***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

## Purpose

These standards will serve as the primary utilidor criteria reference documents for services provided by architectural and engineering (A&E) firms and consultants in the development of both design-bid-build and design-build contracts. This document is not intended to be used in lieu of detailed design documents in the procurement of facility construction. No part of this document should be considered inclusive to all government requirements.

## 1. General Utilidor Construction Criteria

1.1. Pipe anchors in utilidors shall consist of welded steel plates, channels and wide-flange sections as required. Channel sections that extend between concrete walls and welded steel plates in the walls and channel sections that extend between the ceiling and floor and welded plates in floor and ceiling are acceptable. Wall anchors for steam and condensate piping shall have bolts extending all the way through the walls, plated on both sides, with bolts sized according to the size of steam and condensate piping. Floor anchors must be approved by Utilities Maintenance Shop Supervisor (CES/CEOIU).

1.2. Cast-in-place anchor points shall be used when possible.

1.3. Manholes shall have Bilco-style aluminum lids (J-AL, JD-AL or approved equal) with fixed ladders. Frost lids shall also have Bilco-style aluminum insulated lids. Some lids may open at the center of the ladder in two halves, opening right and left. Some lids may open at the center of the ladder toward the back of the manhole. See drawing example. Lids are to have a keyed locking system for security and “panic bar” hardware on the interior for emergency egress. An additional option, with the approval of the Utilities Maintenance Shop, is the installation of an insulated roof hatch (rather than a frost lid), Bilco "Single Leaf Roof Access Hatch”, Type F-50TB or approved equivalent. These lids will incorporate a keyed locking system for security and “panic bar” hardware on the interior for emergency egress.

1.4. Welding shall be performed with qualified procedures with performance qualified welders in accordance with latest edition of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) Section IX code and America National Standards Institute (ANSI) B31.1. A qualified weld inspector shall perform 100% visual and 10% radiographic weld inspection. A complete weld inspection report shall be provided at conclusion of job as a record document.

1.5. Air Force Civil Engineering Utilities Maintenance Shop personnel will perform periodic site inspections and report deficiencies to the project inspector.

1.6. Cracked or damaged utilidor lids shall be replaced prior to backfilling. Joints between utilidor lid sections shall be sealed with expanding foam and an elastomeric sealer.

1.7. Guide and support all steam, condensate, and domestic water piping in accordance with the respective expansion joint manufacturer's recommendations.

1.8. Government retains salvage rights.

1.9. All utility main shut downs and start-ups will be done by base Utilities Maintenance Shop personnel. The contractor shall submit a formal request for utility shut down to the 354 CES Project Manager responsible for oversight of the project at least 21 days prior to the proposed shut down date. Shut down requests must include submittal of a work plan to the responsible Project Manager who will route the plan and request to the Air Force Engineering Utilities Maintenance Shop for review and approval.

1.10. Valve operations on active utilities will only be performed by Utilities Maintenance Shop personnel.

1.11. Questions regarding this guide can be directed to Mr. Sheldon Sites, Utilities Maintenance Supervisor (CEOIU – 377-2172), Mr. Neil Sweet, Mechanical Section Superintendent (CEOM – 377-2240), or their alternates/replacements.

1.12. All water leaks in concrete utilidors should be sealed to minimize infiltration during upgrades to utilities system.

1.13. All water lines shall be kept as far as possible away from steam lines to minimize heat transfer to water system.

1.14. No foam insulation (sprayed or board) is to be used on the INSIDE of the utilidors; use on exterior is approved.

1.15. Pipe support racks in accessible utilidors shall be designed to provide clear center aisle walkways from one manhole to the next. Stagger support racks so the vertical struts are not directly across from each other to maximize clearance.

1.16. Do not install communications or electrical conduit over utilidors with removable lids.

## 2. Insulation specifications

2.1. Water Lines in Manholes

2.1.1. Material – Polyiscocyanurate insulation molded by the manufacturer specifically for the pipe and appurtenances on which it is to be installed. The insulation shall be homogenous, of uniform density, self-extinguishing and meet the requirements of American Society for Testing and Materials (ASTM) C 591. The insulation shall have the following properties:

a. Compressive Strength 20-psi minimum by ASTM D 1621 at 74 degrees F.

b. Initial Thermal Conductivity 0.014 BTU/(hr - ft²- degrees F) (maximum) K value at 75 degrees F by ASTM C 518.

c. Moisture Adsorption 3% by volume (maximum) by ASTM D 2842.

2.1.2. The insulation shall have an Underwriters Laboratory (UL) listed fire and smoke hazard rating not exceeding a flame spread of 25 and a smoke developed value of 50.

2.1.3. Jacket – 5 feet outside of MH and in MH , Aluminum jacket secured by bands, 0.0016 inch nominal thickness (minimum); ASTM B 209, Type 3003, 3105, or 5005.

