

FUSION BONDED EPOXY

CLASS A STEEL CONDUIT SYSTEM



FUSION BONDED EPOXY

THERMACOR'S FUSION BONDED EPOXY (FBE) coated Class A Steel Conduit System is Federal Agency Committee Approved for steam, condensate, and high temperature hot water systems. The system is professionally engineered as a complete system that is drainable, dryable, and air testable with total manufactured components: pipes, loops, elbows, tees, end seals, gland seals, and anchors. The system is built to withstand heavy traffic/ earth loads, high water tables, and the most corrosive of soils.

FUSION BONDED EPOXY PIPE AND STRUCTURES COATING SPECIFICATIONS

DESCRIPTION

FUSION BONDED EPOXY is a primerless, one-part, heat curable, thermosetting powdered epoxy coating designed to provide maximum corrosion protection to pipeline systems.

A fusion bonded coating utilizes heat to melt and adhere the coating material to the metal substrate. It is a 100 percent solid, epoxy applied from the powdered state onto preheated pipe. The powder, when in contact with the hot pipe, melts, flows, and cures to a well-adhered, continuous, corrosion resistant coating.

PRODUCT PROPERTIES

• Impact (ASTM G14)	160 in-lbs
• Abrasion Resistance (ASTM D1044)	0,1144 g loss
• Adhesion to Steel (ASTM D1002)	6150 psi
• Penetration (ASTM G17)	0
• Tensile Strength (ASTM D2370)	9300 psi
• Elongation Compressive (ASTM D2370)	6.9%
• Strength (D695)	11600 psi
• Thermal Shock	No visible effect
310° to -100°F 4x4 in coated panel	10 cycles
• Salt Fog (ASTM B117)	No blistering, no discoloration, no loss of adhesion
1000 hrs	
• Salt Crock	<u>Disbondment Dia.</u>
90 day, 5 volt, 5% NaCl	29 mm average
90 day, 1.5 volt, 3% ASTM G8 salt solution	24 mm average
90 day, 6 volt, 3% ASTM G8 salt solution	31 mm average
30 day, 5 volt, 5% NaCl sand crock 230°F	26 mm average
180 day, 1.5 volt, 3% ASTM G8 salt solution sand crock 230°F panel temperature, 26 mil coating thickness	39 mm average

- Hot Water Resistance (212°F immersion 1000 hrs)
 - No blistering, good adhesion, slight discoloration, surface roughening and softening
- Color Blue Green, Green, or Brown

APPLICATION

The exterior surface of the pipe or structure to be coated shall be abrasive blasted to near-white metal with a nominal 2 mil anchor pattern.

The next step in the process is to uniformly heat the pipe to a temperature in the range of 450°F using a noncontaminating heat source. Three heating methods are used - electrical induction, gas fired forced air, and a combination of high velocity direct flame impingement and infrared. All of these methods are suitable providing the pipe is heated uniformly.

After the pipe has been heated to the proper temperature, it passes through powder coating machines where the fusion bonded epoxy coating is uniformly applied to the specified film thickness, min. 20 mils, using electrostatic deposition on the exterior of the carrier pipe or conduit. After application, the coating is allowed to cure using the residual heat in the pipe. During the curing process, the coated pipe should be carefully handled to avoid damage to the coating. After the coating has cured, the pipe can be force-cooled with air or water to facilitate inspection and handling.

INSPECTION

Coated pipe is electrically inspected using conventional search electrodes operating at 125 volts DC per mil of coating thickness. Small imperfections in the coating are repaired using hot melt patch sticks or two-part ambient curing liquid epoxy resins.

CATHODIC PROTECTION: **FUSION BONDED EPOXY** on steel is easily compatible with cathodic protection utilizing galvanic anodes or impressed current type systems.

SPECIFICATION GUIDE ***GENERAL**

All piping to be installed as shown on plans shall be **THERMACOR PROCESS INC. CLASS A STEEL** manufactured pre-insulated conduit with all necessary pipe, loops, elbows, tees, seals, anchors, and other appurtenances as specified hereinafter and as recommended by the manufacturer.

CONDUIT

Conduit for all components shall be either electric resistance welded or spiral welded steel pipe conforming to ASTM specification A-134, A-135, and A-139. Conduit thickness shall be 10 ga. up through 26" diameter pipe and 6 ga. for 28" diameter and above.

Conduit shall be factory coated with fusion bonded epoxy, minimum 20 mils thick. Conduit straight lengths shall be normally fabricated in 40 foot nominal lengths with five pipe supports per length. Shorter lengths will be fabricated as required and provided with pipe supports not more than nine feet apart and with a pipe support not more than two feet from each end. Tees, anchors, elbows, and other fittings will be coated and pre-fabricated to straight sections whenever shipping requirements permit.

EXPANSION LOOPS, ELBOWS, AND ECCENTRIC FITTINGS

Expansion loops and elbows shall be factory manufactured utilizing the same casing thickness, material, and coating as the straight conduit lengths. Loops and elbows shall be sized to allow carrier pipe expansion without damage to the insulation. Eccentric fittings shall be factory manufactured, coated, and utilized whenever changes in casing size are required as determined by the manufacturer.

FIELD JOINTS

Field joints shall be applied by the installation contractor utilizing the manufacturer's furnished kits and instructions. Field joints shall not be applied until after the carrier pipe has been hydrostatically tested and approved.

CATHODIC PROTECTION

Sacrificial galvanic anode cathodic protection systems are required in soils with resistivity readings less than 30,000 ohms/cm.

TERMINAL SECTIONS AND ANCHORS

Leak plates shall be 10 ga. steel plate conforming to ASTM A-36. End seals shall be of ½" steel plate conforming to ASTM A-36. Gland seals shall consist of a steel closure plate with stainless steel bolts and steel gland welded to a temperature resistant packing gland and a gland follower. Anchor sections shall be ½" steel plate conforming to ASTM A-36 steel with air passage holes and welded to carrier pipe and conduit.

CARRIER PIPE

Carrier pipe shall be as specified by the design engineer.

INSULATION

Insulation shall be mineral wool and shall be of a thickness as specified by the design engineer.

INSTALLATION

The installing contractor shall be responsible to excavate, string conduit, weld, test, place in trench, backfill, or otherwise treat and install the system as per directions furnished by the manufacturer and approved by the design engineer in accordance with the plans and specifications. The conduit shall be air tested at 15 psig for not less than two hours and the carrier pipe hydrostatically tested to 1½ times the working pressure for not less than four hours, or as specified by the engineer. Holiday testing of conduit coating shall be the responsibility of the contractor under the directions furnished by the manufacturer. All holidays shall be recoated and retested. A qualified representative of THERMACOR PROCESS INC. shall be present at the jobsite during critical periods of installation and testing. Backfill shall not commence until approval of tests by the THERMACOR PROCESS INC. representative. Field modifications must be approved by the manufacturer. The installing contractor shall certify that he has complied with the manufacturer's directions.

** For alternate specifications, please contact THERMACOR.*

THERMACOR PROCESS INC. Your Authorized THERMACOR Representative Is:

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Fort Worth, Texas 76179-5248
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Phone (817) 847-7300
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THERMACOR PROCESS INC. sole and exclusive warranty is as stated in the Standard Terms and Conditions of Sale for these products. In no event will THERMACOR PROCESS INC. be liable for any direct, indirect, or consequential damage.



CLASS "A" STEEL

Specification Guide

CASG
4.111

FUSION BONDED EPOXY SPECIFICATION

2.02.2021

Pre-insulated Class "A" Steel Piping Systems with FBE coating suitable for Steam, High Temperature Hot Water, Pumped Condensate and Gravity Condensate Service.

Part 1 - General

1.1 Pre-insulated Piping - Furnish a complete system of factory pre-insulated steel piping for the specified service. The piping system shall be of the drainable, dryable, testable type, suitable for all ground water and soil conditions, site Classification "A" (Federal Agency Guide Specification, UFGS-02552 & UFGS-02556). The system shall be provided as specified below and shown on the drawings.

1.2 The pre-insulated pipe manufacturer shall make a complete layout of the system showing anchors, expansion provisions, and building entrance details. Means for expansion must be made in pipe off-sets or loops unless this is compensated for integrally in the system.

1.3 The system shall be Class "A" STEEL as manufactured by **Thermacor Process Inc.** of Fort Worth, Texas.

Part 2 – Products

2.1 The conduit shall be 10 gauge, welded, smooth-wall black steel conforming to A-134, A-135, and A-136. Conduit shall be tested at the factory to insure air and watertight welds prior to any fabrication or application of coating. The outside conduit surface shall be blasted to clean, bright metal. Immediately after blasting, the outer conduit surface shall be given a factory coat of Fusion Bond Epoxy (FBE). Coating application shall be a minimum of 20 mils thickness.

2.2 Conduit closures shall be 10 gauge steel, furnished with the conduit at a ratio of one closure for each fabricated item or length. Closures shall be field welded over adjacent units after pipe insulation. After testing, all exposed closures shall be covered in the field with a heat shrinkable sleeve, furnished with the conduit.

2.3 Piping in the conduit shall be standard weight (Std. Wt. is the same as Sch. 40 through 10") or extra strong (XS is the same as Sch. 80 through 8"), steel, ASTM A-53, Grade B, ERW or Sml. Pipe joints shall be welded in accordance with the Power Piping Code for ASME/ ANSI B 31.1.

2.4 The pipe insulation shall be mineral wool/ calcium silicate (or equal specified), of the thickness listed on the drawings.

2.5 Pre-fabricated ells, loops, and tees shall be furnished and installed where shown on plans and shall consist of pipe, insulation, and conduit conforming to the same specification as hereinbefore stated for straight runs. Expansion loops shall be designed in accordance with the stress limits indicated by the Code for Pressure Piping, ASME B31.1. Loop piping shall be installed in conduit suitably sized to handle indicated pipe movement.

2.6 Terminal ends of conduits inside manholes, pits, or building walls shall be equipped with end seals consisting of a 1/2" steel bulk head plate welded to the pipe and conduit. If there is no anchor within five feet of a terminal end, conduits shall be equipped with gland seals consisting of a packed stuffing box and gland follower mounted on a steel plate welded to the end of the conduit. End seals or gland seals shall be equipped with drain and vent openings. Terminate all conduits 2" beyond the inside face of manhole or building walls.

2.7 Pre-fabricated anchors shall be furnished and installed where shown on plans and shall consist of a steel plate, welded to pipe and conduit. The steel anchor plate shall be 1/2" thick and shall be 1-1/2" larger horizontally and 1-1/2" larger vertically than nominal conduit diameter.

2.8 A concrete thrust block shall be cast over the anchor plate and conduit, large enough for firm anchorage into undisturbed trench sidewalls and/or bottom. The concrete block shall be at least 36" in length and extend a minimum of 12" beyond the top and bottom of the anchor plate.

2.9 Wall sleeves with leak plates shall be provided at all building and manhole entries to provide an effective moisture barrier. The wall sleeve and leak plate shall be electrically isolated from building rebar. The space between the conduit and wall sleeve shall be made watertight by use of modular seal penetration seals or equal assemblies, which will also provide electrical isolation.

(Continued)



CLASS "A" STEEL

Specification Guide

CASG
4.112

FUSION BONDED EPOXY SPECIFICATION

2.02.2021

2.10 Cathodic protection shall be provided for the protection of the external surface of the conduit. The design Engineer shall furnish the soil resistivity for CP design purposes. The Cathodic protection system, complete with test stations, shall be designed for the particular site conditions. Cathodic protection drawings shall provide installation details, including anode location, test station location, wiring diagrams, electrical isolation, and cadwelding procedures. A CP Test report is to be furnished.

Part 3 – Execution

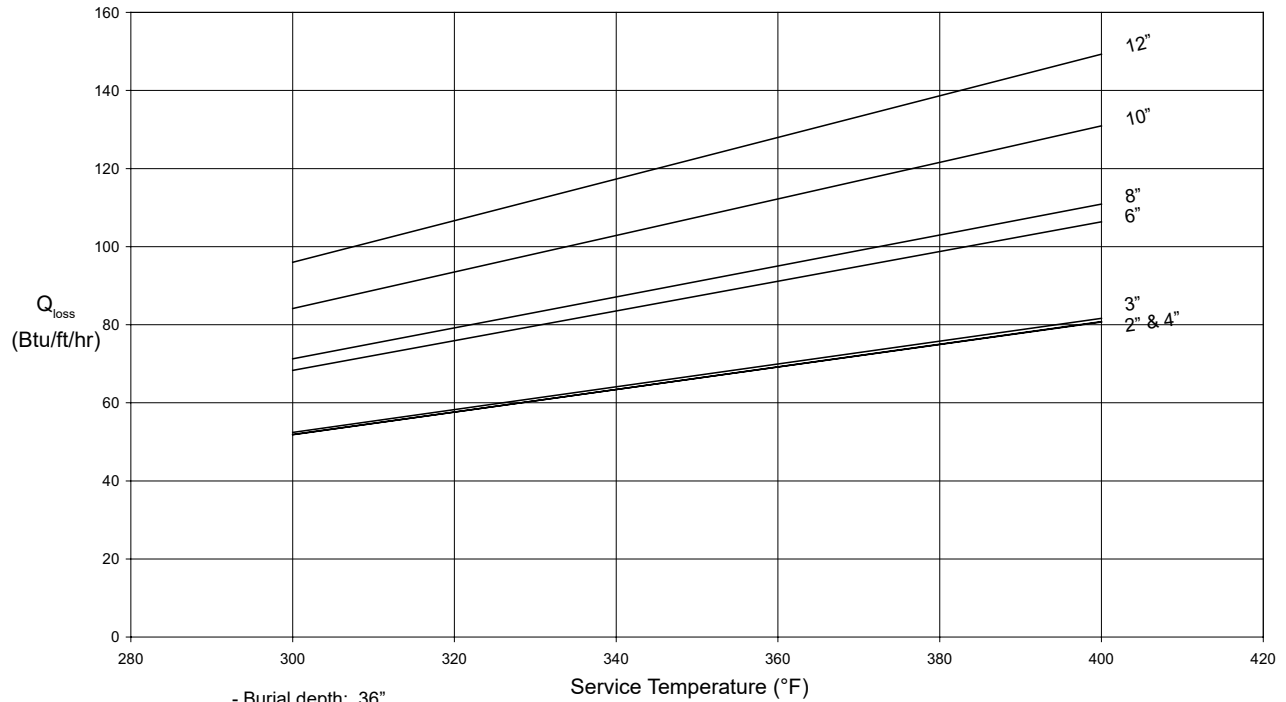
3.1 The installing contractor shall be responsible to excavate, string conduit, weld test, place in trench, back-fill, or otherwise treat and install the system as per the specifications and the directions furnished by the manufacturer and approved by the design engineer in accordance with plans and specifications.

