



**LP-105 Installation Procedure
For LOKRING™
Carbon Steel, Stainless Steel (CRES), and Copper Nickel
Pipe and Tube Fittings**

LOKRING™ fittings: MAS-3000 micro-alloyed carbon steel pipe fittings; SS40 and SS-3300 Type 316L stainless steel (CRES) pipe fittings; CN-200 Type 90/10 and CN-700 Type 70/30 copper nickel pipe fittings; SS40, SS-3000 and SS-3300 Type 316L stainless steel (CRES) tube fittings; CN-3300 and CN-700 Type 70/30 copper nickel tube fittings, other Lokring fittings

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1.0 SCOPE

The handling, installation and inspection of LOKRING™ fittings should be carried out only by qualified, trained personnel. This LOKRING Installation Procedure provides the instruction and procedures necessary to qualify an individual as a trained LOKRING installer. Contact your local LOKRING distributor or LOKRING Technology for more information regarding installation training (for specifics see us at our website, www.lokring.com).

LOKRING couplings and fittings are ideally suited for fast-track or cost-effective fabrication of small bore piping and tube systems and field modification and repair of existing piping and tube systems. When used, LOKRING couplings and fittings provide a cost effective alternative to field welding or flanging. By using couplings and fittings (e.g., tees, elbows, reducers, and flanges) with matching straight pipe or tube, an entire piping system can be mechanically assembled without any hot work. This increases safety and reduces costs and rework especially for pre-fabricated spools.

Use of LOKRING couplings and fittings is consistent with good engineering practice in the design and construction of piping and tube systems. Where pressures, temperatures, or services require conformance with national standards to pressure piping, LOKRING couplings and fittings have been designed and manufactured to meet the requirements of those standards. The various ASME book sections which comprise the ASME Code for Pressure Piping, B31 (which are often referred to as codes themselves) have requirements with which non-standard and proprietary piping, tube and product forms and assemblies can be qualified for use in piping/tubing systems which are intended to conform to those codes.

As a manufacturer of non-standard proprietary product forms and assemblies, LOKRING provides design, materials, and workmanship conforming to the requirements of the ASME B31.1, 31.3, 31.4, 31.8, 31.9 codes (reference section 9.0 items 1, 2, 3, and 4). Finally LOKRING has developed this installation procedure to ensure that the final assembly and installation provides a joint that conforms to the ASME B31 codes.

In addition to this Installation Guide, the following aids are available for installation training. Contact your local LOKRING distributor or LOKRING Technology for more information (for specifics see us at our website, www.lokring.com).

- LOKRING Installation Procedures Video (VHS or DVD)
- LOKRING 5-Step Installation Guide (provided in the LOKTOOL Kits)
- LOKRING Installer's Field Installation Guides (Tri-Folds)
- LOKRING internet site www.lokring.com
- Hands-on LOKRING training session by LOKRING or authorized personnel

2.0 LOKRING PIPING SYSTEM DESIGN CONSIDERATIONS

2.1 LOKRING Fitting Design

LOKRING fittings use a patented, elastic strain preload technology (ESP®) to permanently join small diameter nominal pipe (1/4" thru 3") and tube (1/4" thru 2-1/2") without threading or welding. Following insertion of the pipe or tube end into the fitting, hydraulic tooling is used to advance each drive ring axially over the fitting body, radially compressing (swaging) the fitting body on to the outside diameter of the pipe or tube.

As the pipe or tube is compressed first elastically and then plastically by the swaging action of the fitting, circumferential sealing lands machined in the bore of the fitting body grip and seal on the pipe/tube outside diameter (O.D.), forming a gas-tight, metal-to-metal seal without O-rings or other elastomeric seals. Figure 1 below shows the sealing indentations left on the pipe or tube O.D. corresponding to the sealing lands in the fitting body I.D.

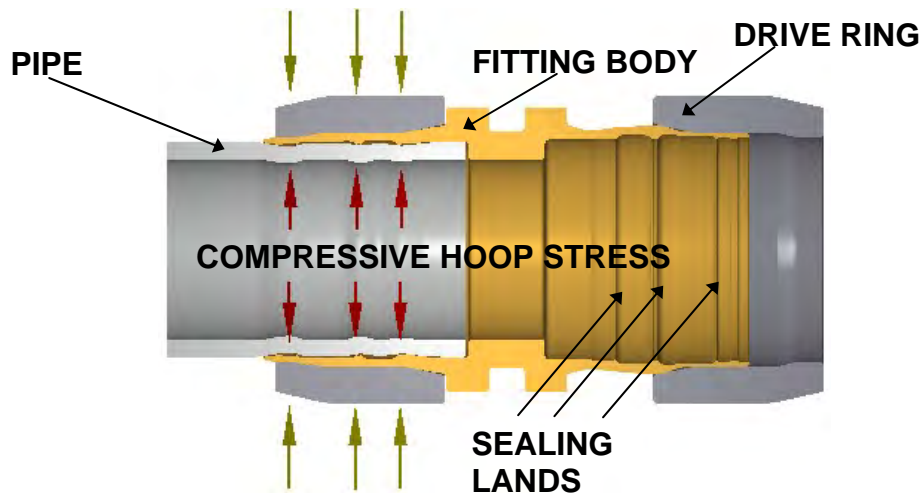


Figure 1: Installed and Sectioned Fitting/Pipe

LOKRING stainless steel (SS)/corrosion resistant steel (CRES), copper nickel, and tube (excluding 1/4") couplings and carbon steel repair couplings are designed with a "thru-bore" feature which permits the coupling to slide completely over the prepared pipe or tube end. This facilitates the repair of existing piping by eliminating the need to "spring" the cut pipe ends apart axially to install the coupling.

