SECTION 22 0713

PLUMbing and hvac insulation

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LANL MASTER SPECIFICATION

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| Rev. 7 Summary of Changes:  Updated to reflect changes per ASHRAE 90.1-2019.  Added requirements for Steam Blowdown Piping and Refrigerant coil condensate drain piping. |

Word file at <https://engstandards.lanl.gov/specs.shtml>

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  This specification template is tailored to meet requirements contained in the LANL Engineering Standards Manual (ESM). To seek a variance from requirements of the ESM that are applicable, contact the ESM Mechanical[POC](http://engstandards.lanl.gov/POCs.shtml#mech). Please contact POC with suggestions for improvement as well.  
  
When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.  
  
Specification developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

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1. GENERAL
   1. SECTION INCLUDES
2. Piping insulation
3. Ductwork insulation
4. [Equipment not factory insulated]
   1. DEFINITIONS
5. Finished Areas: Areas where floor, walls, ceilings, trim, or exposed steel are painted, tiled, or similarly finished.
6. Unfinished Areas: Areas with unpainted walls.
7. Conditioned Spaces: A heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55, e.g., offices, mechanical rooms, storage rooms, etc.
8. Unconditioned Spaces: Pipe tunnels, covered pipe trenches, spaces inside walls, duct or pipe shafts, spaces above dropped ceilings, unfinished attic spaces and crawl spaces.
9. Ductwork Exposed to Outdoor Temperatures: Includes ductwork located outdoors, and ductwork located indoors that transports unconditioned outside air.
10. Exposed Areas: Finished areas and other areas used by personnel in the normal use of the building, such as fan rooms, mechanical room, and storage rooms.
11. Concealed Areas: Pipe tunnels, covered pipe trenches, spaces inside walls, duct or pipe shafts, spaces above dropped ceilings, unfinished attic spaces and crawl spaces.
    1. RELATED SECTIONS
12. Section 01 2500, *Substitution Procedures*
13. [Section 01 8113.13 Sustainable Design [LEED v4 and] Guiding Principles 2020: Requirements for water efficiency, energy efficiency, material composition, and indoor air quality requirements.]
    1. SUBMITTALS
       * + 1. Action Submittals:

Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

* + - * 1. Informational Submittals:

Manufacturer's Installation Instructions: Manufacturers published literature indicating proper installation procedures.