3.2 The conduit shall be air tested at 15 psi for two hours. Repair any carrier pipe leaks and retest prior to making field closure. Holiday testing of the conduit shall be the responsibility of the contractor under the directions furnished by the manufacturer. Holiday test the 20 mil fusion bond epoxy coating at 2500+/- 10%, volts. All holidays shall be recoated and retested.

3.3 A factory trained or qualified representative of Thermacor Process Inc. shall be present at the jobsite during critical periods of the installation such as unloading, commencement of the installation, and testing. Backfilling shall not begin until approval of pressure tests by the Thermacor field representative.

3.4 A hydrostatic pressure test of the carrier pipe shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal system operating pressure for not less than two hours. Care shall be taken to insure all trapped air is removed from the system prior to the test. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

HEAT LOSS FOR STANDARD SIZES OF MINERAL WOOL *



- Burial depth: 36"
- Soil conductivity: 12 (Btu/h.ft².°F/ft)
- Soil temperature: 50°F

Pipe Size	Mineral Wool Thickness	Conduit O.D.
2"	1-1/2"	8-5/8"
3"	1-1/2"	8-5/8"
4"	1-1/2"	10-3/4"
6"	2"	12-3/4"
8"	2"	16"
10"	2"	18"
12"	2-1/2"	20"

* Other pipe sizes and pipe, insulation thickness, and conduit size combinations are available.



CLASS "A" STEEL Installation Manual

CAIM
4.201

GENERAL INSTALLATION INSTRUCTIONS

3.31.2022

INSTALLATION INSTRUCTIONS

UNLOADING & HANDLING

Lift joints from trucks. DO NOT DROP SHARP OR HEAVY OBJECTS ON INSULATED UNITS. DO NOT use chains or other devices which might puncture insulation jacket.

STORAGE

Pipe is stockpiled off the ground. Do not exceed a stacking height of 6'. Prevent dirt and debris from entering pipe. Fittings, joining materials, etc. must be stored indoors to protect them from freezing, overheating, moisture, or loss.

LAYING OF PIPE UNITS – TRENCHING

All sharp rocks, roots, and other abrasive material must be removed from the trench. The trench bed should be 6" of sand or backfill as specified by the engineer, providing a smooth and uniform stabilizing surface (sandbags may be used as a means to keep pipe off the ground until backfilling is started). The trench width should provide a minimum of 6" from trench wall to jacket O.D. and a minimum of 6" between pipe units. Trench depths will be indicated on the contract drawing and in line with good construction practices. Trench depth should allow for a minimum cover of 24" on top of the insulated unit. Pipe is to be sloped per the construction documents, or at a minimum 1" per 40' towards the drains. Pieces that are marked top should have "top" up.

FIELD JOINING METHODS

Piping shall be joined in the field using approved methods of welding for appropriate pipe. Installation drawings will be provided to indicate location of each individual piece of pre-insulated pipe. Pre-insulated pipe will be marked with Job and Piece Number correlating to those on the installation drawings. Installation of pipe must follow the installation drawings. Shipping bars should be removed prior to welding, but only after carrier pipe has been tack welded. Care should be taken in removing shipping bars so as not to damage carrier pipe. ONLY grinders shall be used to remove shipping bars - torch cutting of shipping bars is NOT permitted unless allowed for by the construction documents. **Field changes to fabricated units must be authorized in writing by the factory.**

ANCHORS AND COLD SPRINGING

All carrier pipe welds, with the exception of the cold spring welds, should be made and anchors poured prior to the cold springing. Anchors should be sized by the engineer of record, extending into the undisturbed dirt of the trench wall. Cold springing is to be performed per the Engineer's instructions and as shown on the installation drawings. Bridging the conduit may be used when circumstance does not allow traditional methods.

TESTING

The hydrostatic pressure test shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal operating pressure for not less than two hours. Inspect all welds at this time. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

INSULATION

Joints should be insulated after the hydro-test to the thickness and material specified, making sure that the insulation is cut to length and secured with two stainless steel bands, as provided. **The insulation and/ or the inside of the conduit must be kept dry during the entire insulation process.**

CASING SLEEVES

Casing sleeves are welded and air tested at 15 psi for two hours or per construction documents, whichever is more stringent. After testing, sleeves are to be cleaned of any weld splatter and either coated, heat shrink is applied, or both.

HOLIDAY TESTING

Conduit should be holiday tested right before backfill or earlier if pipe is handled with care. Pipe should be holiday tested at the required voltage for the particular coating. Make any repairs with the patch sticks provided. (Larger repairs can be made with liquid coating from Thermacor.)

CATHODIC PROTECTION

Cathodic protection should be installed right before backfill, per the instructions of the corrosion engineer.

BACKFILL FINAL

Before backfilling is started, the trench should be cleaned of any trench wall cave-ins and general trash, especially metal. Backfilling should be done with sand or other engineer-approved material 6" below the casing to 6" above. Engineer-approved backfill may be used to fill the rest of the trench. This material should be free of rocks, roots, large clods, or anything that could cause damage to the casing or casing coating. Casing should have a minimum of 2' cover.

WHEELED OR TRACKED VEHICLES SHALL NOT BE USED FOR TAMPING!

SHIPPING & HANDLING INSTRUCTIONS

HANDLE COATED PIPE WITH EXTRA CARE! THIS PIPE CAN DAMAGE WHEN HANDLED, MOVED, OR STORED IMPROPERLY!

UPON RECEIPT OF MATERIALS

Make an overall inspection of the load, checking all bands and braces to see if they are intact. Also, check the load for shifting. If the load has shifted, or if the braces and bands are broken, examine each pipe for damage. **HAVE THE TRUCK DRIVER MAKE AN ITEMIZED NOTATION OF ANY DAMAGE ON THE DELIVERY RECEIPT AND HAVE IT SIGNED BY THE DRIVER.**

CHECK PACKING LIST

Compare materials received with those listed on the packing list. Count all pipe and boxes. **NOTE ANY SHORTAGES ON DRIVER'S DELIVERY RECEIPT.**

CHECK BOXES

Open all boxes and inspect for damages, shortages, and correct size. **REPORT ANY DISCREPANCIES WITHIN 30 DAYS AFTER RECEIPT.**

CLAIMS FOR DAMAGES

Claims for damages in transit or lost goods must be made within 30 days. The filing of any claim is the Purchaser's Responsibility. Thermacor will file any claim on Purchaser's behalf upon receipt of the following:

1. Written authority to file such a claim.
2. Written notice of loss or damage (signed and noted Bill of Lading) by truck driver or carrier freight agent.

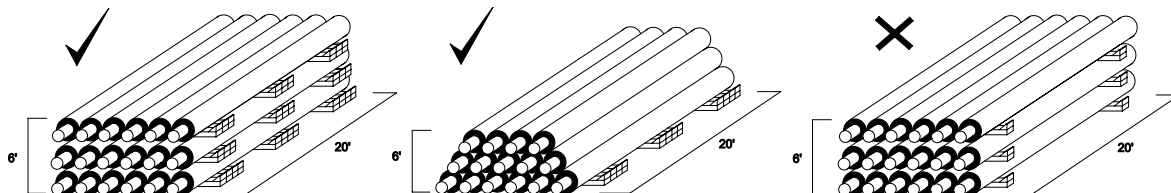
UNLOADING PIPE

Pipe may be unloaded by hand or with fork lifts*, cherry pickers, or cranes. **DO NOT HOOK** pipe ends. Minimum 4" wide straps or slings should be used.

*Fork Lift – When using Fork Lift, wide tines or a large surface covering the fork tines must be used to prevent coating damage. Fork Lift must be able to handle the weight of the insulated pipe length.

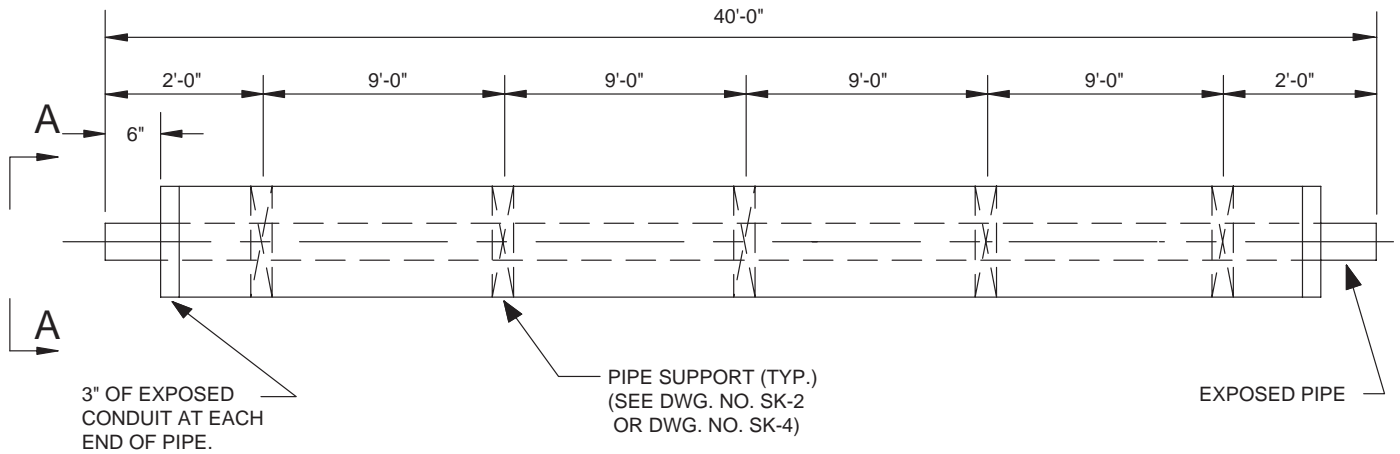
PIPE STOCKPILING

Pipe should be stored on level ground, elevated to be as dry as possible, and in such a way that the pipe ends do not lie in water or on the ground. To prevent deformation of the jacket and insulation due to the weight of the pipe, place a series of supports (3 for 20' or 5 for 40') of ample size generally constructed from 2" x 4"s under the pipe as shown below. Supports should increase in width as weight load increases so that the top supports of a fully loaded stockpile should be approximately 10" wide, gradually increasing to the bottom level, approximately 18" wide. Pipe can be pyramided (within reasonable and safe limits) approximately 6' high after a properly braced or chocked base is formed. Pipe stored outside for long periods of time can be covered with blue mesh tarpaulin (plywood can also be used). **Do not prevent airflow as jacket can be deformed from heat buildup.**



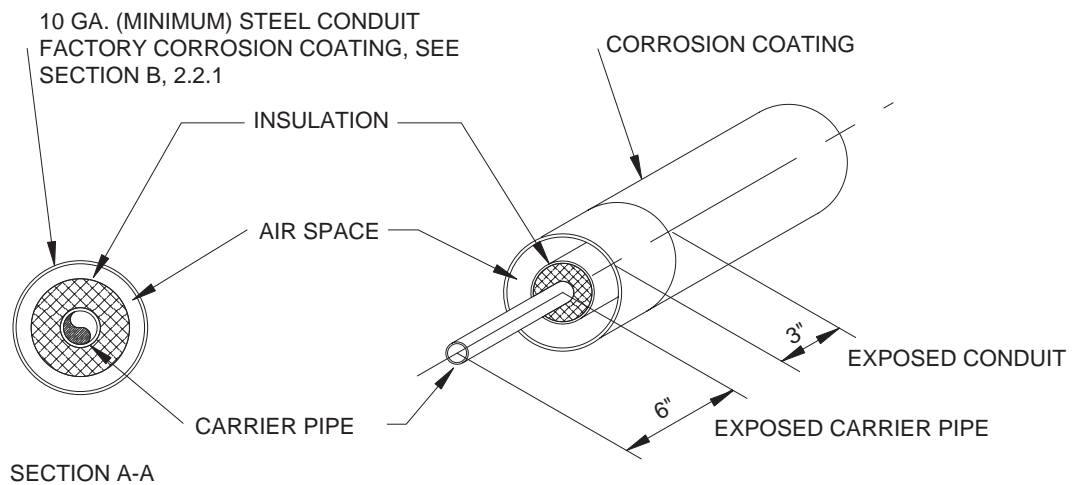
BE VERY CAREFUL NOT TO DROP THE PIPE!