All other LOKRING stainless steel(SS)/corrosion resistant steel (CRES), carbon steel, copper nickel, and tube fittings have an internal shoulder (see Figure 1) which acts as a center stop for the pipe or tube when it is inserted into the fitting.

2.2 Applicable Fittings

LOKRING Carbon Steel fittings (MAS-3000 series) are designed for use on carbon steel pipe to ASTM A106 and A53. Consult LOKRING Product Specification FS-3000 for more information.

LOKRING Stainless Steel/Corrosion Resistant Steel (CRES) fittings (SS40 series) are designed for use on stainless steel pipe to ASTM A312 and carbon steel pipe to ASTM A106, ASTM A53. Consult LOKRING Product Specification FS40 for more information.

LOKRING Copper Nickel pipe fittings (CN-200) type 90/10 are designed for use on copper pipe (0.065 wall) to MIL-T-24107 and 90/10 copper nickel pipe to MIL-T-16420.

LOKRING Copper Nickel pipe and tube fittings (CN-700) type 70/30 are designed for use on copper-nickel pipe and tube per MIL-T-16420 (class 200, 90/10, class 200 70/30, and class 700 70/30)

LOKRING Stainless Steel/Corrosion Resistant Steel (CRES) tube fittings (SS40 & SS-3000-XXX-TYY series) are designed for use on stainless steel tube to ASTM A269 or A213 and MIL-P-24691/3 or MIL-T-8606. Consult LOKRING Product Specification FS40-T for more information.

LOKRING Copper Nickel tube fittings (CN-3300-XXX-T04) are designed for use on 70/30 copper nickel tube to MIL-T-16420.

See LOKRING specification LP-110 for information on LOKRING's BR series medical gas fittings.

Before using LOKRING fittings on pipe/tube with material specifications or schedules other than those included in these specifications, contact your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com).

2.3 Pressure-Temperature Ratings & Qualified Matching Pipe and Tube

Pressure-temperature ratings for LOKRING series MAS-3000 carbon steel fittings on qualified matching pipe specifications and wall schedules are summarized in LOKRING Product Specification FS-3000.

Pressure-temperature ratings for LOKRING series SS40 stainless/corrosion resistant steel (CRES) fittings on qualified matching pipe specifications and wall schedules are summarized in LOKRING Product Specification FS40.

LOKRING series CN-200 Copper Nickel pipe fittings are rated to 250 psi, -60 to 425° F.

LOKRING series CN-700 Copper Nickel pipe and tube fittings are rated to 700 psi, -60 to 425° F.

LOKRING series CN-3300 Copper Nickel tube fittings are rated to 3300 psi-60 to 425° F.

Pressure-temperature ratings for LOKRING series SS40 & SS-3000 stainless/corrosion resistant steel (CRES) tube fittings on qualified matching tube specifications and wall schedules are summarized in LOKRING Product Specification FS40-T.

Pressure and temperature ratings for LOKRING series BR medical gas fittings are listing in LOKRING installation guide LP-110.

Before using LOKRING fittings on pipe/tube with material specifications or schedules other than those included in these specifications, contact your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com).

2.4 Installer Training

The handling, installation, and inspection of LOKRING fittings should be carried out only by qualified and trained personnel. Installers should be familiar with and use good pipe fitting practice. First time LOKRING users must undergo a formal training session carried out by either a representative of LOKRING, one of its authorized distributors, or other authorized personnel. Contact your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com) for more information regarding installation training. **Appendix H** contains an installation training certification test which may be administered to, and discussed with all personnel trained to install LOKRING fittings.

2.5 Tool Selection & Safety

Correct selection and maintenance of LOKTOOL installation tooling is critical to a safe and successful application. Tooling selection is found in **Appendix C**. Safety precautions and maintenance instructions relating to the handling and operation of LOKTOOL installation tooling are found in **Appendix D**.

2.6 Pipe/Tube Preparation

LOKRING fittings will provide a permanent, gas-tight seal when installed on pipe or tube that is clean and free of deep longitudinal scratches and when installed in conformance to the installation procedures of this document. In most cases, the necessary pipe/tube surface condition can be achieved by O.D. sanding as detailed under Section **4.0 Pipe/Tube End Preparation**.

