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Chapter 1
Introduction

These procedures are for trepanning (cutting the hole), positioning and welding Cosasco Access Fitting bodies and welded end fittings on pipelines, pressure vessels, or tanks containing flammable products, either with access entry points already completed, or after making hot tap access entry. The procedures represent a composite of petroleum industry (hydrocarbon and petrochemical) safe practices for this type of work. They may be used as a guide or as a source of information; however, they cannot be expected to cover all the contingencies which may be encountered. If a special need or a special problem exists or arises, the responsible supervisor should revise these procedures, keeping in mind that safety of the operation and personnel is the primary consideration.

THE METHODS DESCRIBED HEREIN MAY BE USED BY ANYONE DESIRING TO DO SO; HOWEVER, ROHRBACK COSASCO SYSTEMS SHALL NOT BE HELD RESPONSIBLE OR LIABLE IN ANY WAY, EITHER FOR LOSS OR DAMAGE RESULTING THEREFROM, OR FOR THE VIOLATION OF ANY SOVEREIGN NATION, FEDERAL, STATE, OR MUNICPAL CODES OR REGULATIONS WITH WHICH THEY MAY COME IN CONFLICT.
Cosasco Access Fittings or other welded end fittings may be installed on equipment by one of several methods. One of the methods considered herein involves welding a piece of equipment which is under pressure. Because air (normal atmospheric oxygen content) is excluded from pipeline, vessel or tank contents, the possibility of fire or explosion from hydrocarbons or petrochemicals is reduced as compared with methods requiring the equipment to be open. The possibility of burning through the wall of the equipment during welding operations can be minimized by employment of capable welders and proper inspection of equipment prior to welding.
Chapter 3
Precautionary Safety Considerations

To maintain control of the conditions under which welding or hot tapping is to be done, the responsible supervisor in charge must:

1. **Determine contents of the system.**
   Will it permit welding? Hot work on lines or vessels containing corrosive or toxic materials should be given special consideration. Certain materials may cause metallurgical or chemical changes in the heat zone. Carbon steel, for example; is changed metallurgically at elevated temperatures in the presence of caustic or elemental sulfur. Welding should never be performed on equipment which is operating above its rated working pressure and temperature, nor on equipment which is operating at less than atmospheric pressure; that is, in a vacuum.

2. **Determine if air is present…**
   especially in combination with vapors in equipment. The oxygen content should be, and should remain, at a level which precludes the formation of a flammable mixture. Heating compressed air lines or vessels may cause detonation. (For example; if lubricating oil has been vaporized and distributed throughout the system by a compressor). Pipelines or vessels subject to this possibility usually can be removed or isolated from service and purged prior to hot work.

3. **Determine if the equipment is metallurgically suitable for welding.**
   (For example; hydrogen embrittlement or attack would make it impossible to complete the weld). Some steels and thicknesses require stress relieving. Special treatment is required for high tensile alloy steels and special welding rods must be used.

4. **Determine conditions…**
   under which welding may be done and establish a safe procedure. The job should be inspected by the individual responsible for authorizing the welding operations. Before granting authorization to proceed, the responsible supervisor should indicate definite safety precautions to be followed. A test of the hot work area for flammable gas presence may be desirable or required. An inspection of the parent metal is a necessity.

5. **Observe the operation…**
   to make sure the foregoing conditions are followed during performance of the job operation.

6. **If hot tapping, determine…**
   the capabilities of the hot tapping equipment. Hot tapping tools are limited to use within their pressure/temperature ratings.
Chapter 4
Preliminary Job Considerations

In addition to safety considerations under which welding or hot tapping is to be done, the responsible supervisor in charge must:

1. **Be sure the correct equipment or line** has been selected to be welded or hot tapped.

2. **Obtain**… the necessary clearance or approvals.

3. **Provide**… either a suitable fire extinguisher (preferably dry chemical) and/or a pressurized fire hose.

4. **Determine**… by visual inspection, hammer testing, ultrasonic thickness measuring devices, radiography (x-rays), or by some other approved thickness measuring devices that the equipment to be welded or hot tapped is of sufficient strength and thickness to receive the connection. Previous inspection records and data on corrosion rates will be useful in making this determination.