NOTE: Thermacor does not approve of the practice of installing pipe and fittings, and backfilling the pipe before testing. Thermacor will not allow or pay claims for charges which arise in locating and digging up leaks regardless of cause.



MINIMUM GAUGE AND THICKNESS FOR STEEL CASING CONDUIT SYSTEMS		
CASING TYPE	CASING DIAMETER	MIN. WALL THICKNESS
BLACK STEEL	UP THROUGH 26"	0.1345" (10 GAUGE)
SMOOTH WALL	28" THROUGH 36"	0.1943" (6 GAUGE)
	38" THROUGH 42"	0.2242" (4 GAUGE)

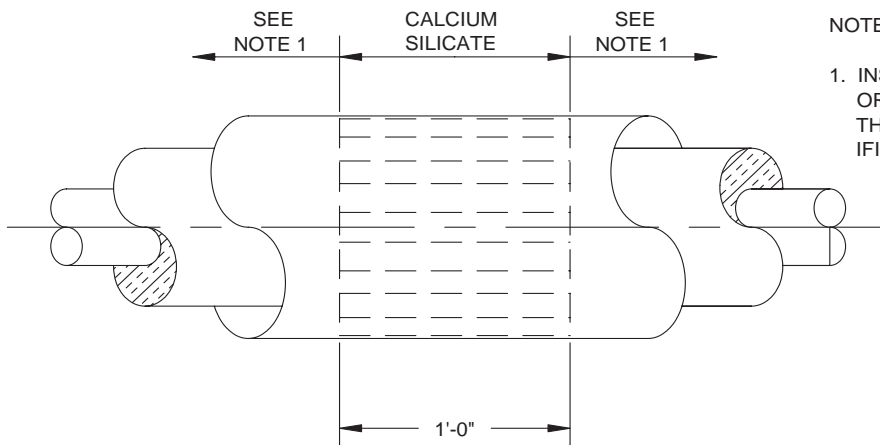
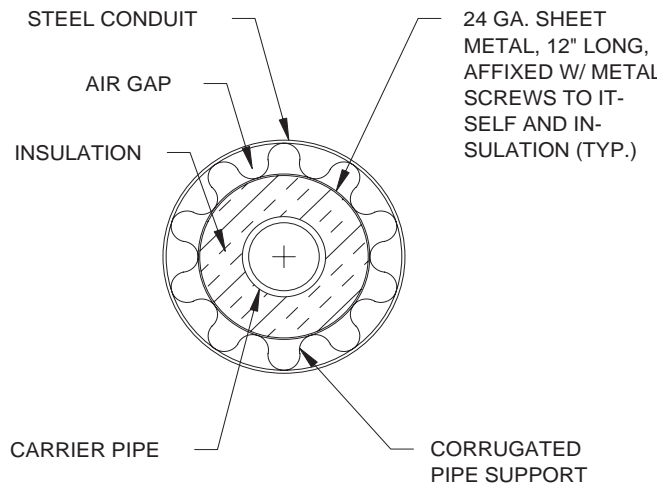
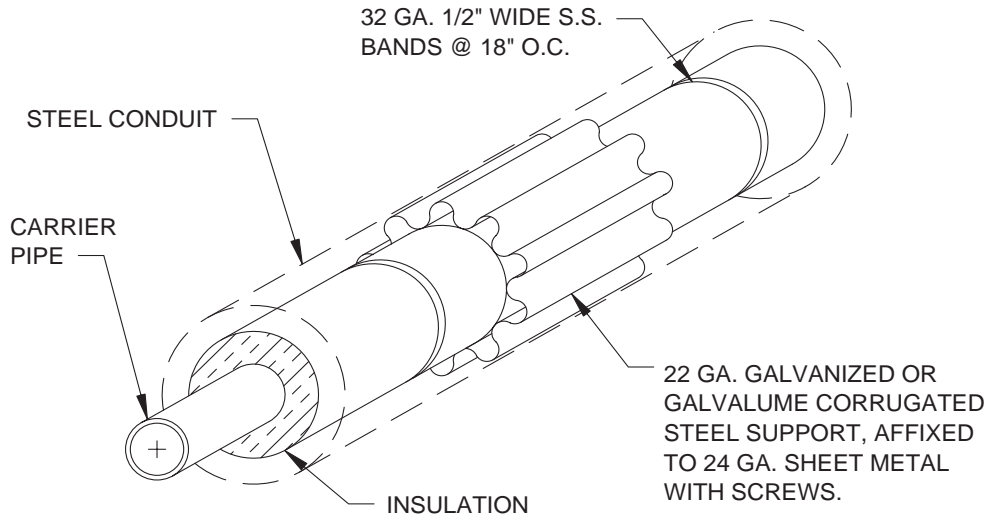
The above thicknesses will support a highway loading H-20, or equivalent, with a minimum of 2' burial and 95% of maximum density compacted backfill in cohesive soils or 70% of relative density compacted backfill for cohesive soils. For special loadings and soil conditions, conduit thickness may change.



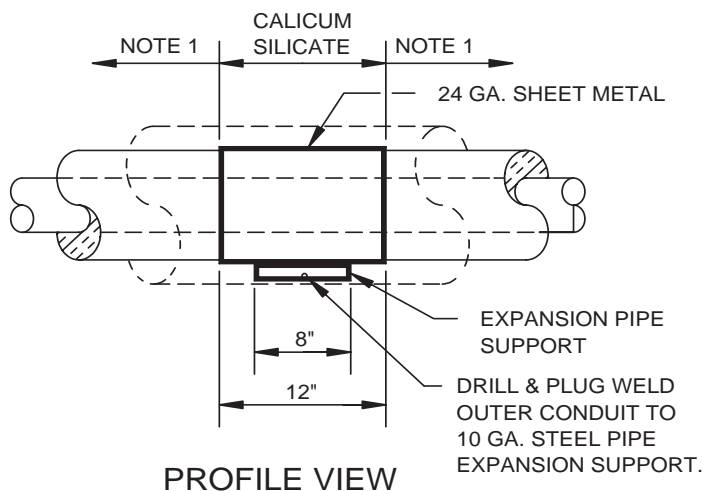
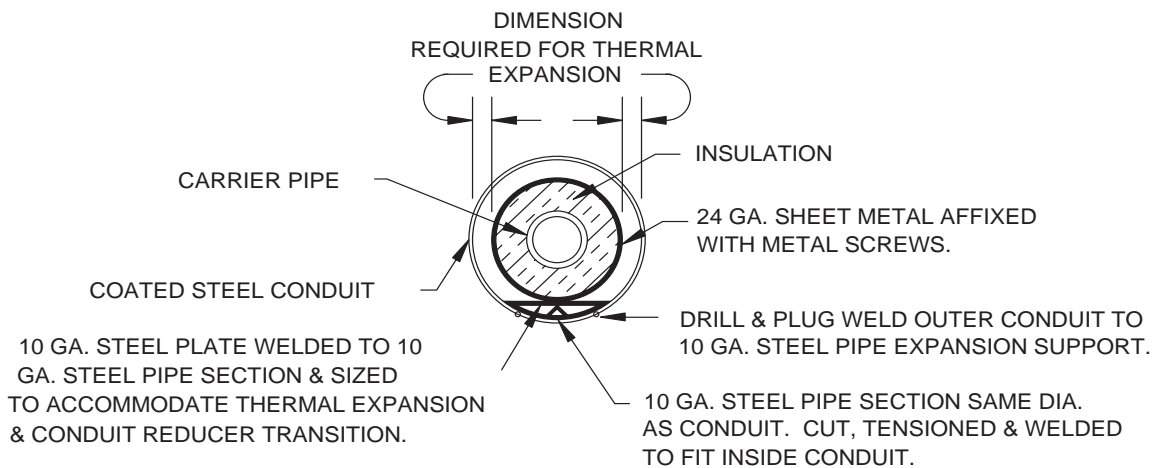
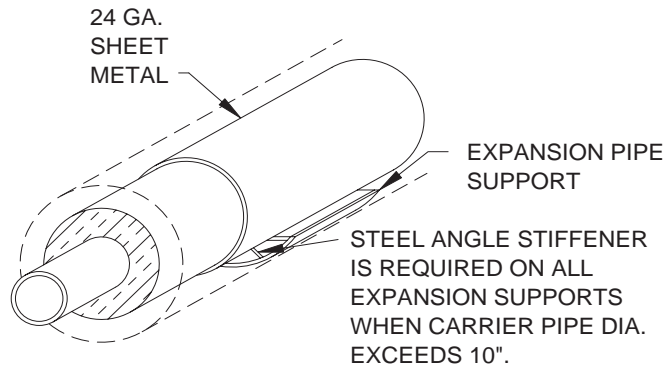
NOTE:

This detail shows a single pipe in a conduit. The support spacing dimensions and casing thickness are applicable for a dual pipe system in a single conduit.

TYPICAL INSTALLED PIPE SUPPORT/ GUIDE

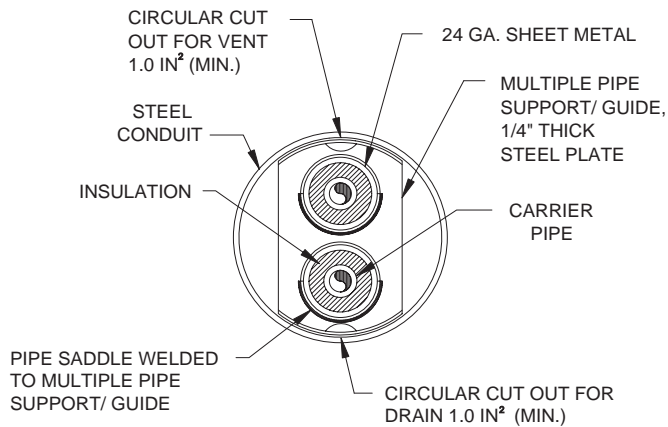
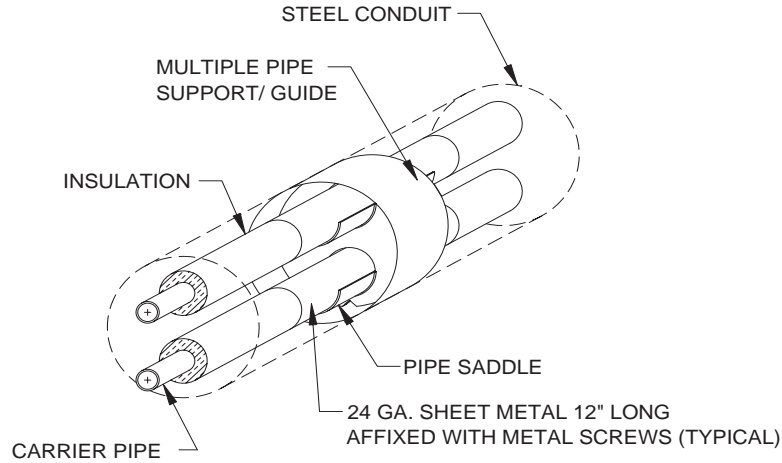


TYPICAL EXPANSION PIPE SUPPORT

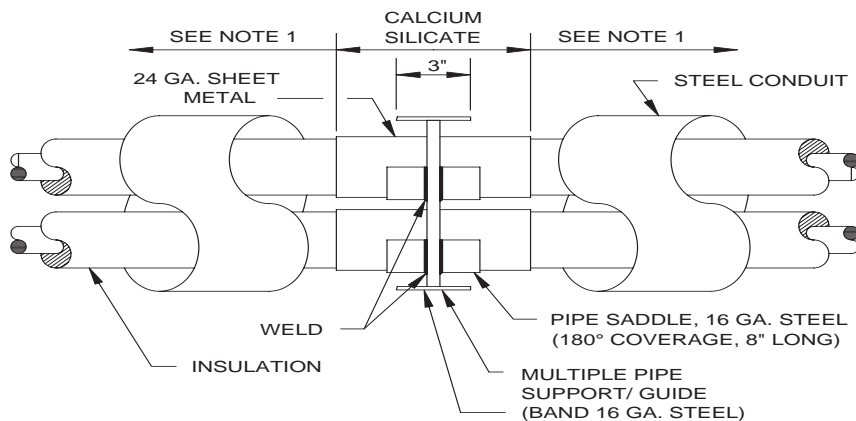
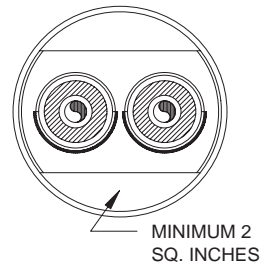

NOTE:

1. INSULATION CAN BE MINERAL WOOL OR CALCIUM SILICATE AS PER THE BROCHURE AND PROJECT SPECIFICATIONS.
2. CONDUIT WITH EXPANSION PIPE SUPPORTS SHALL HAVE SHIPPING BARS TACK WELDED ON CARRIER PIPE AND CONDUIT AND SHALL BE PAINTED TO SHOW TOP OF CONDUIT FOR PROPER SHIPPING, HANDLING, AND INSTALLATION.