* 1. QUALITY ASSURANCE

1. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84 and UL 723.
2. Provide insulation material 100 percent asbestos-free.
3. Provide products that do not promote or support the growth of mold, fungi, or bacteria.
4. Piping and ductwork insulation work shall be in accordance with the following:
5. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation
6. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
7. ASTM C547 - Mineral Fiber Pipe Insulation
8. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation
9. ASTM C1290 - Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Duct
10. ASTM E84 - Surface Burning Characteristics of Building Materials
11. ASTM E96 - Water Vapor Transmission of Materials
12. UL 723 - Surface Burning Characteristics of Building Materials
    1. ENVIRONMENTAL REQUIREMENTS
13. Maintain ambient temperatures and conditions required by manufacturers of adhesive, mastic, and insulation cements.
14. Maintain temperature during installation per manufacturer’s instructions.
15. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
16. PRODUCTS
    1. PRODUCT OPTIONS AND SUBSTITUTIONS
17. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures.* 
    1. GENERAL
18. K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft2•F.
    1. MANUFACTURERS
19. Knauf Fiber Glass
20. Owens/Corning Fiberglass
21. CertainTeed
22. Johns Manville
23. Armaflex
    1. FIBERGLASS PIPE INSULATION
24. Insulation: Rigid molded in compliance with ASTM C547, Class 1, minimum density 3.5 pounds/cubic foot, K-factor of approximately 0.23 at 75 degrees F, suitable for temperatures from 0 degrees F to 850 degrees F.
25. Jacket: Factory applied vapor barrier, reinforced foil kraft with self-sealing adhesive joints, ASTM C1136.
26. Valves and Fitting Covers: Pre-molded PVC covers with fiber glass insert. Manufacturers: Proto Corp., Ceelco.
    1. ELASTOMERIC PIPE INSULATION
27. Manufacturer: Armacell AP Armaflex.
28. Insulation: Cellular closed cell in compliance with ASTM C534, Type 1, Grade 1 minimum density 5 pounds/cubic foot, K-factor of approximately 0.30 at 75 degrees F, suitable for temperatures up to 220 degrees F.
29. Valve and fitting covers: Same as pipe insulation, cut to fit.
30. Weather Resistant Protective Finish: Acrylic latex enamel paint. Manufacturer: WB Armaflex finish.
    1. UNDERGROUND PIPE INSULATION
31. Insulation: Gilsulate 500XR dry granular particles in compliance with ASTM C177-04, density 30-34 lbs/ft3 K-factor of approximately 0.53 at 100 degrees F suitable for temperatures up to 300 degrees F.
32. Fittings: Same material as pipe insulation.
    1. HYDROUS CALCIUM SILICATE PIPE INSULATION
33. Insulation: Rigid, in compliance with ASTM C533, Type 1, minimum density 13 pounds/cubic foot, K-factor of approximately 0.45 at 200 degrees F, suitable for temperature from 140 degrees F to 1200 degrees F.
34. Valve and Fitting Covers: Same as pipe insulation or "Quick Set" insulating cement.
    1. UNDERSINK PIPING COVERS
35. Provide ICC A117.1-compliant, resilient, molded, white vinyl covers for wheelchair-accessible lavatory/sink P-traps and angle valve/supply line (hot and cold) assemblies.
36. Manufacturer: Truebro Lav Guard 2 E-Z Series
    1. GLASS FIBER BLANKET DUCT INSULATION

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Exterior ductwork may also be insulated using duct liner installed inside the ductwork. Refer to Section 23 3101, *HVAC Ducts*, for liner specification and limitations.

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1. Insulation: Flexible blanket, in compliance with ASTM C1290, Type III, minimum density 3/4 pounds/cubic foot, K-factor of approximately 0.30 at 75 degrees F, suitable for temperature up to 250 degrees F.
2. Jacket: Factory applied reinforced aluminum foil jacket meeting ASTM C1136.
3. Fittings: Same material as insulation.
   1. GLASS FIBER BOARD DUCT INSULATION

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1. Insulation: Rigid glass fiber, in compliance with ASTM C612, Type IA or IB, minimum density of 3 pounds/cubic foot, K-factor approximately 0.23 at 75 degrees F, suitable for temperature up to 450 degrees F.
2. Jacket: Factory applied, metalized, polypropylene-scrim kraft facing meeting ASTM C1136.
3. Fittings: Same material as insulation.
   1. METAL JACKETING - PIPING/DUCTWORK

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In heavy abuse areas, use metal jacketing to protect piping or ductwork insulation.

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1. Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.
2. Valve and Fitting Insulation Covers: Fabricate from same material as jacketing or use prefabricated insulation covers made in two matching halves.
3. Metal Jacketing Bands: 3/8 inch wide, 0.010 inch thick stainless steel.
   1. protection saddles and shields
4. Provide factory engineered galvanized steel hanger shields on horizontal insulated pipe complying with MSS SP-58 standards for gauge and length of saddle.
5. Saddles (Piping/tubing up to 2 inches):
6. Use 180-degree saddle on systems utilizing teardrop type hangers. B-Line B3151 or B3153 Series
7. Use 360-degree saddle on systems utilizing trapeze hangers or clamps. B-Line B338 Series.
8. Inserts and Shields (Piping/tubing over 2 inches):
9. Manufacturer: B-Line B338 series.
10. Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.
11. Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.
12. The unit shall have an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.
13. Insert: Calcium silicate, minimum density 9 pounds/cubic foot.
    1. REMOVABLE INSULATION COVERS
14. Manufacturer: Auburn Manufacturing. Style: Evergreen Cut ‘N Wrap.
15. ASTM C1695, fiberglass inner core and high-performance-polymer coated woven glass fiber fabric outer layer on both sides.
    1. Maximum temperature 500oF
    2. Weight, oz/ft2: 7.65
    3. [equipment not factory insulated]