2.1.4. Bands – Bands for Aluminum jacket shall be 3/8 inch wide and 32-gauge thickness made of aluminum or annealed stainless steel. Bands for insulation shall be ½ inch wide and 32-gauge thickness make of annealed stainless steel.

2.2. Water Lines in Utilidors/Utiliducts

2.2.1. Material – Polyiscocyanurate insulation molded by the manufacturer specifically for the pipe and appurtenances on which it is to be installed. The insulation shall be homogenous, of uniform density, self-extinguishing and meet the requirements of ASTM C 591. The insulation shall have the following properties:

a. Compressive Strength 20-psi minimum by ASTM D 1621 at 74 degrees F.

b. Initial Thermal Conductivity 0.014 BTU/(hr - ft²- degrees F) (maximum) K value at 75 degrees F by ASTM C 518.

c. Moisture Adsorption 3% by volume (maximum) by ASTM D 2842.

2.2.2. The insulation shall have an UL listed fire and smoke hazard rating not exceeding a flame spread of 25 and a smoke developed value of 50.

2.2.3. Jacket – Tri-directional reinforced. UL listed, white kraft/foil/scrim laminated jacket with a maximum resistance of 300 degrees F.

2.3. Steam/Cond in Manholes

2.3.1. Material – Insulation for manholes (and extending 5 feet into the utilidor) shall be molded calcium silicate conforming to ASTM C 533, Type I, asbestos free with an aluminum jacket covering. Insulation shall be factory or field applied. Steam traps and steam trace piping shall be uninsulated, except in selected high traffic locations requiring crossing by personnel which shall be insulated with molded mineral fiber insulation conforming to ASTM C 547, Class 2, asbestos free with an aluminum jacket covering.

2.3.2. Jacket – Jacket shall be smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Type 3003, 3105, or 5005. Aluminum jacket shall be used over calcium silicate insulation with a kraft paper backing.

2.3.3. Bands – Bands for aluminum jackets shall be 3/8 inch wide and 32 gauge thickness made of aluminum or annealed stainless steel.

2.4. Steam/Condensate in Utilidors/Utiliducts

2.4.1. Material – Insulation for all piping and fittings in utilidors shall be molded calcium silicate conforming to ASTM C 533, Type I, asbestos free with an aluminum jacket covering.

2.4.2. Jacket – Jacket shall be smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Type 3003, 3105, or 5005. Aluminum jacket shall be used over calcium silicate insulation with a kraft paper backing.

2.4.3. Bands – Bands for aluminum jackets shall be 3/8 inch wide and 32 gauge thickness made of aluminum or annealed stainless steel.

2.5. Sanitary Sewer in Manholes & Utilidors/Utiliducts

2.5.1. No insulation required

2.6. Additional Notes

2.6.1. Flanges, Unions and Fittings – Flanges, union, and fittings shall be insulated with premolded prefabricated, or field fabricated segments of insulation. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoin piping.

2.6.2. Valves and Expansion Joints – Valves and expansion joints shall be insulated with premanufactured blankets with heavy fabric covers. Products shall be manufactured for the purpose intended here and shall be suitable for the temperatures encountered. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoining piping. Insulation shall be secured with nylon buckles and straps on the outside of the insulation. Insulation secured with wire or rope lacing systems shall not be acceptable.

## 3. Steam Distribution

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*Flanges in man holes only. Absolutely no flanges on any size piping or fittings except joining valves or expansion joints. No flanged pups, drip legs, or fittings except joining valves or expansion joints. No flanged fittings, drip legs, or pups entering or leaving manholes. They must be welded.*

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3.1. Designs of steam and condensate services shall consider the following conditions:

3.1.1. Steam is generally at saturated conditions at approximately 85-100 psig.

3.1.2. Steam within close proximity of Central Heating and Power Plant (CHPP) will be superheated to 450°F.

3.1.3. In the event that CHPP turbines drop out, the steam will be superheated to 600°F within 1 mile of CHPP.

3.1.4. Condensate is returned at 10-25 psig and 165°F depending on back pressure and load from high-pressure steam traps.

3.2. All steam mains or service lateral mains shall be schedule 40 ASTM A106 or A53 black carbon steel pipe and have shielded metal arc welded joints, in the utilidor corridors and the manhole, regardless of size. On smaller diameter piping (2” and below) socket weld fittings are acceptable.

3.3. All steam trace lines shall be schedule 80 ASTM A106 or A53 black carbon steel pipe and have shielded metal arc welded joints, in the utilidor corridors and the manhole, regardless of size. On smaller diameter piping socket weld fittings are acceptable. See examples Appendix A of this document.

3.4. Steam trace is not required in steam distribution or service utilidors. Steam trace is required in fire hydrant service utilidors. Steam trace should be installed in a looped configuration with manually operated isolation valves at the steam distribution main or lateral. Piping shall not be less than three quarters of an inch (¾”) Nominal Pipe Size (NPS) with welded sockets. Welded joints are acceptable. Manual valves shall be used for steam trace control. Thermostatic valves are not acceptable.