TYPICAL INSTALLED PIPE SUPPORT/ GUIDE



LATERAL OPTION

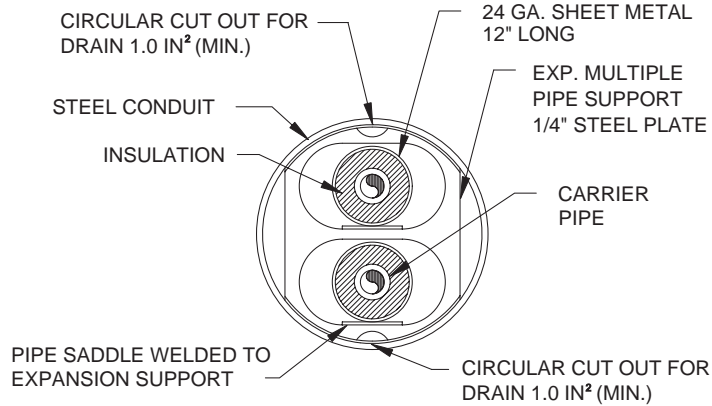


PROFILE VIEW

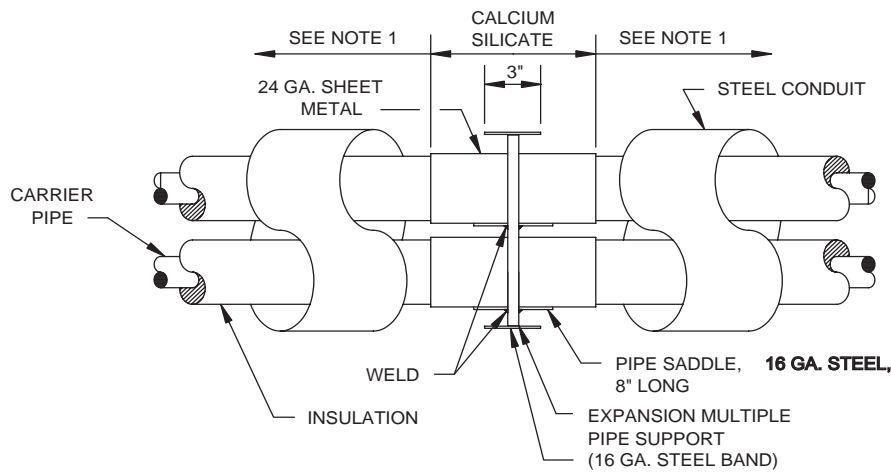
NOTE:

1. INSULATION CAN BE MINERAL WOOL OR CALCIUM SILICATE AS PER THE PROJECT SPECIFICATIONS.

INSTALLED MULTIPLE PIPE SUPPORT



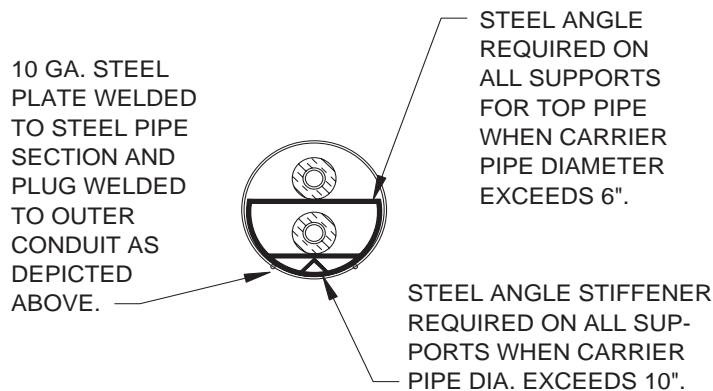
TYPE A EXPANSION SUPPORT



PROFILE VIEW

NOTE:

1. INSULATION CAN BE MINERAL WOOL OR CALCIUM SILICATE AS PER THE PROJECT SPECIFICATIONS.
2. DIMENSIONS FOR INSULATION AND MATERIALS AT PIPE SUPPORTS ARE TYPICAL FOR ALL SUPPORT TYPES.

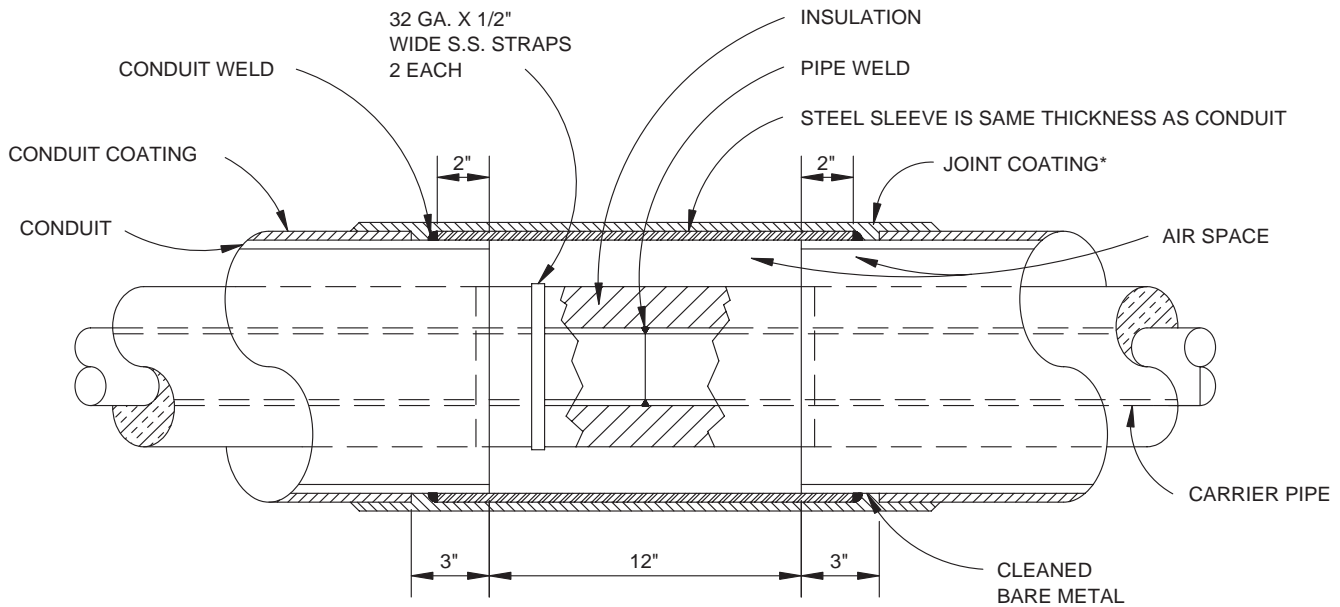


TYPE B EXPANSION SUPPORT



PROFILE VIEW

CONDUIT CLOSURE

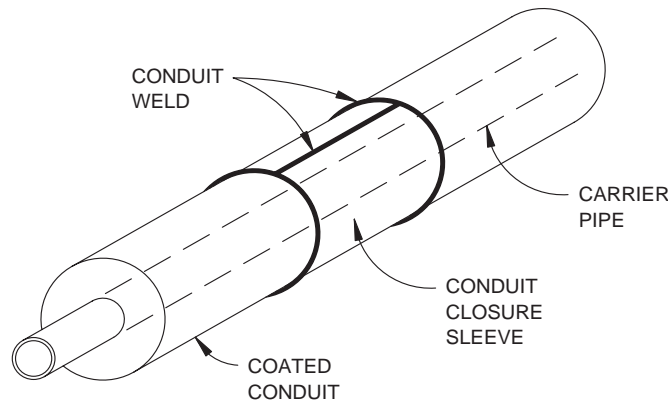


* JOINT COATING MATERIALS OPTIONS:

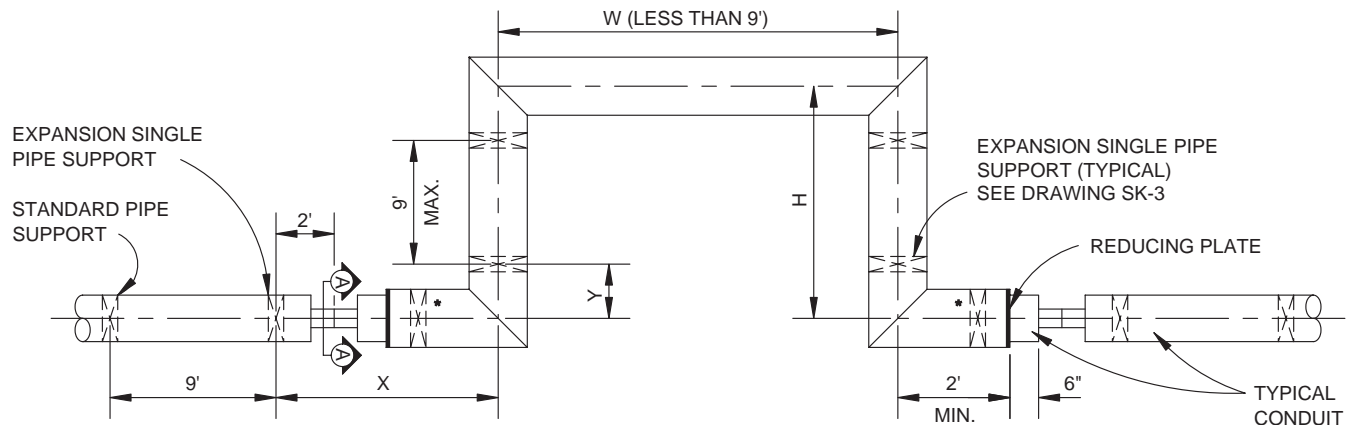
1. CHEMICALLY CURED POLYURETHANE
2. HEAT SHRINKABLE SLEEVE.
3. LIQUID EPOXY COATING

NOTE:

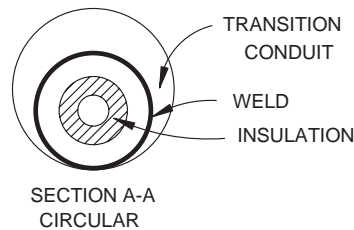
GRIND SHIPPING BARS, (DO NOT TORCH CUT) BETWEEN CARRIER PIPE AND CONDUIT BEFORE MAKING JOINT OR COLD SPRING.



TYPICAL SINGLE PIPE EXPANSION LOOP DETAIL



*EXPANSION SINGLE PIPE SUPPORT
REQ'D WHEN X+Y EXCEEDS 9'.

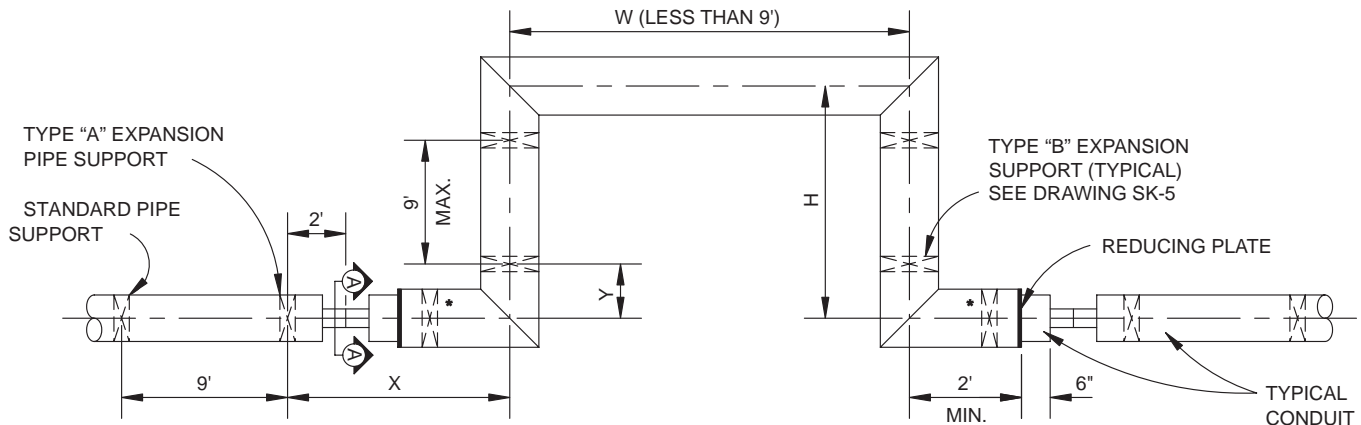


OVERSIZED CONDUIT TO BE DESIGNED
& UTILIZED TO ENSURE CARRIER
PIPE INSULATION WILL NOT CON-
TACT THE INTERIOR OF THE
CASING PIPE DUE TO THERMAL
EXPANSION OR CONTRACTION
FORCES.

