
3	Heating Hot Water Compression Tank	A	1”
4	Steam To Hot Water Heat Exchangers	B	2”
5	Domestic Hot Water Heater	C	N/A

END OF SECTION