3.5. Two-inch and smaller diameter pipe used for drain or trap assemblies shall be schedule 80 ASTM A106 or A53 black carbon steel pipe with threaded or welded connections.

3.6. Valves over two inches shall be 150-pound class outside screw and yoke cast steel valves with class 150 flange.

3.7. Valves two inches and under shall be 200-pound class water/400-pound class steam, threaded bronze, union-bonnet gate valves.

3.8. Valves on straight-line runs of the main distribution shall be flanged, regardless of their size. No deviations allowed unless approved by Utilities Shop supervisor. See # 13, in this section, below.

3.9. Expansion joints shall be internally and externally guided packed metal type (Hyspan model 6501 or approved, by Utilities Maintenance Shop personnel, equal). Slip tube shall be schedule 80 with a chrome-plated seal surface. Expansion joints shall be designed to allow injection of packing and lubricant under full operating pressure. Joints shall have 150-pound class flanges with matching raised face companion flanges.

3.10. All flanges shall be provided with spiral wound, steel ring gaskets with centering rings. Gaskets shall be of appropriate pressure class and temperature rating for selected application. Paper or composition gaskets are not permitted.

3.11. Flanges shall utilize ASTM A193 grade B7 studs with matching ASTM A194 grade 2H nuts. Do not use bolts.

3.12. Provide drip legs with condensate trap assemblies and blow down at any change in grade of steam main and at steam main low points. For pipes smaller than six inches in diameter, drip pocket diameter shall equal the pipe diameter. For pipes six inches and larger diameter, drip leg diameter shall be two thirds of the pipe diameter. Blow downs shall be one and one half-inch diameter as a minimum. Blow downs shall discharge away from other pipes. Install trap assemblies and blow downs as shown in attached detail.

3.13. No warm-up valves are to be used regardless of pipe size.

3.14. Welded tee fittings shall be used at connection of service mains or laterals to main distribution lines instead of weld-o-lets when possible. Locate lateral shut-off valves as close to the main as possible followed by properly anchored and guided expansion joints. No elbows, tees or other fittings shall be installed between the main and the shut-off valve. Do not substitute swing joints, flex-pipe or any other device for specified expansion joints. Keep all components in an accessible arrangement.

3.15. Steam distribution main and lateral piping supports shall adhere to MSS (Manufacturers Standardization Society) SP-58-2009 (Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation) to allow for

axial pipe movement during expansion and contraction, proper support, etc. No deviations allowed unless specifically approved by Utilities Maintenance Shop supervisor. Roller and shoe supports are preferred; B-Line B219 Pipe Rollers and B-Line B3160 thru B6135 Saddles or approved equivalent.

3.16. All piping shall have a minimum of eight inches clearance from utilidor wall and ceiling surfaces, adjacent piping and other equipment unless specifically approved by Utilities Maintenance Shop supervisor.

3.17. Pressure gauges are to be installed on each side of mainline isolation valves on the steam piping. These should conform to ASME B40.1, installed with "pig-tail" siphons, pin type pulsation snubbers and shut-off valves. Gauges to be Trerice Model 450B, Process Gauge or equivalent.

## 4. Condensate Return

*All condensate return piping shall be Schedule 80 ASTM A106 or A53 black carbon steel pipe, shielded metal arc welded regardless of size, in the utilidors and the manholes. For smaller diameter (2" and below) pipe socket weld fittings are acceptable. Flex lines and threaded pipe are not acceptable.*

4.1. Provide drains (one and one-quarter inch minimum diameter) at all low points.

4.2. Nipples on drip and tracer lines shall be Schedule 80.

4.3. Steam trap assemblies shall be ¾" NPS and connect steam distribution main and lateral line drip legs and condensate return main or lateral lines via thread-o-lets. Connection to the drip leg shall be via threadolet. Steam traps shall discharge into the condensate return through threadolet connections with one pipe size smaller long-radius elbow welded inside the threadolet. Direct elbow to discharge in direction of flow. Unions shall be schedule 80. Threaded components will be assembled with Teflon tape applied to the male threads; pipe joint compound is not acceptable.

4.4. Steam traps shall be TLV J3SX Series or approved equal. Refer to attached detail for steam trap assembly details.

4.5. Steam trap assemblies shall have all valves as close to drip legs, steam or condensate lines as possible, on the first nipple before any fittings. All piping and fittings shall be schedule 80.

4.6. Steam trap assemblies shall NOT be located on “soft” (moving) side of expansion joints.

4.7. Expansion joints shall be internally and externally guided packed metal type (Hyspan model 6501 or approved equal). Slip tube shall be schedule 80 with a chrome-plated seal surface. Expansion joints shall be designed to allow injection of packing and lubricant under full operating pressure. Joints shall have 150-pound class flanges with matching raised face companion flanges.