5. **Determine if preheating is required.** Studies have indicated that most steels should be preheated prior to welding (stainless steels with due moderate heat) when the fluid or metal temperature is less than 50°F (10°C).

6. **Determine the proper fitting for use in making the connection.** Many types of connecting fittings are available; such as Weldolets, Sockolets, Thredolets, Sweepolets, Elbolets, Latrolets, and of course, Cosasco’s distinctive Flarweld and Buttweld Access Fittings. (See Figures 4, 5, 6, & 7 for some examples). Cosasco recommends especially the use of Flarweld and Buttweld Access Fittings because they require only one weld, thus reducing the chances of distortion and warpage. They usually also represent a savings in time and money.

7. **Design the connection**… according to the proper code; that is ASME Boiler and Pressure Vessel Code or API Standard 650, Welded Steel Tanks for Oil Storage.
Chapter 5
Trepanning

(CUTTING THE HOLE): NO PRESSURE – TAPPING; PRESSURE – HOT TAPPING

A. No pressure present – Tapping:

Ideally, Cosasco Access Fittings or connecting fittings should be fabricated to the pipeline or pressure vessel before the system goes on stream. However; ideals are not always possible.

1. The access entry hole can be cut with a torch before the fitting is welded on, or with a drill bit or hole saw after the fitting is welded on.

2. The preferred method of welding the fitting to the pipeline before cutting the hole helps prevent distortion of the pipeline run and fitting, and should be done on outlet hole diameters over two inches (5.0 cm).

3. On hole diameters of two inches (5.0 cm) and under, either method is acceptable. For the nominal 2” Cosasco Access Fitting with full opening bore of 1-3/8” (1.375” or 34.9 mm), a like-sized drill bit or hole saw is recommended.

B. Pressure Present – Hot Tapping:

If the pipeline or pressure vessel is pressurized or on stream a hot tap should be used. Cosasco recommends the use of the Cosasco Hot tap Kit. Cosasco’s Hot Tap Kit also demands the use of the Cosasco Retriever and Service Valve hook-up. After the body is welded to the line, the Cosasco Hot tap Assembly is coupled with the access fitting body to cut the hole. The cut is made under full operating pressure without shutting off the flow in the pipeline or vessel and without loss of pressure or product. For installation, Operation and Maintenance of the Cosasco Hot Tap, see Manual P/N 740078.

Hot Tapping precautionary considerations:
Cosasco DOES NOT recommend cutting into a gas-filled pipeline, except with the Cosasco Hot Tap. In addition, the following suggestions and precautions may prove of value and be necessary for the safety of welders and Hot Tap operators:

1. Hot work jobs below grade level.
   Excavations should permit quick access and exit by personnel. If necessary, an air siphon or some other positive means of ventilation should be provided to remove fumes or flammable vapors.

2. Hot Work jobs above grade level.
   If in a congested area, necessary precautions should be taken to prevent the entrapment of personnel.
3. Maintain flow in the line... until after welding operations have been completed.

4. Underground lines running through casings. Be sure that welding is done on the line and not on the casing.

5. Flare lines with insufficient flow or without flow. In certain cases it may be necessary to flush the line with steam, inert gas, or hydrocarbon gas. Such steam or gas should be kept flowing through the line during the entire welding operation.

6. Do not agitate tank or vessel contents. Never pump in or out of tanks or vessels while hot work is in progress. The agitator switches should be tagged “off”. Close and tag all valves on product lines at the tanks. Avoid any procedures associated with operation of gas-blanketing valves or heater coil valves which would cause venting to occur.

7. On cone-roof tanks... maintain at least three (3) feet (1 meter) of liquid head above the hot work area when welding or similar hot work is being done. A tape gage of the tank content level should be made.

8. Pipelines filled with combustible gas. If oxyacetylene cutting and electric-arc welding are employed on pipelines filled with combustible gas, the gas must be free of air because of the possibility of an internal explosion. If air is introduced during any operation, the line must be purged with gas before cutting or welding is started.

9. “Controlled-fire” welding. During a cutting or welding operation, air is often prevented from entering the line at the joint by maintaining the gas pressure slightly above atmospheric and allowing the gas to escape through the joint, thus allowing burning to occur on the outside. This procedure is referred to as “controlled-fire” welding. Another method that is used to provide safe working conditions during cutting or welding operations is to replace the gas in the pipeline with a non-combustible one.