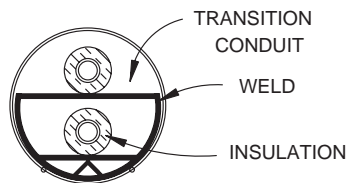
NOTE:

1. SIZE OF EXPANSION LOOPS, 'H' & 'W' BASED ON JOB REQUIREMENTS. SEE TABLE 1 OF BROCHURE.
2. SPECIFIC JOBSITE REQUIREMENTS & DIFFERING FIELD CONDITIONS WILL DICTATE WHICH TYPE OF OVERSIZED CONDUIT WILL BE UTILIZED (CIRCULAR OR ELLIPTICAL).
3. EXPANSION TYPE SUPPORTS SHALL BE UTILIZED TO COMPENSATE FOR THE NECESSARY THERMAL EXPANSION WHEREVER A CHANGE OF DIRECTION (90° ELLS, 45° ELLS, ZEES, TEES, LOOPS, ETC.) OCCURS IN THE CONDUIT SYSTEM. THIS INCLUDES EXPANSION SUPPORTS IN EACH LEG AS NECESSARY TO COMPENSATE FOR THERMAL EXPANSION IN BOTH DIRECTIONS.
4. OVERSIZED CONDUIT TO ALLOW FOR MOVEMENT OF PIPE. TRANSITION CONDUIT 10 GA. THICK-WELDED AT BOTH CONDUITS (IF REQUIRED FOR EXPANSION).

TYPICAL MULTIPLE PIPE EXPANSION LOOP DETAIL



*TYPE "A" EXPANSION PIPE SUPPORT
REQ'D WHEN X+Y EXCEEDS 9'.



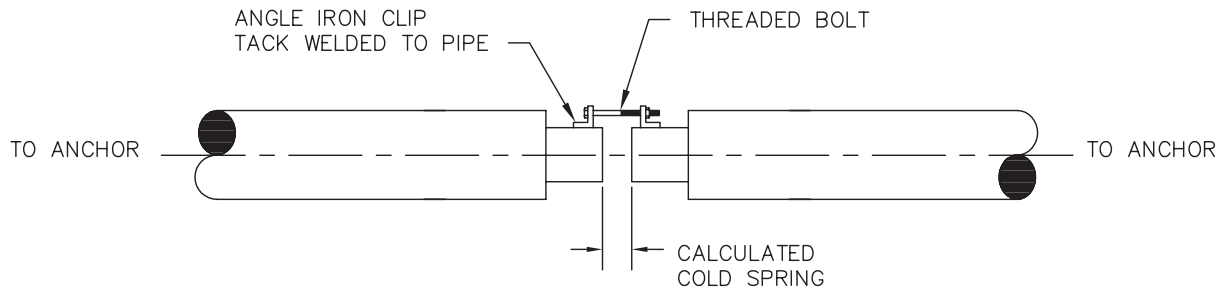
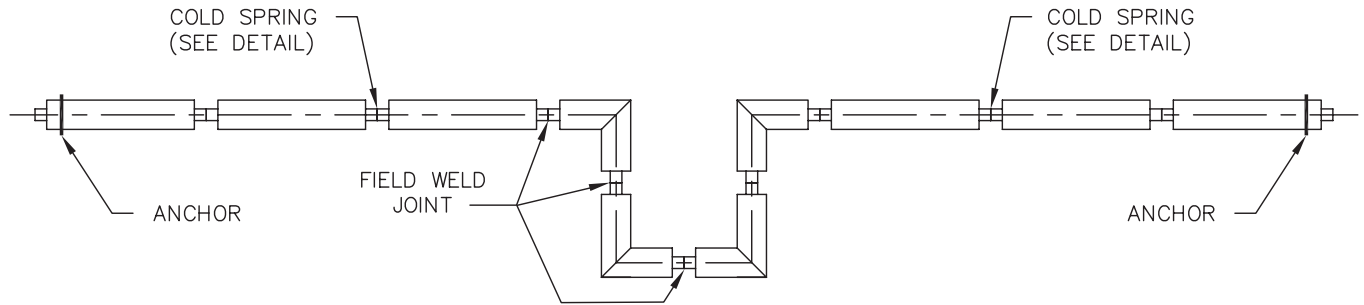
SECTION A-A
CIRCULAR

OVERSIZED CONDUIT TO BE DESIGNED
& UTILIZED TO ENSURE CARRIER
PIPE INSULATION WILL NOT CON-
TACT THE INTERIOR OF THE
CASING PIPE DUE TO THERMAL
EXPANSION OR CONTRACTION
FORCES.

NOTE:

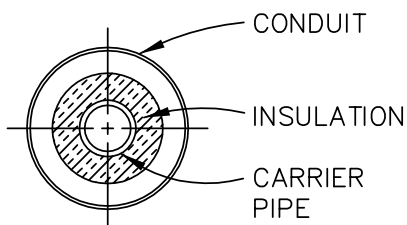
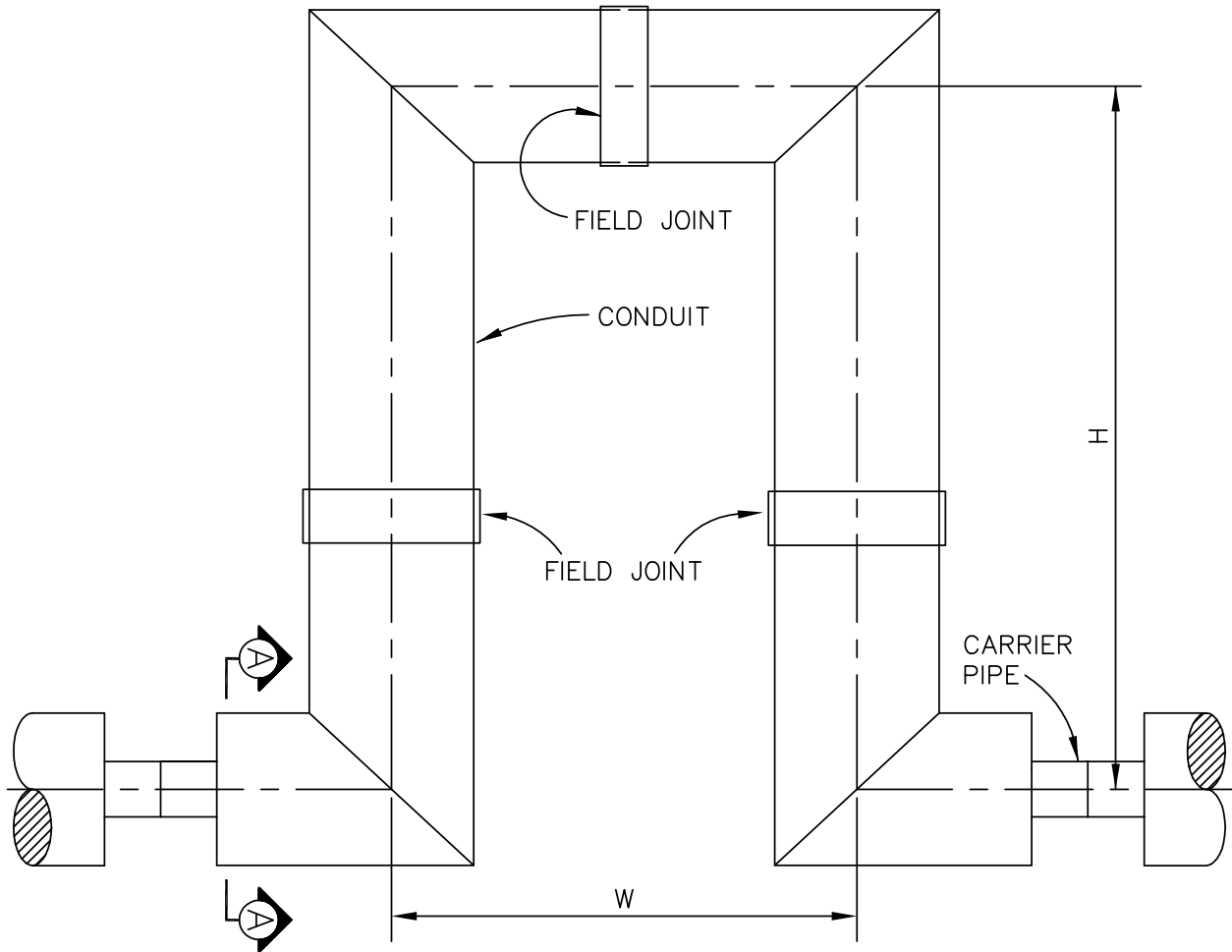
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TYPICAL COLD SPRING