4.8. All flanges shall be provided with spiral wound, steel ring gaskets with centering rings. Gaskets shall be of appropriate pressure class and temperature rating for selected application. Paper or composition gaskets are not permitted.

4.9. Valves over two inches shall be 150-pound class outside screw and yoke cast steel valves with 150-pound class flange.

4.10. Valves two inches and under shall be 200-pound class water/400-pound class steam, threaded bronze, union-bonnet gate valves.

4.11. Condensate return main and lateral piping supports shall adhere to MSS (Manufacturers Standardization Society) SP-58-2009 (Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation) to allow for axial pipe movement during expansion and contraction, proper support, etc. No deviations allowed unless specifically approved by Utilities Maintenance Shop supervisor. Roller and shoe supports are preferred.

4.12. Temperature gauges are to be installed on each side of mainline isolation valves on the condensate piping. These should range from 30 to 300 degree F, with an adjustable dial face such as the Trerice, Model B85600, Universal Angle, Dial Thermometer or equivalent.

4.13. Flanges shall utilize ASTM A193 grade B7 studs with matching ASTM A194 grade 2H nuts. Do not use bolts.

## 5. Domestic Water Distribution

5.1. Contractor shall comply with Alaska Department of Environmental Conservation (ADEC) plan review and approvals as per Drinking Water Regulations 18AAC80.

5.2. Water pressure of Eielson AFB water supply system is generally 60 psi.

5.3. All main, service and lateral pipe greater than two inches in diameter shall be ANSI/ American Water Works Association (AWWA) C151 ductile iron with ANSI/AWWA C104 cement lining.

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
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5.4. Two-inch diameter and smaller pipe shall be schedule 40 ASTM A53 galvanized steel. Copper piping is not allowed.

5.5. Joints may be welded, flanged or ANSI/AWWA C606 mechanically connected grooved and shouldered joints. When using grooved and shouldered joints, Victaulic brand couplings are preferred. These must conform to ANSI/AWWA standards.

5.6. Valves larger than two inches shall be 125-pound class, flanged, cast steel gate valves. Service line from the main shall include valves next to the main allowing room for operation and maintenance. These must conform to ANSI/AWWA standards.

5.7. Valves two inches and smaller shall be 125-pound class bronze, union bonnet gate valves. Provide one schedule 40 union adjacent to valve but not between valve and the main. Butterfly and globe valves are not permitted.

5.8. All flanges shall be provided with one-eighth inch thick rubber gaskets. Flange bolts shall be galvanized or stainless steel only.

5.9. Service lateral piping to hydrants shall not have check valves. Provide Waterous, Kennedy or approved equal hydrants. All hydrants shall be dry-type. Butterfly valves are not acceptable on service lateral to hydrant. Concrete thrust blocks shall NOT be utilized on hydrants.

5.10. Fire hydrants laterals shall be installed in utilidors. Direct-buried hydrants or hydrant lines are NOT permitted unless approved by Utilities Maintenance Shop supervisor.

5.11. Expansion joints shall be laminated bellows-type (Hyspan model 1501 or approved equal). Joint shall feature a stainless steel flow liner and 150-pound class flanges with matching raised face companion flanges. Guide and anchor pipe in accordance with expansion joint manufacturer’s recommendations.

5.12. Require disinfection and submission of report for temporary water supply piping prior to being put into active service the same as for permanent installation. Disinfection and reporting shall be in accordance with AWWA Standard, ANSI/AWWA C651-05 “Disinfecting Water Mains”.

5.13. Water distribution main and lateral piping supports shall adhere to MSS (Manufacturers Standardization Society) SP-58-2009 (Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation) to allow for axial pipe movement during expansion and contraction, proper support, etc. No deviations allowed unless specifically approved by Utilities Maintenance Shop personnel. Roller and shoe supports are preferred.

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

## 6. Sanitary Sewer

6.1. Contractor shall comply with ADEC plan review and approvals as per Drinking Water Regulations 18AAC72.

6.2. All main, service and lateral pipe shall be ANSI/AWWA C104 ductile iron.

6.3. Joints shall be ANSI/AWWA C606 mechanically connected grooved and shouldered joints. Flexible, restrained, push-on joints meeting ANSI/AWWA C111/A21.11 are also acceptable. Restrained joint fittings and the restraining components shall be Ductile Iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53. No-hub joints are not acceptable.

6.4. Gravity sewers shall be sloped at one-quarter inch per foot minimum.

6.5. Sewer lines eight inches in diameter and greater can be direct buried when approved by Utilities Maintenance supervisor.

6.6. Provide at least one clean out in each manhole. Sewers six inches and larger in diameter shall have Y-style clean outs. Sewers smaller than six inches in diameter MAY have saddle-style clean outs with removable hatch measuring no less than 4 inches by 8 inches.