10. “Controlled-fire” flame size. In controlled-fire cutting or welding on large pipes, the size of the flame burning from the joint is often too large for the welder to work near. The amount of air that enters the joint, if mixed with gas, and with a flame of sufficient height can explode in the pipe and can cause serious burning injuries to the welder.

11. “Controlled-fire” “mudding” or taping. In order to keep air out of a pipeline using the controlled-fire cutting or welding procedure, it is essential in case of cutting to progressively “mud” behind the cut as it is made. In the case of welding, it is essential to tape the joint, thus burning off the tape as the weld is made.

12. Welding during tie-in operations. If a gas-filled pipeline is opened to the atmosphere, air will flow into the pipe very rapidly. During a tie-in operation, even momentary opening of the line will allow enough air to flow to be hazardous if welding is to be done. Therefore, all air should be removed by purging with gas before welding is undertaken.
13. **Minimizing air during tie-ins**. During a tie-in operation, the amount of air entering the pipeline can be minimized by the following procedures:

   a. All new sections which are to be tied-in should be previously purged of air, filled with gas and then capped.

   b. When a pipe is to be opened to the atmosphere, the open end should immediately be covered by some appropriate closure.

   c. All cuts or open joints in the pipe should be “mudded” or taped as soon as they are made.

14. **Ineffectiveness of “drifting gas”**. The practice of “drifting gas” out of an open end, large diameter, pipeline to prevent air from entering is not effective. It requires a flow of gas of greater volume than would be safe to discharge.

15. **Stratifying in gas pipelines**. Air entering into a gas-filled pipeline (being heavier) flows and stratifies along the bottom of the pipe. It can be most efficiently purged with gas through a bottom opening. It is essential to be sure that air is absent after purging.

16. **Cutting with an oxyacetylene torch...** into a gas-filled pipe does not inject unconsumed oxygen into the pipe.

17. **Confirmation of completeness of purging**. The air which still gets into the pipe after observing the above considerations and practices must be purged before any welding is done. This can be most effectively accomplished by purging to a final joint where both ends of the pipe are covered with a plate or canvas. By opening the covering at the bottom of the pipe, the air at the bottom can be displaced by “drifting in” gas. Confirmation of the completeness of purging should be determined by testing the exhausting gas from the bottom of the pipe with a reliable combustible gas indicator or suitable gravitometer. The instrument should be capable of showing essentially 100% gas conditions.

18. **Weld integrity test**. Test the integrity of the finished weld before cutting is started. Testing may be done hydrostatically below 200°F (93°C). Cosasco’s Hot Tap Kit includes Hydrostatic Testing Assembly as a component part for testing the integrity of welds. If the temperature of the line or vessel is above 200°F (93°C), an air test or soaping the welds to show leaks may be used. Radiography (x-rays), dye penetration or magnetic particle indicators also may be used for testing the weld.
Chapter 6
Positioning of Fittings

The procedures contained herein are primarily intended for the installation of the standard welded end access fittings, namely, Flarweld, Buttweld, Weldolet, Socketweld, and Thredolet. The installation of flange access fittings and the requirements for installing the mating flange or companion flange vary greatly for each application and are beyond the scope of these instructions.

The Cosasco Access Fitting can be readily installed on a variety of pipelines and vessels. Installation can be on new, shut-in, or on-stream systems by using the Cosasco Retriever and Service Valve hook-up and the compatible Cosasco Hot Tap. Once installed, the access fitting assembly provides a reliable, insertable-retrievable under pressure system, for corrosion monitoring devices or preventive maintenance systems. The access fitting assembly is available in a variety of materials and configurations to make it compatible with any new or existing system.

The Cosasco Access Fitting is a precision machined, high pressure, high quality fitting with close tolerance bores, seats and threads. Excessive heat during welding, or subsequent stress relieving, can produce distortion or warpage which will surely require repair or may be severe enough to render the fitting useless.

A. The Cosasco Access Fitting Assembly…consists of a body, a plug assembly and a recommended, but optional protective cover.

