

FLUOROCARBON LININGS

SPECIFICATION FMS 10

Methods for Field-Flaring PTFE, PVDF, and Polypropylene Lined Pipes

Field - Flaring of Fluoropolymer Linings

This specification defines the procedures for manufacturing field-flare pipes lined in PTFE and PVDF.

Flanges are attached by welding. Usually a slip-on flange is welded to one end, and a lap collar and loose flange are attached at the other end. If weld neck flanges are used, the weld bead inside the bore must be removed.

The inner edge of the flange must be radiused to at least 1/8in, to allow a smooth transition of the liner from the bore to the flange face.

1/8in vent holes must be drilled in the pipe before lining. The inside edges of the vent holes must be completely de-burred before lining, to avoid scoring of the liner during the flaring procedure

Caution

Field flare pipes must be stored in cool dry conditions, to avoid the build-up of rust in the pipe bores, and to prevent liner relaxation. Both of these conditions will cause jamming of the liner in the pipe, preventing flaring.

The problem may be overcome by thermal treatment at the manufacturer's premises. Contact the Fluoroline technical department for advice.

Liners are sized to their own pipes, so, if removed, they may not be interchangeable with other pipes. Liners must be kept cold, and replaced as quickly as possible in their original pipes, if completely removed.

Equipment Required:

1. Drive plug (one per NPS)
2. Drive bolt
3. Cutting ring (one per NPS)
4. Expander (one per NPS)
5. Expander wrench to suit.
6. Flaring head (one per NPS)
7. Dial thermometer
8. Heat source capable of reaching 850⁰ F.
9. Leister "Electron" or similar hot air gun for flaring PVDF only.

Preparation of Pipe

Forged steel or plate flanges can be used. Backing gaskets are not required and are not recommended, as it is difficult to radius the gasket edge to the same profile as the flange edge.

The following table is referred to in later stages of the procedure.
Wall thickness "T" in

Nominal Pipe Size	Heavy Duty PTFE	Heavy Duty PVDF
1	0.125	0.100
1.5	0.125	0.100
2	0.125	0.100
3	0.125	0.100
4	0.167	0.125

6	0.207	0.145
8	0.25	0.160

The original pipe length must be enough to allow for excess liner to produce two flares of appropriate diameter

The steel pipe is cut so that its length is the finished pipe length minus 2 x relevant liner thickness T.

e.g. if a finished length of 96in is required in 3 NPS HD PTFE lined pipe, the calculation is as follows;

$$\text{Cut length} = 96 - (0.125 \times 2) = 95.75\text{in.}$$

The excess length required to form the flares is tabulated below.

NPS	1	1.5	2	3	4	6	8
Excess (A) in	2.3	3	3	3	3.35	3.75	4

Cutting Procedure

The procedure is designed to produce a pipe L-2T long over the FLANGE faces (L long over the flare faces).

1. Make sure that there is sufficient liner inside the pipe to produce a liner length L+A. Use a power saw or grinder to produce a square cut, removing excess pipe. Do not use a cutting tool that can distort the bore or the cut edge. This would prevent movement of the liner.

2. De-burr the cut edge. Cut the pipe to L-2T+A plus an excess for minor trimming, say 20 mm.

3. Use the drive plug, bolt and a hammer to drive the liner 4 1/2in or more from the cut end. Drill two 3 mm holes diagonally opposite to each other 100 mm from the cut end. De burr the drill holes.

4. Repeat para 3, but drive the liner to at least 6in from the pipe end.

Flange Attachment

Steel slip on flanges and lap collars with loose flanges are normally used. Collars must have a weld -prep chamfer on the outside face (as fitted to the pipe).

1. Position the flange or lap collar with its outside face in line with the pipe end.

2. Wrap a wet cloth round the pipe 5in from the back of the flange or collar to act as a heat sink for the welding process.

3. Tack, true-up and fully back weld the flange/collar. Run a partial penetration butt weld into the face between the flange/collar ID and the pipe OD to act as a seal.

4. Grind or machine a 1/8in min. radius on the exit of the pipe bore.

5. Thoroughly clean and cool the pipe end.

6. Drive the liner from the non-welded end as in step 4 of the previous paragraph.

7. Repeat steps 1 - 5.

8. Position the liner so that equal portions protrude from the ends.

Flaring Procedure

1. Cut the protruding lengths of liner at the flange faces to dimn. A divided by 2. Use a cutting ring if provided. Clean up edges with a sharp blade and remove sawdust etc. from inside the liner.
2. Fit the expander inside the liner, and fit the expander wrench to the expander nut. Move the wrench so that the index groove on the stem of the wrench lines up with the edge of the protruding liner. Tighten the assembly, preventing rotation of the expander by fitting a steady bar through the hole in the end of the expander rod. If this is not done correctly, the liner may slide into the pipe during flaring. Alternatively, the expander head may bottom out before the flare is fully formed.