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complete as required to meet job requirements.   
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1. EXECUTION
   1. EXAMINATION
2. Verify that items to be insulated have been pressure tested and approved before applying insulation material.
3. Verify that surfaces are clean, foreign material removed, and dry.
   1. INSTALLATION - GENERAL
4. Install materials in accordance with manufacturer's instructions.
5. Do not insulate factory-insulated equipment.
6. Do not insulate nameplates.
7. Fit insulation tightly against surface to which it is applied.
8. Do not insulate flexible connections.
9. For non-fire rated barriers (e.g., wall, floor, ceiling, or roof) continue insulation and vapor barrier through penetrations. For fire rated barriers, provide UL/FM approved through penetration stop systems.
10. Weatherproof outdoor installations of piping or ductwork covered with aluminum jacket. Provide watershed lap joints and seal with mastic as required.
11. Do not install metal jacketing with raw edges; provide a safety edge.
12. Replace existing insulation where it has been damaged or removed as a result of modifications. Vapor barrier shall be continuous. Thickness of insulation that is replaced shall match new.
    1. INSTALLATION - PIPING INSULATION
13. On exposed piping located in finished areas, locate insulation and cover seams in least visible area.
14. Provide calcium silicate shields (for piping/tubing over 2-inches) or saddles through pipe hangers or supports (for piping/tubing up to 2-inches). Do not notch insulation.
15. Where insulation terminates, taper to pipe and finish with insulating cement or acrylic mastic.
16. Cover insulated pipes located outdoors or in utility tunnels with aluminum jacket. Secure with aluminum bands and screws as required.
17. For underground pipe insulation, follow manufacturer’s instructions.
18. Tape circumferential joints of pipe insulation with 3 inch wide white vinyl tape.
19. Insulate fitting and valves where required with same material thickness as specified for adjacent pipe.
20. Insulate potable and non-potable cold water piping within walls, chases, or ceiling plenums where return air is present.
21. Insulate potable and non-potable cold water piping in equipment rooms.
22. Do not insulate unions, flanges and valves in potable or non-potable piping systems of 140 degrees F or less, except for chilled water. [Provide removable insulation at these locations.]
23. Insulate refrigerant discharge line (hot gas discharge) when there is a danger of personnel coming in contact with piping or when the line is passing through a conditioned space. Insulate refrigerant liquid line when it is passing through spaces having temperatures greater than the refrigerant condensing temperatures. Insulate refrigerant suction piping.
24. Provide removable insulation covers for piping components such as valve stems and bonnets, flanges, pressure regulators, data and name plates, pot feeders, flanges, PRVs, strainers, etc. that are not easily insulated with standard insulation.
    1. INSTALLATION – DUCTWORK INSULATION
25. Secure rigid board insulation to ductwork with metal fasteners (stick-klip) and scrim washer on 12 inch centers each way. Secure fasteners to duct work with recommended adhesive.
26. Tape ductwork insulation joints and penetrations caused by mechanical fasteners with 3 inch wide FSK tape.
27. Cover insulated ductwork located outdoors with aluminum jacketing. Secure with bands as required.
28. Provide continuous insulation through hangers or supports. Do not notch insulation.
29. Use blanket insulation on round ductwork and board insulation (rigid) on rectangular ductwork. Exception: In concealed areas blanket insulation may be used on rectangular ductwork.
30. Stop insulation around access doors and damper operators to allow operation without disturbing wrapping.
    1. INSULATION SCHEDULE
31. HVAC Piping Systems: Use fiberglass pipe insulation.