However, if the required surface finish condition cannot be met, the use of anaerobic sealant, such as Loctite[®] PST sealant (given process compatibility) is recommended. LOKRING recommends that PST always be used when installing LOKRING fittings on ASTM-A53 Type F furnace butt weld carbon steel pipe and on galvanized carbon steel pipe.

Note: Final determination of compatibility with Loctite[®] sealants is the sole responsibility of the user. Use of PST sealant limits temperature rating to 400°F maximum. See Appendix E for service guidelines.

2.7 Fit-Up Considerations When Installing LOKRING Fittings

Pipe/tube lengths or spool pieces to be joined must be properly aligned and supported before making-up the LOKRING fittings. Installation of LOKRING fittings on misaligned pipe or tube (see Fig.2), can result in damage to the fitting sealing teeth, with possible loss of integrity of the metal-to-metal seal.

Fittings should never be "forced" onto or over misaligned pipe or tube, nor should fittings be used to fixture, hold or align misaligned pipe or tube ends prior to creating or "LOK"-ing the fitting. Pipe/tube should be aligned, supported, and clamped into place before installing LOKRING fittings.

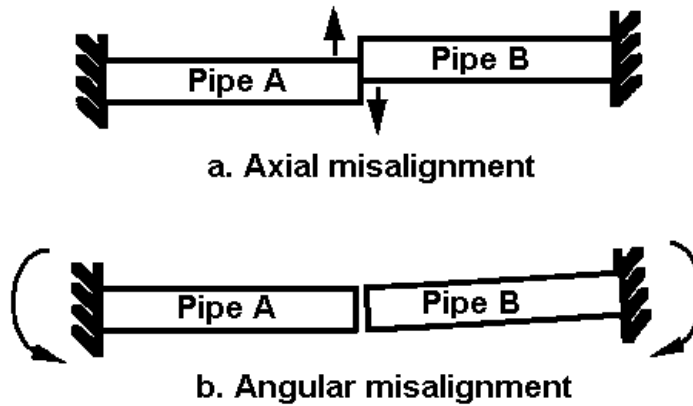


Figure 2: Examples of Pipe/Tube End Misalignment

2.8 Torsional Abuse

Excessive application of torque after installation (fitting LOK) can cause the pipe or tube to rotate or twist inside the fitting. This can cause galling of the fitting sealing lands, and may compromise the integrity of the metal-to-metal seal.

Excessive application of torque is most likely to occur during fit-up when a fitter tries to force two misaligned pipe or tube ends together. By applying a force to the end of the unsupported (free) pipe/tube end, a torque is transmitted to fittings already installed further downstream.

This is demonstrated in Fig.3. Where a force (F) applied to the free pipe end length (L) causes a torque moment (F x L) to be transmitted to the down leg of the already installed LOKRING elbow.

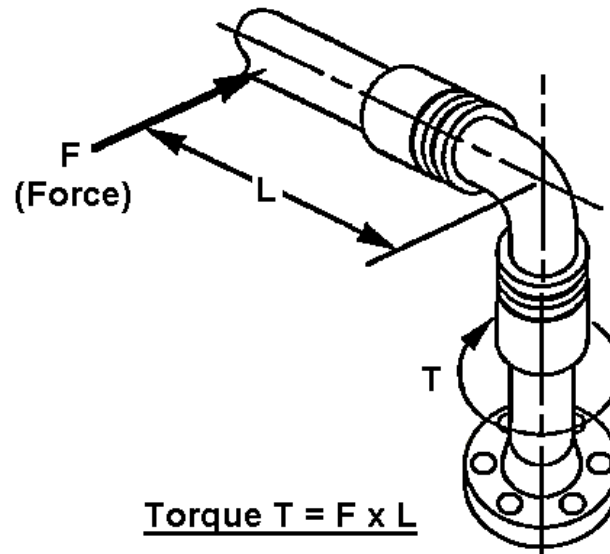


Figure 3: Application of Torque Loads During Fit-Up

The potential to apply excessive torque during fit-up can be virtually eliminated if pipe/tube ends are properly aligned and supported before fittings are LOK-ed. In addition, this will help to ensure that no residual bending or torsional stresses or preloads exist in the installed system, and that the piping system will be "plumb" and straight.

2.9 Tips for Efficient LOKRING Installations

1. When installing LOKRING Fittings, piping and tubing should be:
 - a) Cut to length
 - b) Prepared according to LOKRING: pipe/tube end procedures (see Section 4.0),
 - c) Aligned, supported, and clamped into place before final LOKRING fitting LOK.

For example: Bolt up the LOKRING flange to the valve or pump for alignment and optimal flange sealing before making up the LOKRING connection.

2. When possible, field run your system by "stove piping" it together. In other words, erect and clamp into place most or all of your piping system before finishing your LOKRING connections. This allows the installer to make piping alignment and length adjustments without rework or damage to previously installed LOKRING fittings.

To do this, on the ground or in the shop, install no more than one side of a LOKRING coupling, elbow, tee, etc. on a section of pipe/tube. Bring it into position and clamp it into place. When you have erected most or all of your system, LOK the final LOKRING connections and inspect the installations.