6.7. All sewer mains and laterals will be properly anchored. Concrete saddles are preferred.

6.8. To prevent cross-contamination, sewer main and lateral piping shall be installed below other piping. Observe ADEC requirements for pipe separation.

6.9. Sewer main and lateral piping supports shall adhere to MSS (Manufacturers Standardization Society) SP-58-2009 (Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation) to allow for axial pipe movement during expansion and contraction, proper support, etc. No deviations allowed unless specifically approved by Utilities Maintenance Shop supervisor.

## 7. Additional Items

7.1. Design Guide Drawings are attached

7.1.1. Typical Manhole Plan

7.1.2. Drip Leg Detail and Sparging Tube Detail

7.1.3. Section A Detail

7.1.4. Section B Detail

7.1.5. Steam Trap Assembly

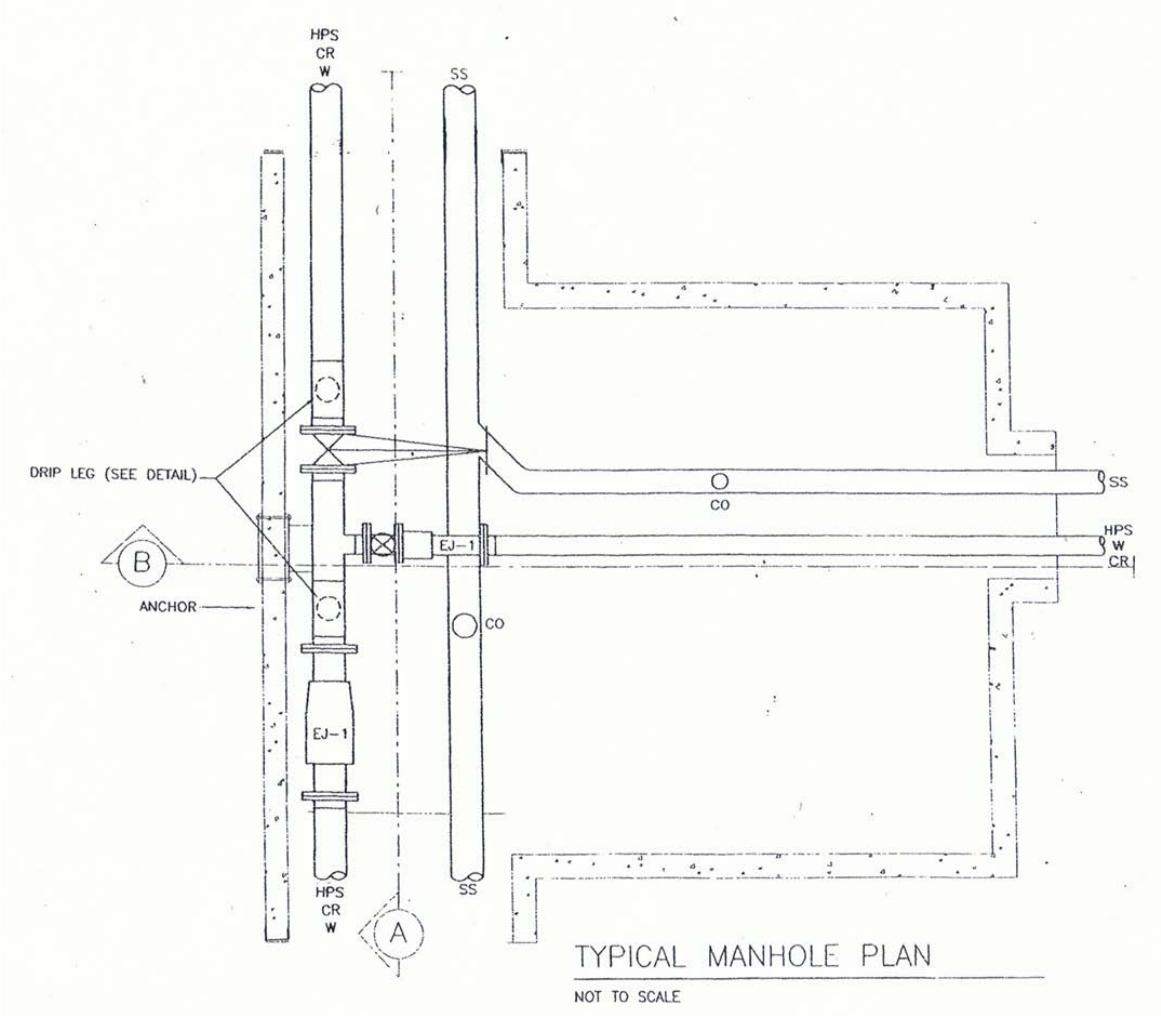
7.1.6. Access Hatch and Frost Lid Detail

## 8. Additional Notes

8.1. The following drawings are for informational purposes only. It is the intent of these designs to keep the water lines as far away from the steam line as possible and still stay within ADEC guidelines for water line/sewer line separations.