COLD SPRING DETAIL

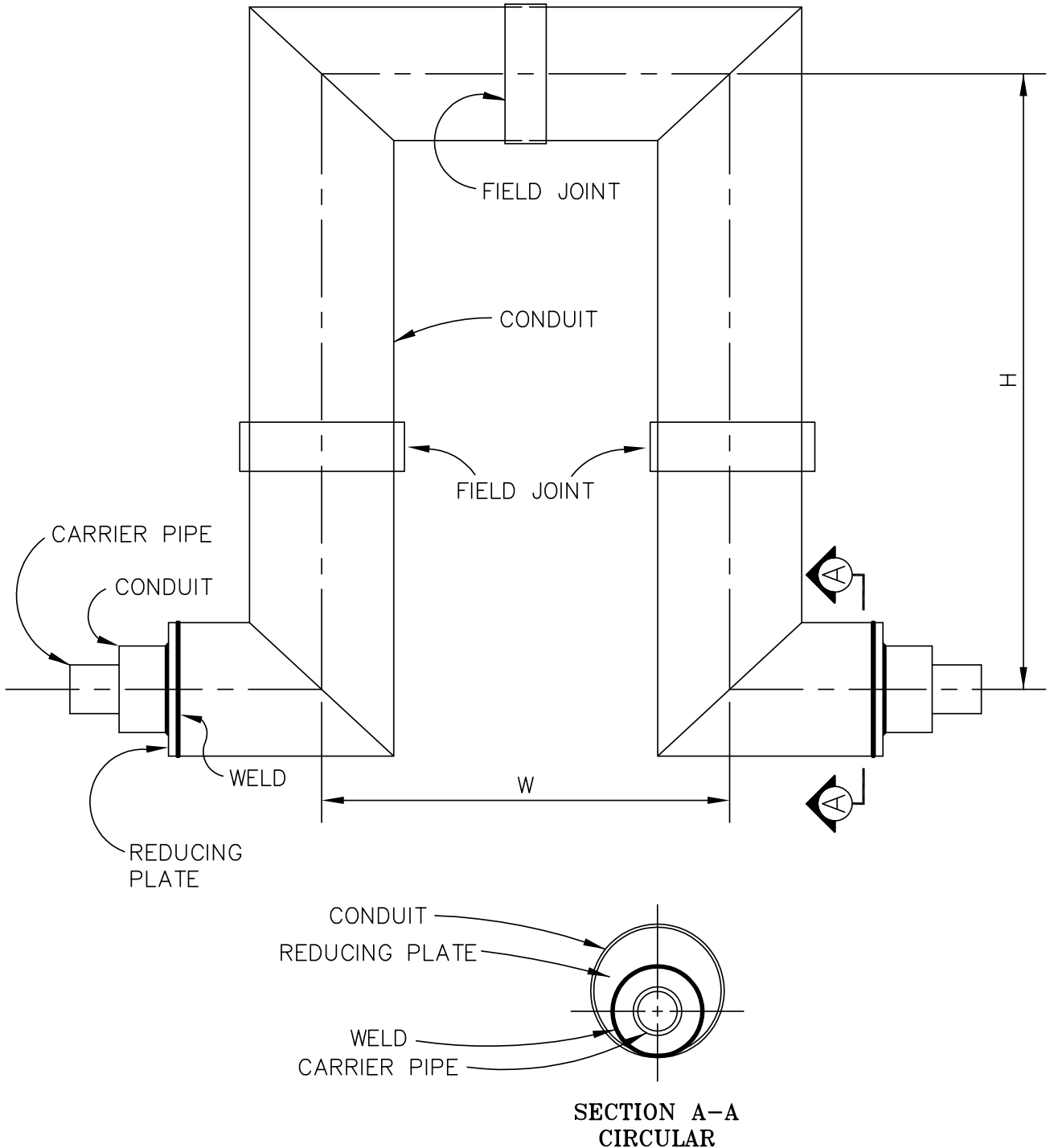
TYPICAL THREE-PIECE EXPANSION LOOP



**SECTION A-A
CIRCULAR**

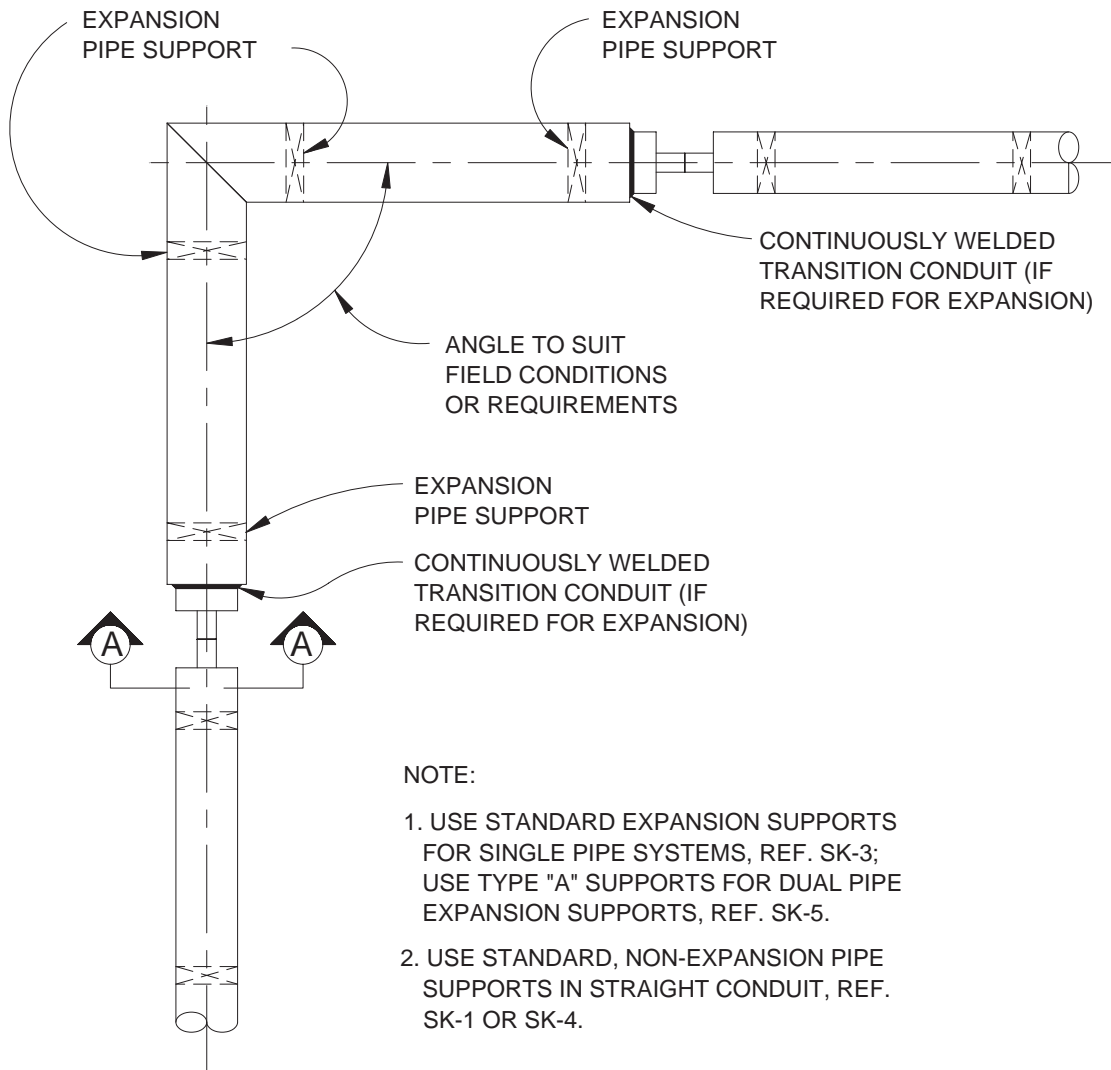
NOTE: DIMENSIONS 'H' AND 'W'
TO BE SIZED FOR JOB
REQUIREMENTS.

TYPICAL THREE-PIECE EXPANSION LOOP WITH ECCENTRIC REDUCER

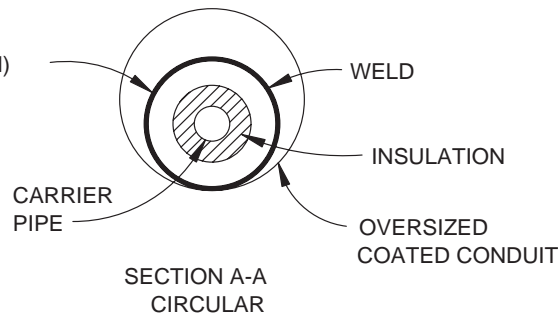


NOTE: DIMENSIONS 'H' AND 'W'
TO BE SIZED FOR JOB
REQUIREMENTS.

TYPICAL EXPANSION ELBOW

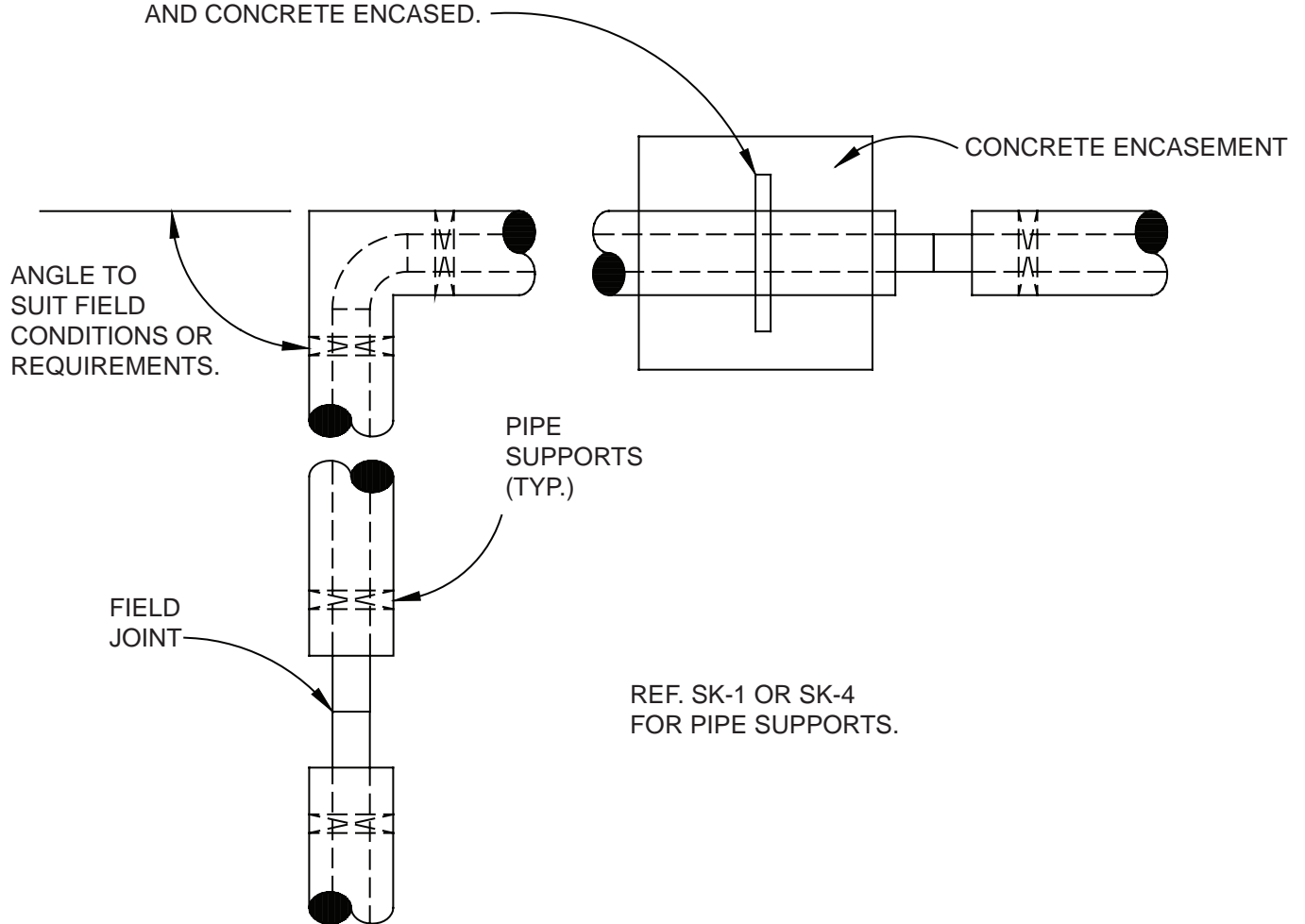


CONTINUOUSLY WELDED TRANSITION CONDUIT (IF REQUIRED FOR EXPANSION)

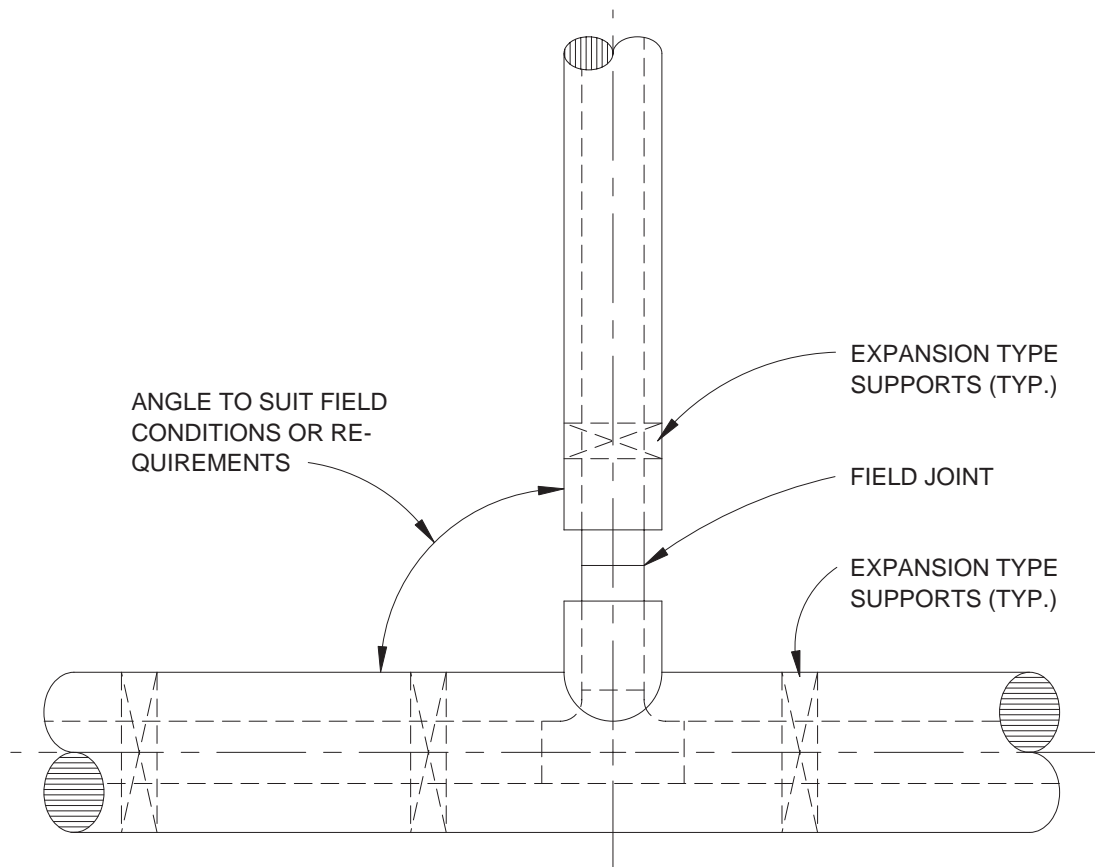


TYPICAL ANCHORED ELBOW

1/2" ANCHOR PLATE CONTINUOUSLY WELDED TO CARRIER PIPE AND CONDUIT. ANCHOR PLATE TO EXCEED CONDUIT O.D. BY MINIMUM OF 6" AND CONCRETE ENCASED.