3. Following the LP-105 Installation Procedure will allow for fast, safe, and successful LOKRING installations. When reviewing this and other sections, please keep in mind three potential areas where installation errors may occur:
 - a) Inadequate pipe/tube end preparation (section 4.0)
 - b) Pipes/tubes not adequately inserted into the fitting (sections 7.2, 7.3, & 7.4)
 - c) Misalignment and/or lack of proper pipe/tube support (sections 2.6, 2.7 & 2.8)

3.0 LOKRING INSTALLATION TOOLING

3.1 LOKTOOL MTK Kits (See Appendix C)

MTK (Maintenance Tool Kits) kits contain all the LOKRING tooling required to install multiple sizes of LOKRING fittings. For example, the MTK60-MAS/SS4-P16/P24/P32-FR kit shown contains all tooling to install the 1", 1½", and 2" LOKRING carbon and stainless steel fittings.



3.2 Accessories for Pipe/Tube Preparation

- **Aluminum Oxide Cloth:** 60# Grit (Coarse) and 120# Grit (Fine)
- **Hacksaw:** reciprocating or band saw
- **Half Round File:** for ID/OD deburring:
- **(Optional) Anaerobic Pipe Thread Sealant:** Loctite® compound PST-567



Figure 4: Tool kit and Accessories

3.3 Hydraulic Pump & Hose

Three different sources of hydraulic power may be used to install LOKRING fittings. Manual, electric (110 or 220 Volt or battery), and pneumatic pumps are available from a number of manufacturers through LOKRING or direct. All pumps must be single acting, automatic dump, with a 10,000 psi rating. When supplied by LOKRING these pumps come equipped with quick disconnect hydraulic fittings that mate to hydraulic hose and LOKTOOLS supplied by LOKRING. Consult the factory for replacement fittings



Figure: 5: Hydraulic Pump & Hose Options

- **Electric Pump (top center) PUMP-OTC-QTRHRSE-ELEC:** Foot operated, high speed pump, best selection for high volume installations of larger size fittings.
- **Pneumatic Pump (bottom left) PUMP-TURBO-AIR-QD:** Foot operated, lightweight, pneumatic pump, operates off shop air (80 psi/minimum). Fast and suitable for installation of LOKRING fittings in atmospheres which need to be fire safe.

- **Manual Pump (top left) PUMP-P-19-QD (smaller) or Pump-P-392-QD (larger):** Manually operated, designed for low volume installations (or emergency repairs) where there is limited or no access to electricity or compressed air, or for atmospheres which need to be fire safe.
- **Portable LOKTOOLS (top right):** Manually operated hydraulic pump connected directly to LOKTOOL head, where there is limited or no access to electricity or compressed air, or for atmospheres which need to be fire safe.
- **Hydraulic Hose Assembly (bottom center) HH15-QD:** 15 ft hose for all fitting sizes, pumps, and tool heads. Two or more hoses can be connected together to form longer lengths.

4.0 PIPE/TUBE END PREPARATION

4.1 Definition of LOKRING Sealing Zone

LOKRING fittings seal on the outside diameter of the pipe/tube. The LOKRING Sealing Zone is defined as the area on the surface of the pipe/tube extending 1-½ pipe/tube diameters from the end of the pipe/tube. See figure 6.

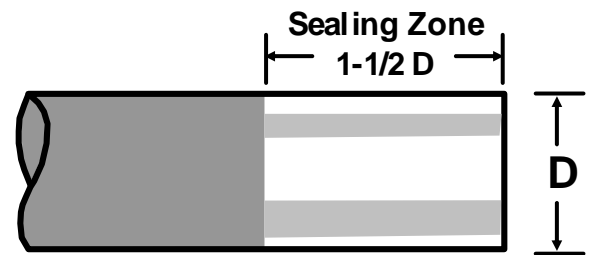


Figure 6: Sealing Zone

The Sealing Zone must be clean and free of deep longitudinal scratches in order to ensure a leak free, metal-to-metal seal. Make sure not to clamp the pipe/tube in a vise or a pipe wrench in the Sealing Zone. When cutting and deburring pipe/tube ends, care must be taken to protect the Sealing Zone from scratches and vise jaw marks.

NOTE: If installing Lokring Fittings on Electric Resistance Welding (ERW) pipe/tube, special consideration should be given to the quality of the weld seam. See section 4.6 for details.

4.2 Cut Pipe/Tube Ends Square to $\pm 5^\circ$

Cut pipe/tube squarely with hacksaw, cutting wheel or reciprocating saw to no more than 5° off-square. See figure 7. Be careful of cutters that can flatten or deform pipe/tube ends such as a wheeled pipe cutter. Flattened or deformed pipe/tube ends caused by cutting equipment should not extend more than 1/16th" (** approx. equivalent to where the 5° ends) beyond the end of the pipe/tube. Leave a minimum straight pipe/tube or spool length equal to the "B" Dimension in **Appendix A**.