1. The body is welded directly onto the pipeline or vessel as in the case of the Flarweld or Buttweld fitting; into a Sockolet (Socketweld); is threaded on the inlet end to enable its mating to a Thredolet or a half-coupling which has been welded to the line (NPT); or it bolts to a mating or companion flange connection (API or ANSI Flange).

2. The Plug Assembly is either of the solid or hollow plug type. Either type seals the bore and acts as the carrier device for the various attendant monitoring systems attachments. When used in conjunction with Cosasco’s Retriever and Service Valve hook-up the plug assembly and its attached monitoring/preventing device can be inserted or retrieved while lines are under full operating pressures.

3. The Protective Cover serves as acme thread protection on the access fitting body against debris, contaminants and weather; and in the case of the heavy protective cover, affords an increased degree of protection against vandalism and tampering.
B. Orientation of the Access Fitting

1. Whenever possible the fitting should be mounted in the vertical position with the acme thread end up. The fitting must be so mounted that there will be adequate clearance or “head room” (regardless of fitting positioning) beyond the access fitting top for the service valve connection and the extension of the retriever in the operation of the Retriever and Service Valve hook-up. The following clearance recommendations should prove of adequate “head room”:

- 14” Stroke Retrievers – 5’ (1.5m)
- 25” Stroke Retrievers – 7’ (2.1m)
- 37” Stroke Retrievers – 9’ (2.7m)
- 49” Stroke Retrievers – 11’ (3.4m)
- 61” Stroke Retrievers – 13’ (4.0m)

2. In addition, circumferential “shoulder room” or non-cramping movement of the operators and also free movement of the equipment is required. The following clearance recommendations should prove of adequate “shoulder room”:

Above ground grade level – From the longitudinal or axial centerline of the body, a radius clearance of at least three (3) feet (1 meter) should be maintained.

Below ground grade level – A minimum diameter culvert or manhole of four (4) feet (1.2 meters) should be provided; with the body placed off-center one (1) foot (30.5 cm) from the culvert wall at the closest point and three (3) feet (1 meter) at the farthest point.

C. Protection of Cosasco Access Fittings During Welding

1. The Cosasco plug assembly and protective cover (if used), along with any monitoring/preventing device attached to it, must be removed from the body before welding. This will prevent damage to the packing, seals and threads of the plug assembly.

2. The Cosasco Access Fittings body internal bore, seat and threads, as well as external acme threads must be protected during welding to prevent weld spatter from depositing on them. An appropriate welding cloth can be used to provide this required protection. Care should also be taken that the proper preheat, interpass and stress relieving temperatures are adhered to for the welding procedure used. Temperature crayons can be used for this purpose.
Chapter 7
Cosasco Welding Procedures &
Special Hole Cutting Considerations

1. Weld Gap. The Cosasco Access Fitting body or connecting fitting must be raised off the surface of the pipe or vessel wall to establish a proper weld gap. This can be done by placing four (4) 1/16” (1.6mm) spacers or rods under the fitting to provide the proper gap between the curvature of the pipeline or the surface of the pressure vessel wall and the root or base of the fitting. Normal weld gap is 1/16” (1.6 mm) per ANSI B31.1 1973. (See Figure 1).

2. Welding. Arc welding should be used, if at all possible, for all grades and types of steel. This will minimize warpage and distortion of the Access Fitting body because of its localization of concentrated heat. Care should be exercised so that the body is properly positioned to prevent misalignment of the hot tapping tool when the cut is made. The hot tapping tool is used at a right angle or perpendicular to the work area. Also avoid excessive arcing because arc spots on the body can cause stress and consequently body warpage while cooling. Recommend procedures for welding and special hole cutting considerations for various metals follows:

   CARBON STEEL AND FORGED STEEL:

   a. Tack Weld. Preheat the access fitting to 400°F (204°C). (Note: When preheating, it is advisable to preheat to a temperature of 100°F (38°C) higher than those shown in code tables used. This is to eliminate the possibility of the material cooling to a temperature below the minimum shown in the tables. Temperature crayons or electrical temperature controls are generally used to determine when the proper heat has been reached. Isolate all welding from chills and drafts). Center the body on absolute top dead center of the pipeline run on which it is to be installed. The base joint is tack welded, preferably at four (4) points, using a 1/8” (3.18 mm) welding rod. After tack welding, the spacers are withdrawn and all slag removed. (Figures 1 and 2).