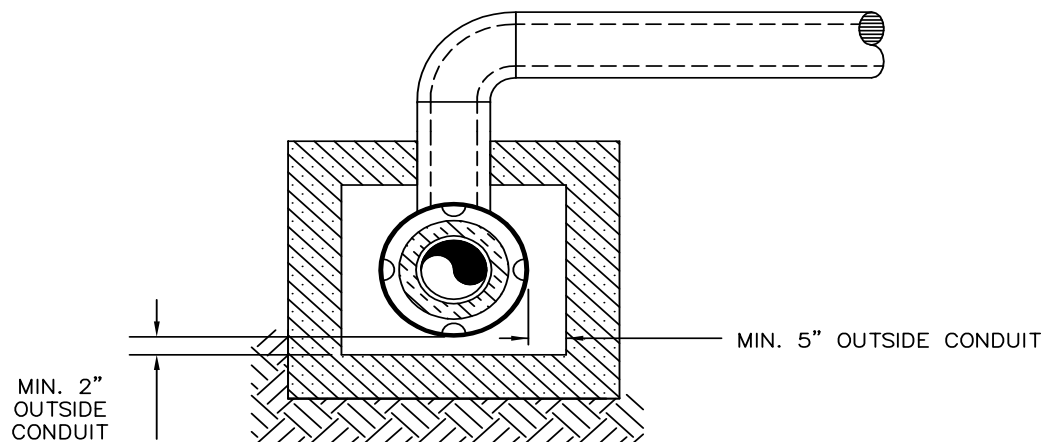
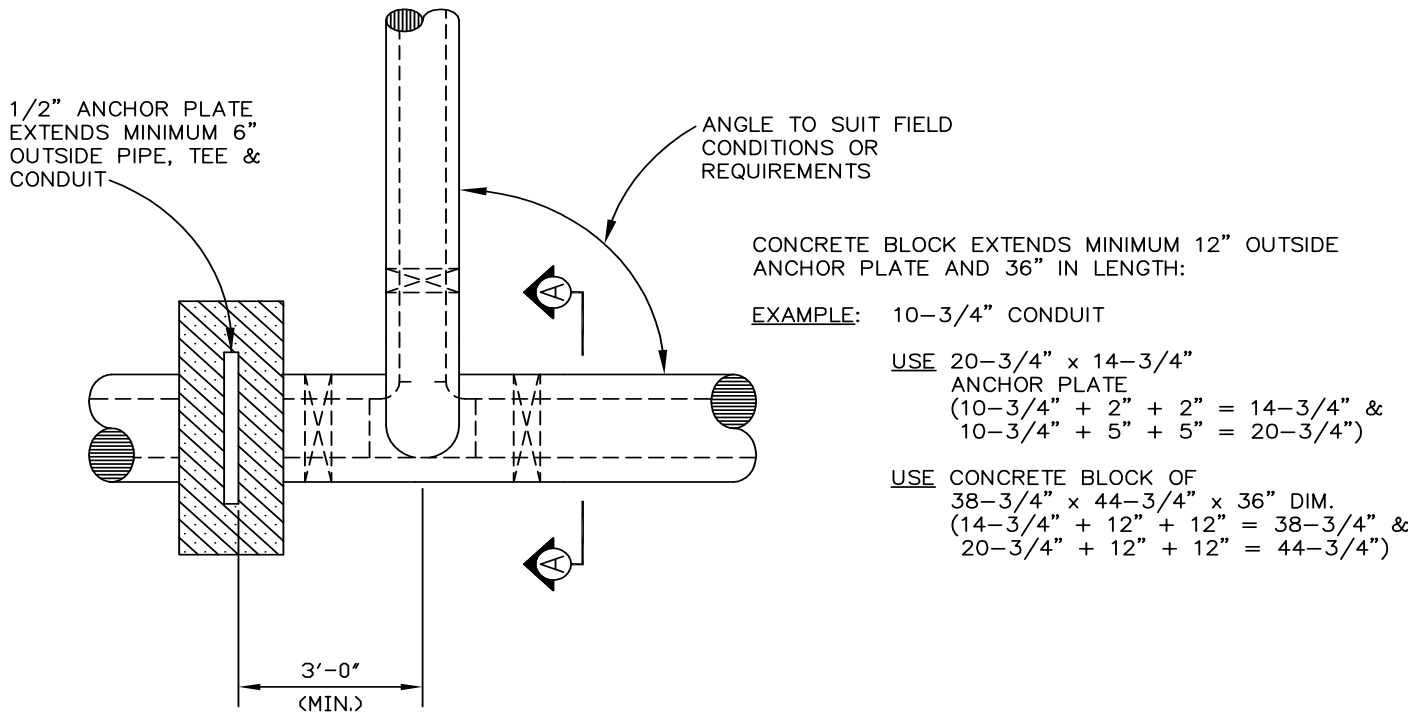


TYPICAL LIMITED EXPANSION TEE



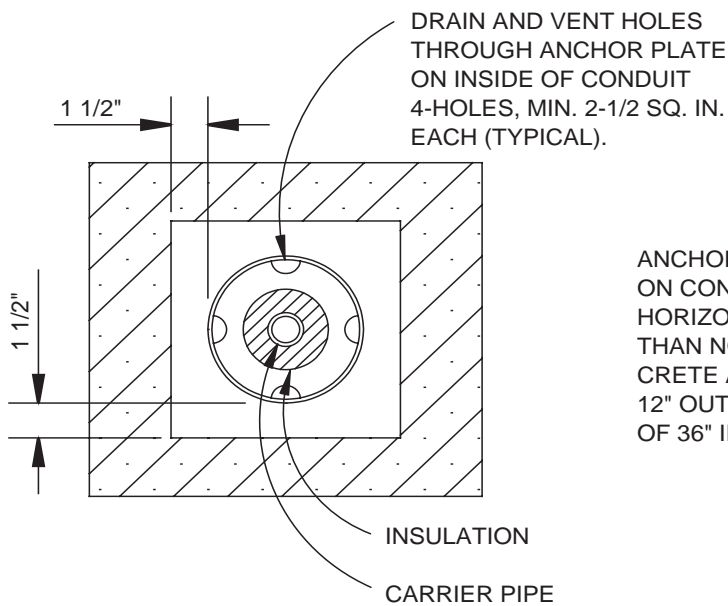
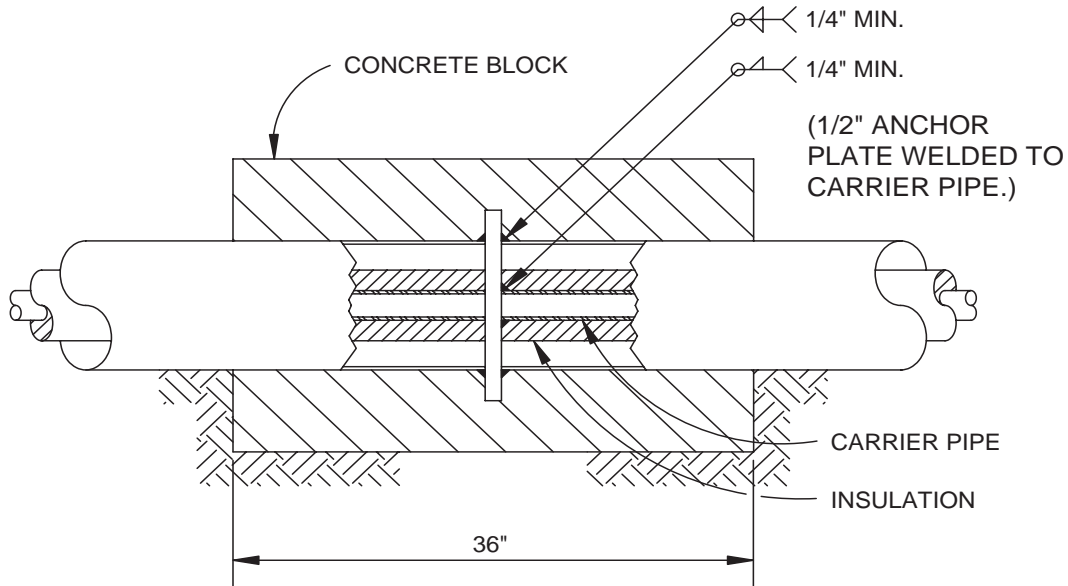
NOTE: LIMITED EXPANSION TEE TO BE USED ONLY IN UNUSUAL OR ISOLATED APPLICATIONS SUCH AS WHERE MANHOLES OR OTHER CONNECTION DEVICES ARE PROHIBITIVE. REF. SK-3 OR SK-5 TYPE B EXPANSION SUPPORTS.

TYPICAL ANCHOR TEE



SECTION A-A

TYPICAL ANCHOR DETAIL



ANCHOR PLATES ARE 1/2" STEEL CENTERED ON CONDUIT WITH DIMENSIONS 1 1/2" LARGER HORIZONTALLY AND 1 1/2" LARGER VERTICALLY THAN NOMINAL CONDUIT DIAMETER. CONCRETE ANCHOR BLOCK EXTENDS MINIMUM OF 12" OUTSIDE ANCHOR PLATE AND IS MINIMUM OF 36" IN LENGTH.



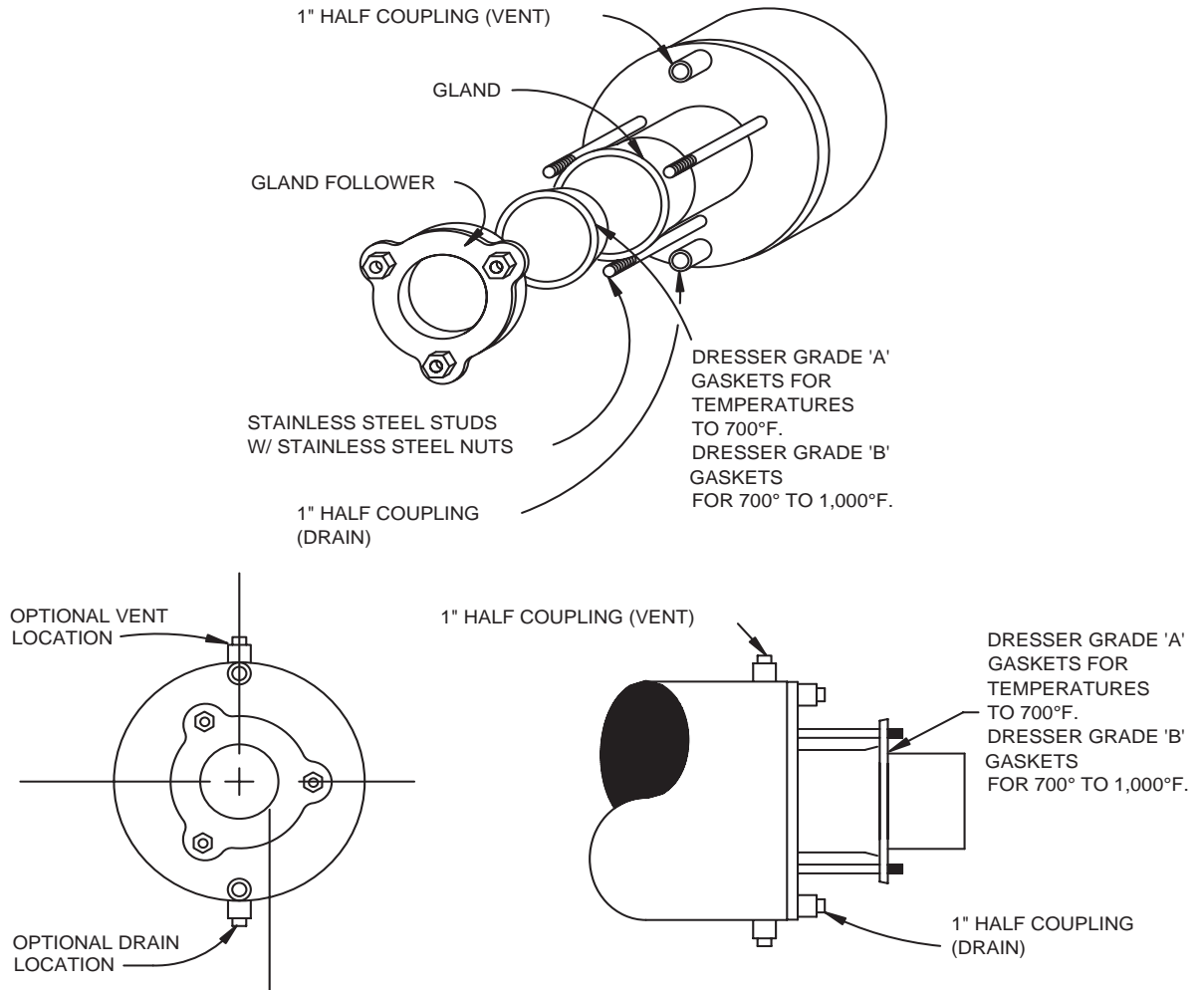
CLASS "A" STEEL SK-17

CAAD
4.317

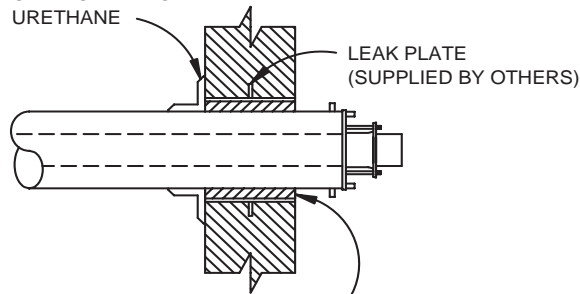
WALL PENETRATION W/ GLAND SEAL & CONDUIT ANCHOR

3.14.07

TYPICAL MANHOLE WALL/ BLDG. WALL PENETRATION W/ GLAND END SEAL & CONDUIT ANCHOR



SEAL WALL PENETRATION
W/ 3 COATS OF BITUMINOUS
MASTIC OR ONE COAT OF
CHEMICALLY BONDED
URETHANE



LINK SEAL OR CAULKING
SEALANT (SUPPLIED BY OTHERS)