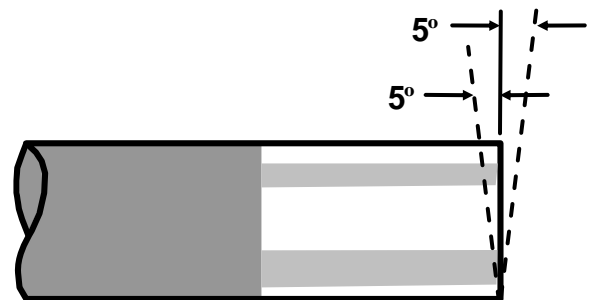


Figure 7: Squareness of cut

When cutting pipe/tube, to minimize the possibility of OD burrs and to reduce OD filing; care should be taken to:

- 1) Use the proper cutting wheel for the pipe/tube material
- 2) Use cutting wheels which are in good condition (dull wheels will result in fat OD burrs),
- 3) Not over tighten the cutter on each turn or rotation. Too much pressure results in a larger burr.

Note: To minimize the gap between pipe/tube end(s) and/or the internal shoulder of the fitting, pipe/tube ends should be squared (faced) using a Tri-Tool (or equivalent) pipe facing tool prior to fit-up.

4.3 Deburr Pipe/Tube I.D. and O.D.

Remove inside and outside burrs in accordance with good pipe fitting practice. Exercise caution when cutting into existing piping systems, and when deburring pipe/tube ends to prevent metal filings from contaminating the system. See figure 8.



Figure 8: Deburr

4.4 Sand Pipe/Tube Ends

Sand the Sealing Zone with 120 grit aluminum oxide abrasive cloth in circumferential direction to clean surface and remove longitudinal scratches, flat spots, paint, lacquer or other mill finishes, corrosion, grease, sand, and grit. See figure 9a. If deep scratches, pits or other surface incongruities persist; use of 60 grit, aluminum oxide abrasive cloth followed by 120 grit cloth is recommended.



Figure 9a: Sanding Preparation

Always sand around the circumference of the pipe/tube. See figure 9b. **DO NOT** sand along the longitudinal axis of the pipe/tube. This can result in undesirable flat spots on the sealing surface.

Notes: When using a belt sander, flapper wheel or other mechanical device, rotate the pipe/tube during sanding, and ensure that the sanding belt is perpendicular to the pipe/tube and move continually around the OD of the pipe/tube and DO NOT sand along the longitudinal pipe/tube axis. DO NOT use grinders or files on the Sealing Zone.

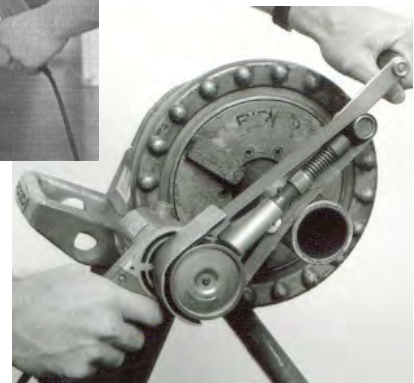


Figure 9b: Sanding Preparation Tools

4.5 Inspect Sealing Zone

Visually inspect Sealing Zone for deep scratches, flat spots, etc. See figure 9c. If any of the Bad Pipe/Tube Surface conditions outlined in Paragraph 4.6 exist, proceed to Paragraph 4.7. If none of these conditions are present, proceed to Paragraph 4.8, as no further preparation of the Sealing Zone is required.



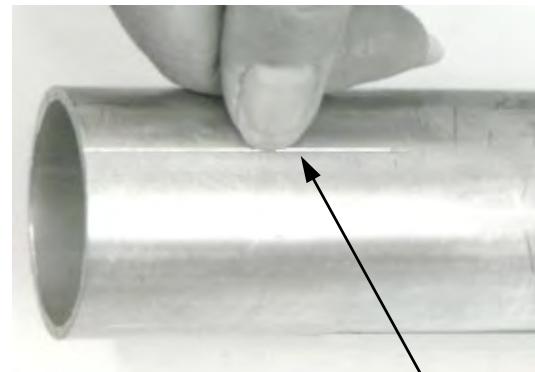
Figure 9c: Sanding Preparation Inspection

4.6 Bad Pipe/Tube Surface

4.6.1 Longitudinal Scratches / Pits or Surface Incongruities

Longitudinal scratches can act as "leak paths" under the sealing teeth of the fitting if they are too deep.

Check for surface scratches by running a thumbnail perpendicular to the pipe/tube surface completely around its circumference. See figure 10a. If scratches deep enough to "catch" a thumbnail remain on the pipe/tube surface (see right), further pipe/tube end preparation is required; see paragraph 4.7.