   b. Stringer beads. The stringer beads are applied completely around the base of the fitting. Use 1/8” (3.18mm) welding rod for a 1/8” (3.18mm) maximum layer. The established weld gap assures full penetration. Remember….the first pass is the most important one; between passes all slag must be removed. (See Figure 3).

   c. Reinforcing or cover beads. Continuous reinforcing or cover beads should be added to fill the bevel and provide a smooth, tapered, and very slightly convex weld slope. Use a 5/32” (3.97 mm) welding rod for the reinforcing or cover beads. (See Figure 3).

   CHROME MOLY STEEL: Use same welding procedure as shown for carbon steel, with the following consideration:
If the tap hole is to be flame cut, rather than hot tapped or machine cut it is very important that all slag be removed and rough edges ground to a bright metal finish. It is also important that the surrounding area to be welded be ground to a bright metal finish.

**STAINLESS STEEL:** Do not preheat! ....otherwise; use the same procedure as shown for carbon steel, with the following considerations:

In the hole cutting procedure, a hole saw or drill bit should be used to cut small size openings. Abrasive cutting wheels are generally used to make larger sized holes.

Arc cutting or the injection of iron powder into an acetylene flame are other methods used. If however, any of these flame or arc methods are used, the hole should be cut undersize 1/4” (6.5 mm) on the diameter to allow for removing the heat affected areas by grinding before welding.

Either the heli-arc (electric arc) or metallic (T.I.G. – tungsten inert gas, or M.I.G. – metallic inert gas) methods may be used for welding. The sequence of welding passes for both alloy and stainless is the same as outlined for carbon steel.

**COPPER NICKEL:** Use the same welding procedure as shown for carbon steel, with the following considerations:

In the hole cutting procedure, a hole saw or drill bit is recommended for cutting small holes. Use an abrasive cutting wheel for large diameter holes (outlet sizes 4” (10 cm) and larger).

The heli-arc or metallic method of welding is recommended. Either method may be used with a coated rod.

3. **Post welding.** It is advisable to follow stress relieving procedures at once. The stress relieving temperature should be determined by the type of alloy and the engineer’s recommended specifications procedure. If however, this is not feasible, a post heat of approximately 600° F (316° C) should be applied to the welded section. (Note: Stainless steel excepted!). The whole area should then be wrapped with an appropriate welding cloth and allowed to cool slowly.

4. **Follow-up inspection:**

   a. Inspect the external acme threads to ensure freedom from weld spatter. If there is any evidence of weld spatter this should be carefully removed by filing.

   b. Inspect the internal threads, bore and seat to ensure freedom from weld spatter. If there is any evidence of weld spatter, appropriate tools should be used to chase or re-tap the threads (Thread Tap Assembly #125111, or ream the bore and seat (Ball End Mill Assembly #612015-7.12 for reaming the bore, and Seat Reamer Assembly #125125 for the seat).
c. Inspect the internal bore below the seat, the interior surface of the weld area and the internal surface of the hole through the pipe or vessel wall. These surfaces should be ground or reamed, as necessary, to ensure a full ID opening of 1-3/8” (1.375” or 34.9 mm) throughout. Extreme care must be taken to eliminate any contact of the grinding tool with the internal threads, the internal bore above the seat, or the internal seat, as these are close to tolerance, machined areas directly involved in ensuring proper sealing of the plug assembly and its seals and packings.

d. Upon completion of the above inspection and any stress relieving, a Cosasco solid or hollow plug assembly should be threaded into the body and fully seated. The plug assembly should be capable of insertion and full seating easily, using a 12” crescent wrench. (Full seating implies that the top of the plug assembly should be slightly below the level of the top of the body – approximately 1/16” or 1.6 mm). If the plug assembly is tight, the access fitting body may be warped or distorted and the internal threads should be chased with a Thread Chaser Assembly #125102 designed for this purpose. If after this step, the plug assembly still cannot be inserted easily, the installation should be redone with a new Access Fitting body, observing each of the guidelines or considerations indicated in this Manual, as applicable.