Flaring HD PTFE

1. Heat the flare head by any convenient method to 730⁰F.
2. Place the flaring head on the screwed rod of the expander, with the profiled face facing the protruding liner.
3. Fit the drive nut behind the flaring head, and screw it up so that the head progressively heats and forms the liner into the desired flare shape. During this process the resistance to forward motion can be felt to decrease as the liner softens. This change should be followed so that there is no tendency for the protruding liner to collapse in towards the flange face. If the flare tends to roll back on itself as it forms, the flaring head is too hot. Release the pressure and allow some cooling to take place before reapplying pressure.
4. When the head has bottomed out, and the flare is compressed on the flange face, the pipe end should be quenched in cold water, and the flaring head left in place until the temperature drops below 100⁰F.

Flaring PVDF

1. Before preheating the flaring head, spray it lightly with silicone lubricant to prevent sticking in the flaring procedure. Preheat to 270⁰F.
2. Preheat the protruding liner using the Leister gun set on maximum temperature setting. The gun should be held at 45⁰ to the axis of the pipe. Rotate the gun round the pipe end, or rotate the pipe so that the liner is evenly heated. At 300 - 320⁰F, the liner softens. This can be detected by gently pressing out the liner using non-stick material such as PTFE rod, or a gloved finger.
3. Fit the flaring head and bring into place as described in the section preceding this.
4. Quench the assembly in cold water immediately, and disassemble when the temperature is below 100⁰F.

General Notes

As a minimum, the finished pipe should be tested using a high voltage spark tester. Pressure testing with water to 1.5 x working pressure, followed by spark testing is the recommended procedure.

Protect the flares with smooth faced plastic or wooden blanks, bolted or tied firmly in place.

Lubricate the expander screw and nuts with a non-migrating high temperature grease. Protect screw threads with the plastic sleeve provided.

Keep the rubber expanding sections free of lubricant.

Clean and polish the aluminium flaring heads to remove build-up of dirt and silicone lubricant residues.

Field-Flaring of Polypropylene Liners

This specification defines the method of flaring polypropylene-lined pipes using a melt-flaring technique. The size range covered is 1, 1.5, 2, 3 and 4 NPS.

Equipment Required

1. Leister hot air gun
2. Heating heads (one per NPS). CPT 95 sheet 4 of 6
3. Heating head support pins (Pairs). CPT 95 sheet 5 of 6
4. Liner cutting template (one per NPS). CPT 95 sheet 5 of 6
5. Liner driving plug (one per NPS). CPT 95 sheet 6 of 6
6. Driving plug bolt. CPT 95 sheet 6 of 6
7. Allen key for actuator bolt
8. PTFE tube (nom. 1 OD x 10 long)
9. Silicone spray lubricant
10. Moulding head assembly comprising:
 - 1 mould actuator to suit all allowed flange variations. CPT95 sheet 3 of 6
 - Flare head (one per NPS). CPT 95 sheet 3 of 6
 - Flare head outer ring for ANSI #150 CPT 241
 - 2 pairs dowel pins. CPT 95 sheet 2 of 6
 - 1 pair taper keys. CPT 95 sheet 2 of 6

Method

Storage and other precautions as described in FMS 10A apply to polypropylene lined field-flare pipe.

Pipe cutting, liner movement, drilling and welding are described in FMS 10A pages 2 and 3.

Flaring

1. Fit the appropriate flare head outer ring to the actuator using the cap-head screws provided. Fit the dowel pins through the outer ring on the correct PCD to suit the pipe flange. Offer the assembly up to the pipe flange to verify correct assembly.
2. Fit the heater head to the Leister gun. The nose in the centre should fit inside the projecting liner, and the inner concentric cylinder should fit outside the liner. This will allow hot air to flow around the outer surface of the liner and be deflected on to the inner surface, before exhausting at the open opposite end of the pipe. The opposite end must be kept open to allow correct air flow
3. Switch on the Leister gun and set the Triac control on the back of the gun to "6". Support the gun so that it cannot cause damage during the preheating process. Allow the temperature to stabilise for 5 minutes.
4. Check that the liner is correctly positioned, and that sawdust and loose fibres have been removed. Fit the heater support pins in the lowest pair of bolt holes, and rotate the pipe so that the chord between them is horizontal. Lubricate the PTFE tube with silicone spray, keeping it to hand, in a clean condition

5. Position the head over the projecting liner, and rest the head on the support pins with the outer skirt of the head in contact with the flange face.
6. Periodically, partly withdraw the head and check the appearance of the heated liner.
7. When the liner is transparent down to the edge of the flange face, it is ready for flaring. If the melt has not progressed sufficiently into the projecting liner, a crack will be formed behind the flare. This can seriously affect the service life of the pipe.
8. Remove the heater head and support pins.
9. Use the previously lubricated PTFE tube to spread the molten liner across the flange face, keeping it within the notional raised face of the flange.
10. Quickly position the moulding head over the flange face, and lock into position with the taper keys.
11. Using the Allen key, screw the actuator so as to push the inner of the moulding head into contact with the liner. Continue to turn the Allen key until no further movement can be made. Leave in position for 2 minutes.
12. Slacken off the actuator, remove the taper keys, and remove the moulding head.
13. Ensuring that there has been no dirt pick-up on the mould head, repeat from clause 3 on the other end of the pipe.
14. Inspect both flares for surface finish. Radial grooves may prevent effective sealing.
15. Spark test the flange faces and bore of the pipe at 25 kV for possible leak paths.
16. Preferably test the pipe to 29 bar (425 psig) with clean water.