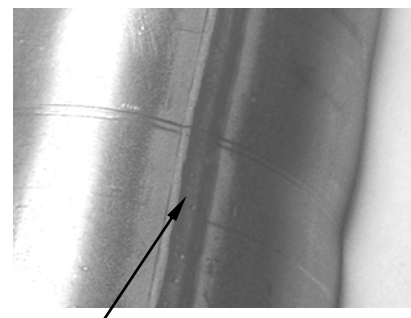


Deep Scratch

Figure 10a: Deep Scratches

Extensive work has been done in an attempt to quantify the effect on performance of the depth and degree of surface incongruities. Due to the combined effects of dimensions, tolerances, pipe/tube hardness, wall thicknesses and other factors, results are conditional. Consult your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com) if you have questions.

4.6.2 Considerations for ERW Pipe/Tube



Weld suck-back

4.6.2.1 Weld Seam Suck-back

On ERW (electric resistance welded) pipe/tube, pay particular attention to the quality of the weld seam (see figure 10b). Poor control of the weld at the weld seam can result in a visible depression, or suck-back along the weld seam. This suck-back, like a longitudinal scratch, can provide a potential leak path for small molecule fluids and gases. Further pipe or tube end preparation is required; go to paragraph 4.7

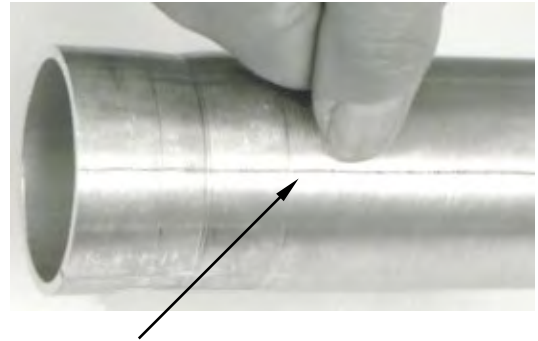
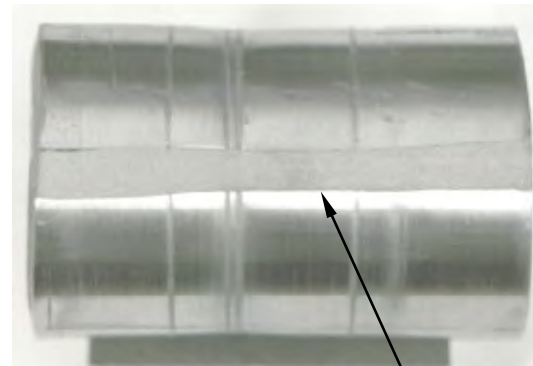


Figure 10b: Weld Seam Suck Back

4.6.2.2 Flat Spots

On ERW (electric resistance welded) pipe/tube, poor O.D. weld bead removal at the manufacturer can result in a flat spot at the weld seam (shown at right) over the length of the pipe/tube (see figure 10 c). Leak paths can occur at the center of this flat spot where the round fitting is unable to conform to and seal on the flat section of the pipe or tube's O.D. Further pipe/tube end preparation is required; go to Paragraph 4.7.

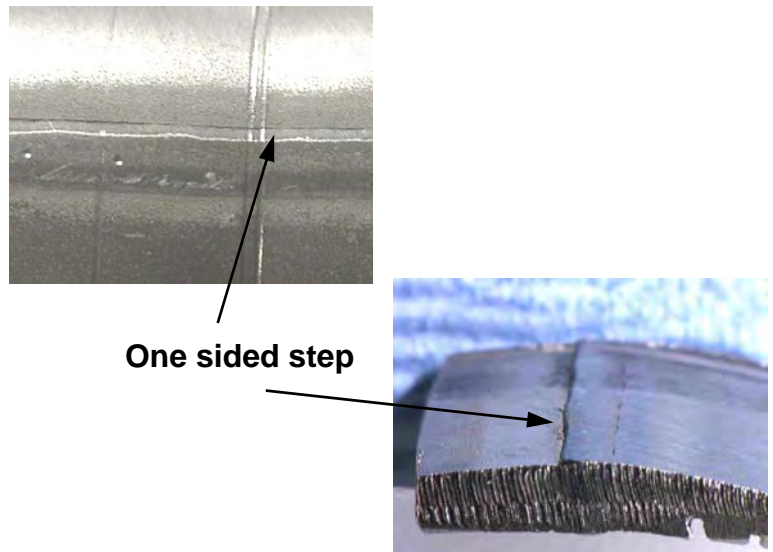


Flat Spot

Figure 10c: Flat Spots

4.6.2.3 Weld Seam Misalignment

On ERW pipe/tube, misalignment at the weld seam of the two mating sides during pipe production may result in a step-down of the O.D. (see figure 10d). This change in diameter can cause leak paths on installed fittings. Care must be taken to remove any step-down. To remove this defect, further pipe/tube end preparation is required; go to Paragraph 4.7.