ELEVATION

STUD AND NUT TABLE
FOR VARYING PIPE SIZES

CARRIER PIPE SIZE	NO. OF NUTS AND STUDS
1/2" TO 2"	2
2 1/2" TO 4"	3
5" TO 6"	4
8"	5
10" TO 12"	6



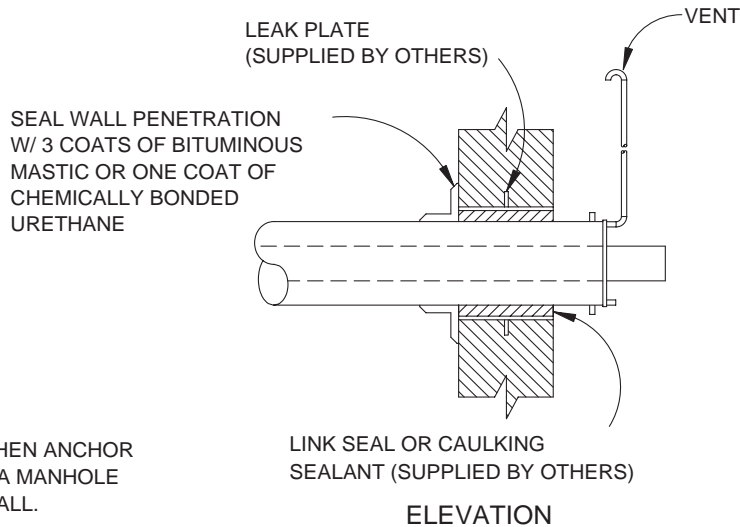
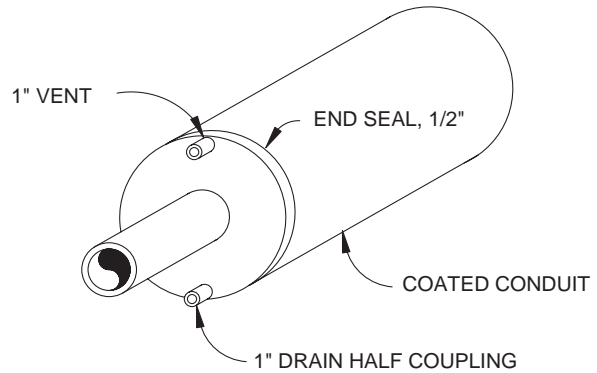
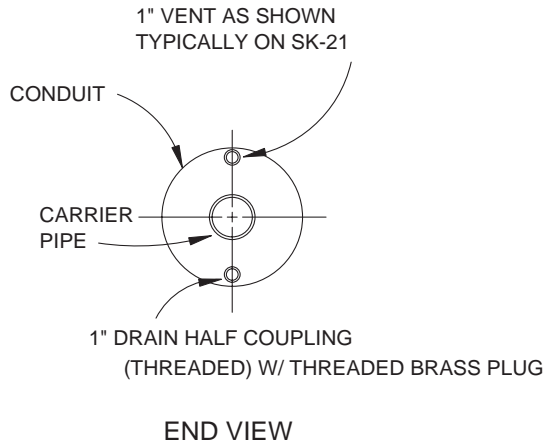
CLASS "A" STEEL SK-18

CAAD
4.318

WALL PENETRATION W/ END SEAL & CONDUIT ANCHOR

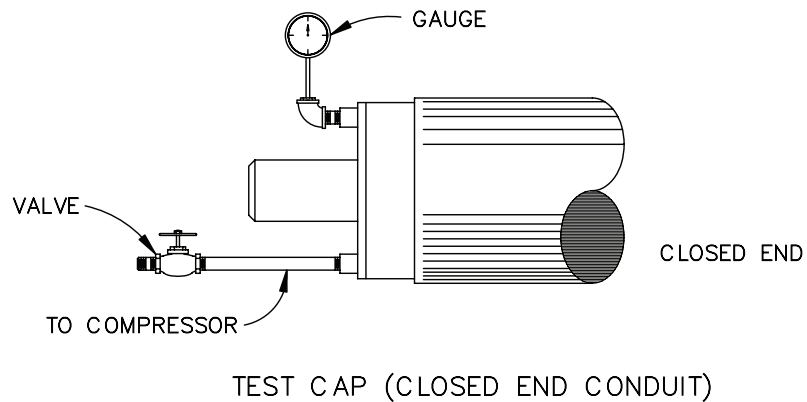
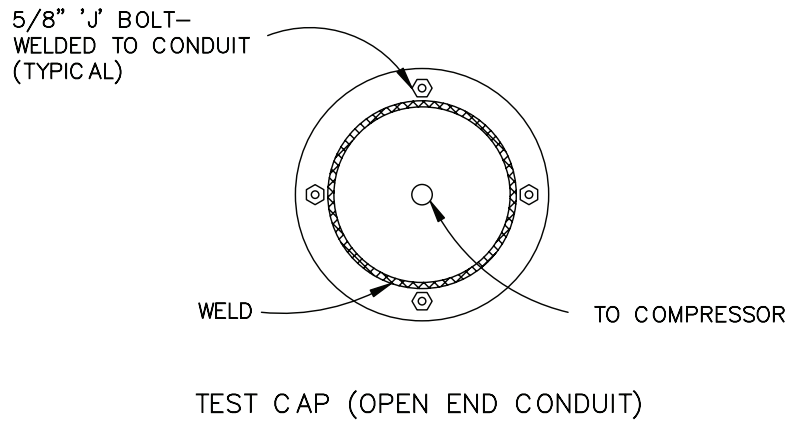
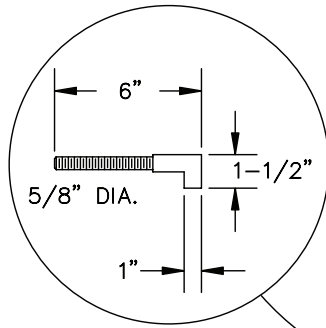
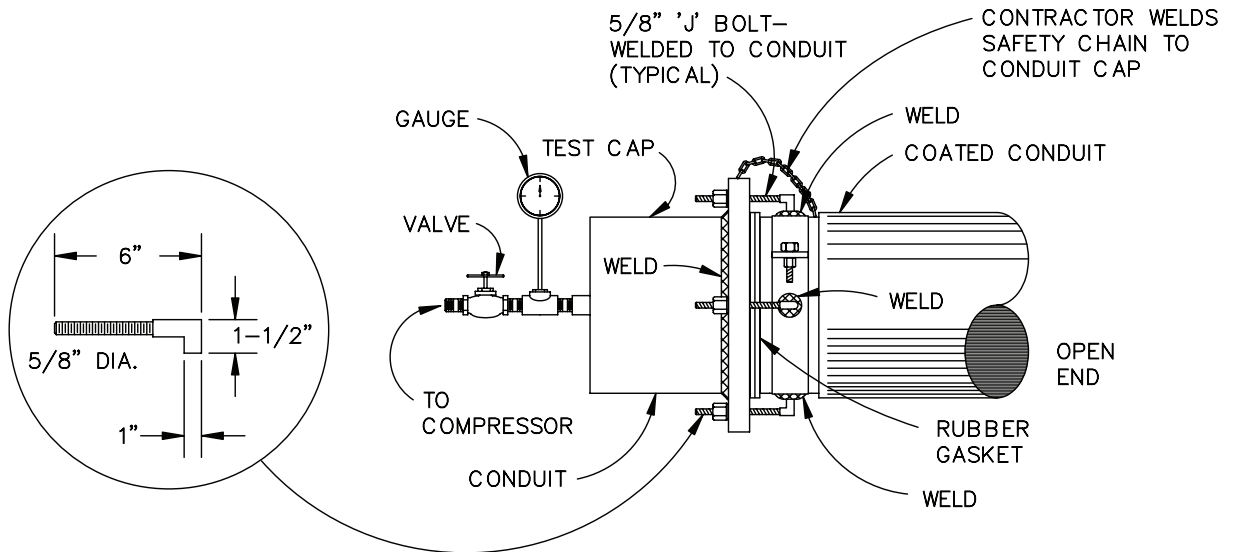
3.14.07

TYPICAL MANHOLE WALL/ BLDG. WALL PENETRATION W/ END SEAL & CONDUIT ANCHOR



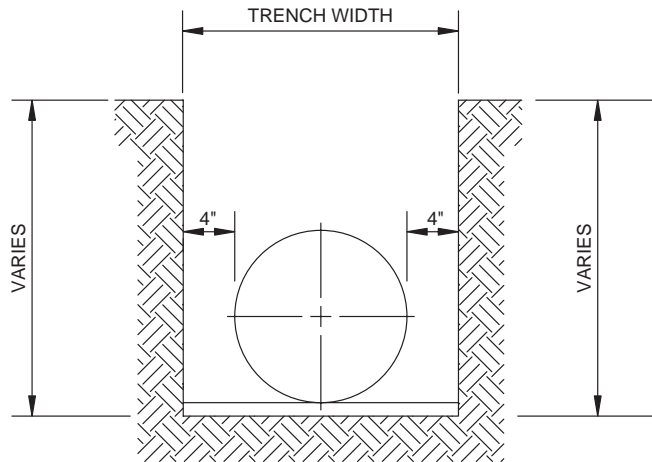
NOTE: USED WHEN ANCHOR
IS WITHIN 5' OF A MANHOLE
OR BUILDING WALL.

TYPICAL CONDUIT AIR TEST



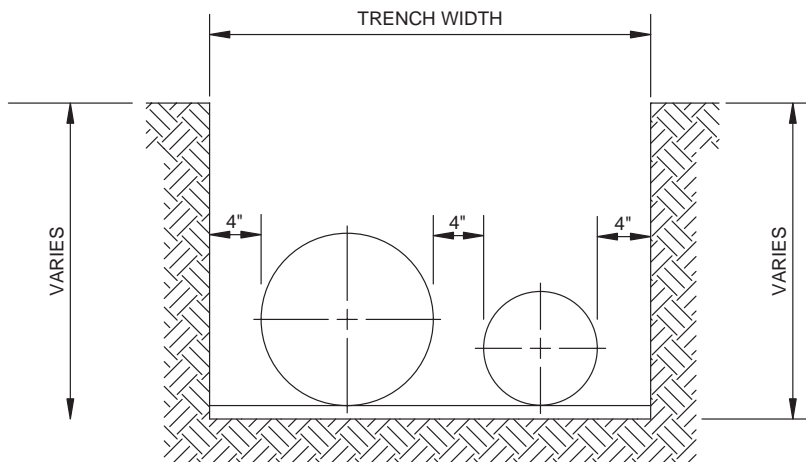
TEST CAP (CLOSED END CONDUIT)

TYPICAL TRENCH WIDTH



SINGLE CONDUIT SYSTEM

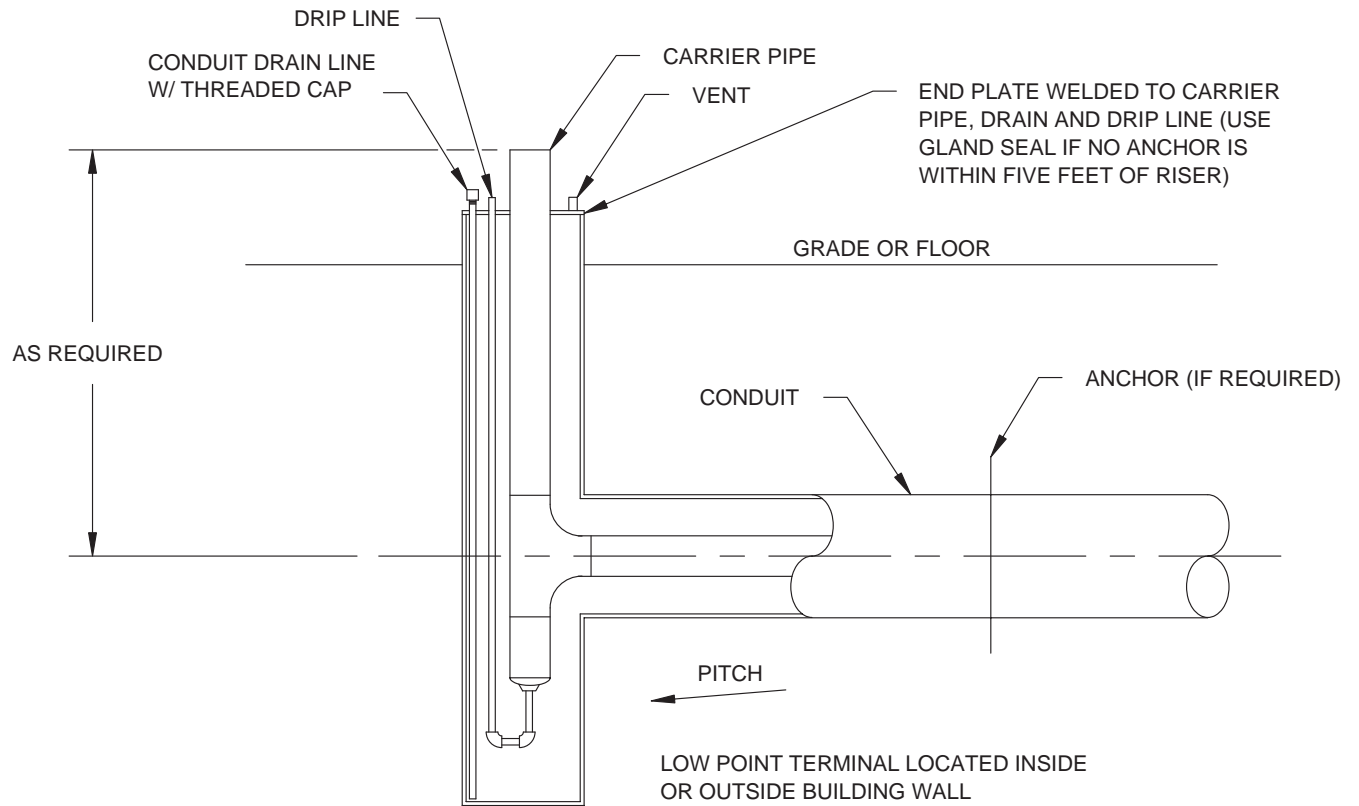
MAX O.D.	TRENCH WIDTH
4"	12"
10"	18"
16"	24"
22"	30"
28"	36"
36"	44"



TWO CONDUIT SYSTEM

DETERMINE THE MINIMUM TRENCH WIDTH BY ADDING 12" TO THE NOMINAL PIPE DIAMETERS OF THE PIPE SYSTEM.

TYPICAL DRIP-TEE RISER



NOTE:

INSULATION NOT SHOWN
FOR CLARITY.