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

# Appendix A – Sample Details



***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

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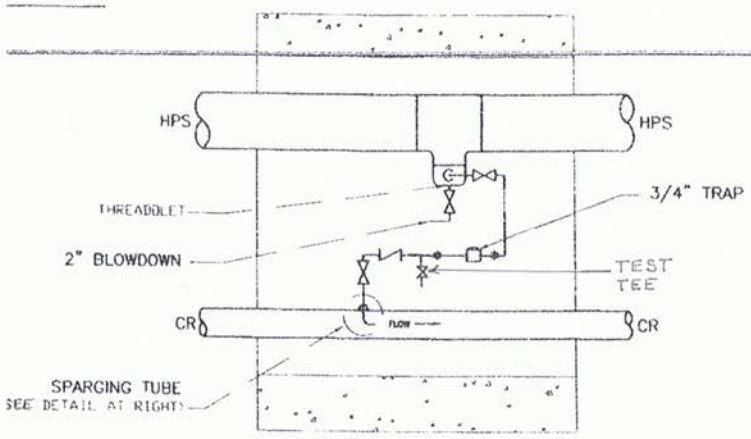


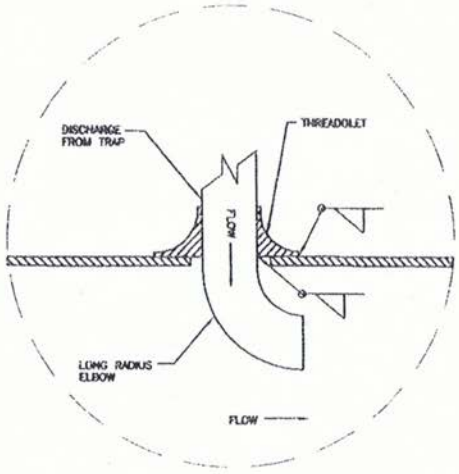


## DRIP LEG DETAIL

NOT TO SCALE

## LEGEND

| | |
|---|---|
| HPS | HIGH PRESSURE STEAM |
| W | WATER |
| SS | SANITARY SEWER |
| CR | CONDENSATE RETURN |
| EJ-1 | PACKED METAL EXPANSION JOINT |
| EJ-2 | LAMINATED BELLOWS EXPANSION JOINT |
| CO | CLEANOUT |

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

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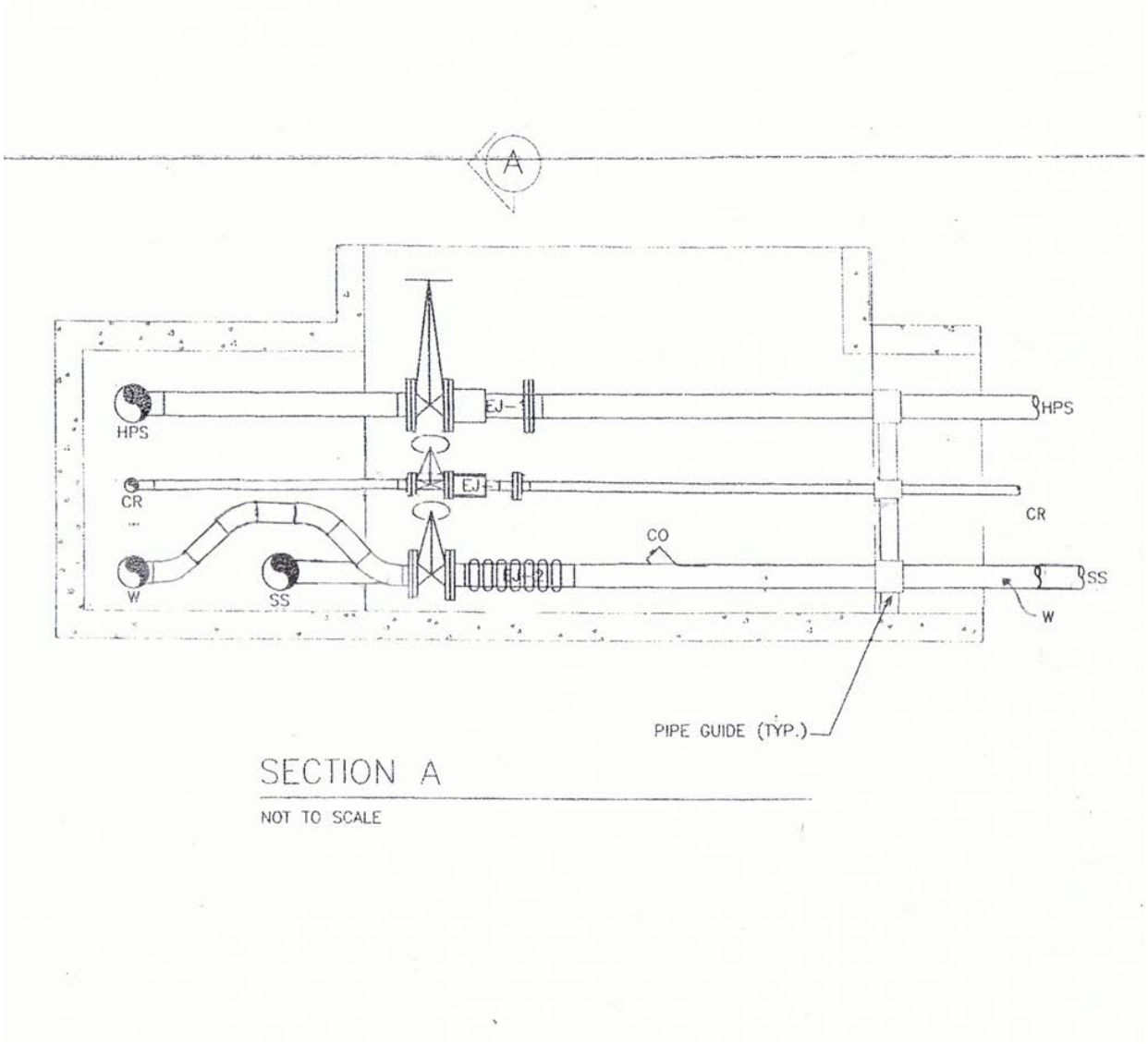