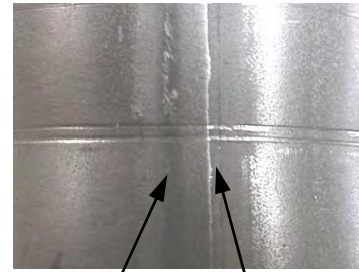


One sided step

Figure 10d: Seam Misalignment

4.6.2.4 Weld Seam Re-enforcement

On ERW (electric resistance welded) pipe/tube, incomplete weld bead removal at the manufacturer can result in a high spot at the weld seam (shown at right, figure 10e) over the length of the pipe/tube. Leak paths can occur due to this condition. Further pipe/tube end preparation is required; go to Paragraph 4.7.



Two sided step

Figure 10e: Seam Reinforcement

4.6.3 Other Surface Defects

Corrosion/Pitting: The surface of pipe/tube, especially carbon steel, which has been in the field for some time can become badly pitted and corroded; when installing LOKRING fittings on badly corroded pipe/tube, special care should be taken during sanding to remove corrosion products. Where deep pits cannot be removed by sanding, the use of PST is recommended. **If the corrosion is too severe a proper seal may not be obtained.**

Out-of-Round: Pipe/Tube with out-of-round (oval) cross-section can result either from poor quality pipe/tube finishing operations (e.g., drawing-straightening), or during transportation and handling. Use the Multipurpose Gauge to measure the OD of the pipe/tube (paragraph 5.2). If pipe/tube is determined to be out-of-round, go to paragraph 4.7.1. below.

4.7 Suggested Approaches to Bad Pipe/Tube Surface

If any of the Bad Pipe/Tube Surface conditions exist, use one of the following three alternatives:

4.7.1 Cut Pipe/Tube Back

Cut pipe/tube back to an area clear of surface condition problems, and repeat the Sealing Zone preparation steps from paragraph 4.2.

4.7.2 Continue Sanding Pipe/Tube Surface

Continue to sand Sealing Zone circumferentially with coarse grit (60#) aluminum oxide cloth as per paragraph 4.4 to remove the Bad Pipe/Tube Conditions. **DO NOT** sand along the axis of the pipe/tube. Also, do not sand the pipe/tube below the minimum OD tolerance specified in Table 1.

4.7.3 Application of PST sealant

If sanding is not effective in removing the Bad Pipe/Tube Conditions, or is too time-consuming, an anaerobic pipe/tube thread sealant such as Loctite® PST #567 may be applied to the pipe/tube surface within the Sealing Zone in lieu of further sanding. When used, anaerobic sealant is applied following Pipe/Tube Gauging and Marking. See paragraph 5.4 for application instructions.

Note: For carbon and stainless steel piping, a thin coat of Loctite® 567 PST may be applied as an aide to seal where pipe surface is poor, and is suggested for Sch 10 pipe and thinner

Note: For stainless steel tubing, a thin coat of Loctite® 567 PST may be applied as an aide to seal where tube surface is poor, and is suggested in applications where the tube wall thickness to OD ratio is less than 0.07.

Note: For automotive paint applications, a thin coat of Loctite® 567 PST is required and is strongly recommended for other applications which must seal gas tight where the tube wall thickness to OD ratio is less than 0.07. The use of PST compensates for minor tube imperfections. For example, a 1 ½” OD tube with 0.065” wall would have a ratio of 0.043 and should have PST applied.

When used, anaerobic sealant is applied following Pipe/Tube Gauging and Marking. See paragraph 5.5 for application instructions.

4.7.4 Contact LOKRING

If there are any further concerns, contact your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com) for assistance.

4.8 Clean Pipe/Tube Ends of Debris

Remove all metal filings, grit, etc. from the outside and inside surfaces of the pipe/tube after pipe/tube end preparation. Visually examine the Sealing Zone prior to fit-up to ensure that the desired surface condition has been obtained.

5.0 PIPE/TUBE END GAUGING & MARKING

5.1 The LOKRING Multi-Purpose Gauges

The LOKRING Multi-purpose Gauge ("MPG") is an instrument included in each LOKTOOL Kit which is required for the proper installation of LOKRING fittings. The installer uses the MPG to check the squareness of the cut, gauge the OD of the pipe/tube, and draw the **INSTALL** and **INSPECT** marks on the pipe's or tube's OD. NEVER install a LOKRING fitting without first using the MPG on the pipe/tube. Failure to do so may result in an unsatisfactory installation.

A different MPG gauge exists for use with each of the product lines that LOKRING manufactures. The current gauges are: a carbon steel fittings MPG that is black with no handle, a stainless steel fittings MPG which is grey with handle, a copper nickel fittings MPG that is red with handle, and a stainless steel tube fittings MPG which is blue with handle, in addition other gauges exist for product lines not covered in this document.

The gauges for the product lines can be seen in Figure 11.

The gauges from top to bottom are: stainless steel fittings MPG with handle, copper nickel fittings MPG with handle, tube fittings MPG with handle, and carbon steel fittings MPG without a handle.

Use only the MPG for a specific product with that product line, i.e. use the stainless steel MPG for SS40 series stainless steel fittings only, NEVER mix up the gauges across product lines

IT IS IMPORTANT THAT THE CORRECT MPG IS USED.