**NOTE**: Increase insulation thickness 1/2 inch when piping is exposed to outdoor temperatures except when service is noted for outdoor temperature.

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Verify insulation thickness with ASHRAE 90.1

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| **Service** | **Nominal Pipe Diameter (inches)** | **Insulation Thickness (inches)** |
| --- | --- | --- |
| Steam  (to 15 psi) | Less than 4  4 and over | 2.5  3 |
| Steam  (above 15 psi to 100 psi) | Less than 1  1 to 1-1/4  1 1/2 and over | 3  4  4 1/2 |
| Steam Condensate | Less than 1 1/2  1 ½ and over | 1 1/2  2 |
| Steam Blowdown Piping | All Sizes | 2 |
| Heating hot water  (141 to 200 degrees F) | Less than 1 1/2  1 ½ and over | 1 1/2  2 |
| Heating hot water  (105 to 140 degrees F) | Less than 1 1/2  1 ½ and over | 1  1 1/2 |
| Potable hot water  (105 degrees F & greater) | Less than 1 1/2  1 ½ and over | 1  1 1/2 |
| Non-potable hot water  (105 degrees F & greater) | Less than 1 1/2  1 ½ and over | 1  1 1/2 |
| Chilled water  (40 to 60 degrees F) | Less than 1 1/2  1 ½ and over | 1/2  1 |
| Potable cold water | Less than 1 1/2  1 ½ and over | 1/2  1 |
| Non-potable cold water | Less than 1 1/2  1 ½ and over | 1/2  1 |
| Tower water exposed to outdoor temperature | All sizes | 1 1/2 |
| Roof drain bowl and storm water piping | All sizes | 1 |

1. Refrigerant Piping: Use elastomeric piping insulation. Protect insulation exposed to weather with aluminum jacket or weather resistant protective finish.

| **Service** | **Nominal Pipe Diameter (inches)** | **Insulation Thickness (inches)** |
| --- | --- | --- |
| Refrigerant suction | Less than 1  1 and over | 1/2  1 |
| Refrigerant discharge | Up to 1-1/4  Over 1-1/4 | 1/2  1 |
| Refrigerant liquid | All Sizes | 1/2 |
| Refrigerant Coil Condensate Drain | All Sizes | 1/2 |

1. Handicapped Lavatory Piping: Use elastomeric pipe insulation per ADA Standard for Accessible Design Section 606.5:

|  |  |  |
| --- | --- | --- |
| **Service** | **Pipe Sizes**  **(inches)** | **Insulation Thickness**  **(inches)** |
| Exposed drain and hot water lines | All sizes | 1/2 |

1. Concealed Ductwork: Use glass fiber (flexible blanket) duct insulation.

|  |  |
| --- | --- |
| **Service** | **Insulation Thickness (inches)** |
| Supply and return air | 1 1/2 |

1. Exhaust Piping: Use hydrous calcium silicate insulation. Wrap with aluminum jacketing.

|  |  |
| --- | --- |
| **Service** | **Insulation Thickness (inches)** |
| Generator Exhaust Piping/Muffler | 1 1/2 |

1. Exposed Rectangular Ductwork: Use glass fiberboard (rigid) duct insulation on the exterior of the ductwork.

**NOTE**: Use nominal 4-inch-thick insulation (R-12 equivalent) for ductwork exposed to outdoor temperatures.

|  |  |
| --- | --- |
| **Service** | **Insulation Thickness (inches)** |
| Supply and return air | 1 1/2 |

1. Exposed Round Ductwork: Use glass fiber (flexible blanket) duct insulation.

**NOTE**: Use nominal 4‑inch‑thick insulation (R-12 equivalent) for ductwork exposed to outdoor temperatures.

|  |  |
| --- | --- |
| **Service** | **Insulation Thickness (inches)** |
| Supply and return air | 1 1/2 |

END OF SECTION

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Do not delete the following reference information.

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 22 0713 Rev. 7, dated April 30, 2024.