SECTION A

NOT TO SCALE

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

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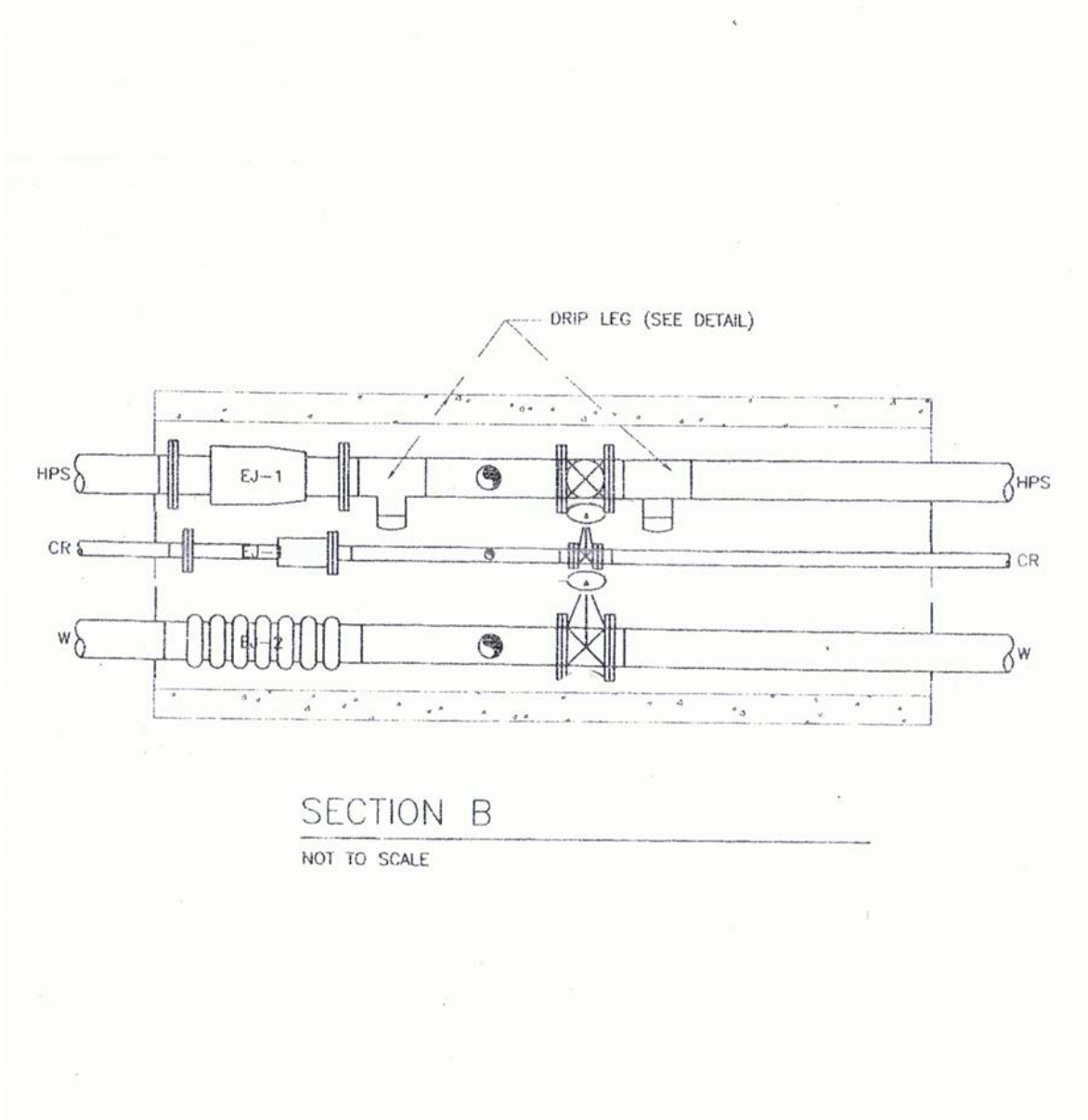
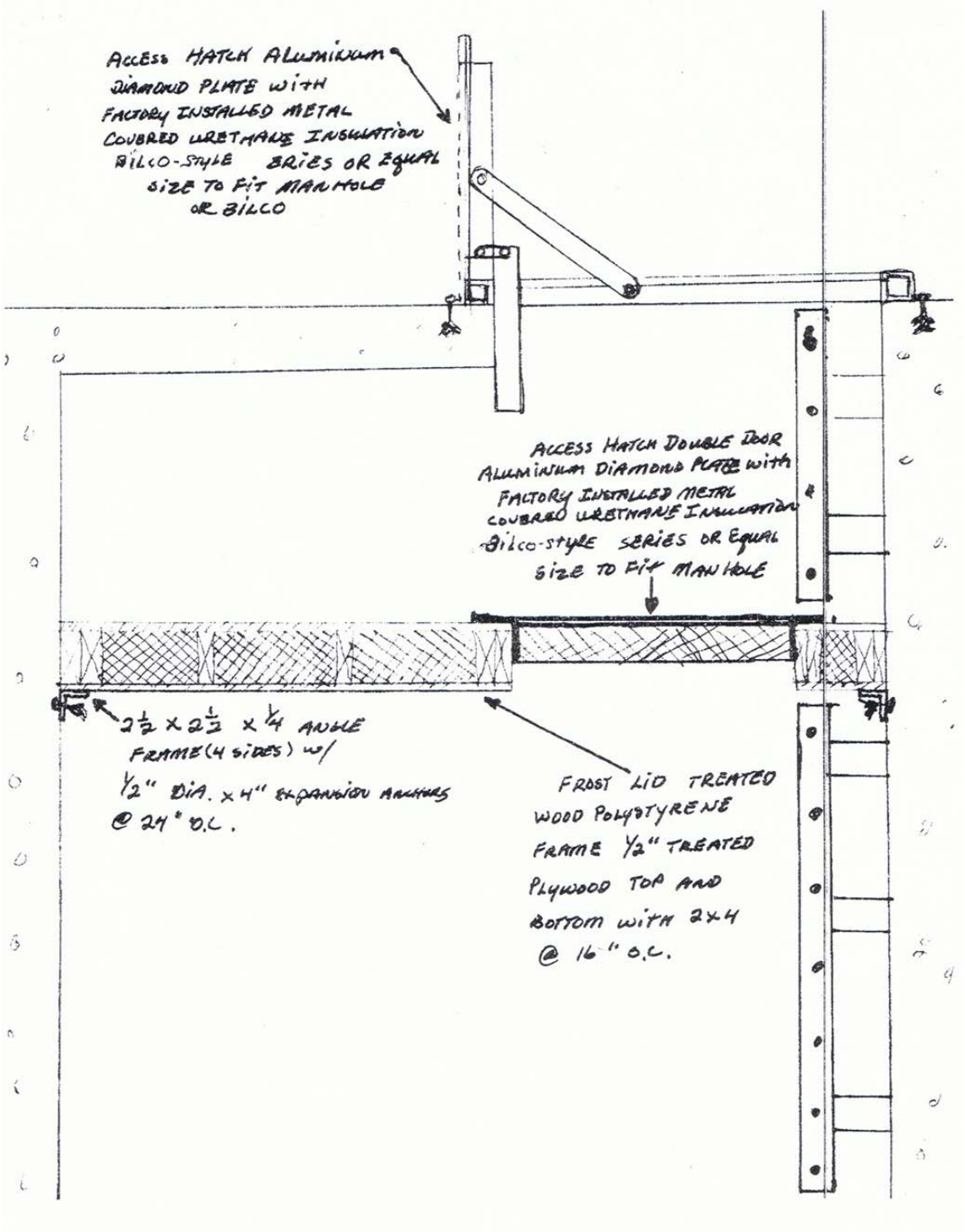



SECTION B

NOT TO SCALE

***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
ISSUED: 11 August 2017

## Appendix A – Sample Details



***10 – Utilidors***
354th Civil Engineering Squadron
OPR: CES/CEO
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