Figure 11: Gauges

5.2 Check for Squareness of Cut

Slide the Multi-purpose gauge (MPG) over the prepared pipe/tube end until pipe/tube bottoms out inside the gauge. Rotate the pipe or tube inside the gauge (or gauge around the pipe/tube).

If a gap appears between the pipe/tube end and the undercut lip of the MPG, the pipe/tube has not been cut to $\pm 5^\circ$ of square and must be squared off and re-inspected

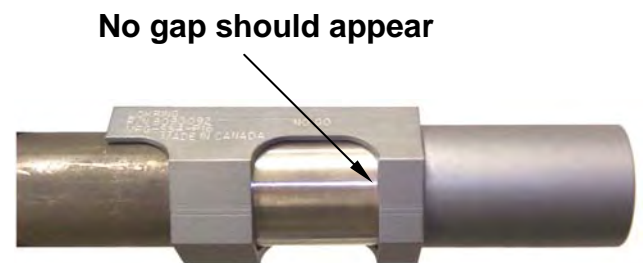


Figure 12: Squareness Check

Note: If after removing pipe/tube coatings, the pipe/tube end will not slide easily into the MPG, the pipe/tube is either over-sized or excessively oval, and should not be used.

5.3 Check for Minimum Pipe/Tube O.D.

Using the MPG furnished for each pipe/tube size, gauge the pipe/tube O.D. at two points 90° apart within the Sealing Zone. Place the NO-GO cut away of the gauge lightly against pipe/tube OD; do not force it.

If the pipe/tube O.D. passes through the gauge at either point and bottoms out in the "NO-GO", cut-out, the pipe/tube will be out of specification. This can be confirmed by measuring the pipe/tube O.D. using a caliper (or equivalent) and compared with minimum specification values (see Table 1).

Do not use pipe/tube that is undersize and bottoms out in the NO-GO cut-out of the MPG.

Forcing the pipe/tube through the NO-GO cut-out may cause it to be worn to the point where it is no longer reliable, and may require replacement.

Note: LOKRING fittings are designed to be installed on the full O.D. tolerance range of qualified matching pipe/tube specifications.

Do not use pipe or tube whose O.D. is outside of the range listed in Tables 1 and 2 below.



Figure 13: NOGO Gauge

Table 1: Pipe O.D. requirements

Pipe N.P.S.	Nominal O.D. inches	Minimum O.D. Inches				Maximum O.D. Inches			
		CS	SS	CuNi	Cu	CS	SS	CuNi	Cu
1/4 (P04)	0.540	0.509	0.509	0.535	0.538	0.555	0.555	0.540	0.542
3/8 (P06)	0.675	0.644	0.644	0.670	0.673	0.690	0.690	0.675	0.678
1/2 (P08)	0.840	0.809	0.809	0.834	0.838	0.855	0.855	0.840	0.843
3/4 (P12)	1.050	1.019	1.019	1.044	1.047	1.065	1.065	1.050	1.053
1 (P16)	1.315	1.284	1.284	1.307	1.312	1.330	1.330	1.315	1.318
1-1/4 (P20)	1.660	1.629	1.629	1.652	1.657	1.675	1.675	1.660	1.663
1-1/2 (P24)	1.900	1.869	1.869	1.892	1.897	1.915	1.915	1.900	1.903
2 (P32)	2.375	2.344	2.344	2.365	2.371	2.406	2.406	2.375	2.379
3 (P48)	3.500	3.465	3.469	N/A	N/A	3.535	3.531	N/A	N/A

Table 2: Tube O.D requirements

Tube	Nominal O.D. inches	Minimum O.D. Inches		Maximum O.D. Inches	
		SS	CuNi	SS	CuNi
1/4 (T04)	0.250	0.246	0.245	0.254	0.250
3/8 (T06)	0.375	0.371	N/A	0.379	N/A
1/2 (T08)	0.500	0.496	0.495	0.504	0.500
5/8 (T10)	0.625	0.621	N/A	0.629	N/A
3/4 (T12)	0.750	0.746	N/A	0.754	N/A
7/8 (T14)	0.875	0.871	N/A	0.879	N/A
1 (T16)	1.000	0.994	N/A	1.006	N/A
1-1/4 (T20)	1.250	1.244	N/A	1.256	N/A
1-1/2 (T24)	1.500	1.494	N/A	1.506	N/A
2 (T32)	2.000	1.990	N/A	2.010	N/A
2-1/2 (T40)	2.500	2.488	N/A	2.512	N/A

5.4 Mark Pipe/Tube Ends

Place two (2) marks (**INSTALL** and **INSPECT** marks) on the Sealing Zone on all pipe/tube ends to aid in positioning during fit-up and installation, and for post-installation inspection.

To do this, slide the MPG over the pipe/tube end until the gauge bottoms out on the pipe/tube end. With a permanent marking pen, draw two marks through the milled slots on the Multipurpose gauge marked **INSTALL** and **INSPECT**. This step may be repeated 180° around the pipe/tube to aid in assembly if access to pipe/tube once installed is difficult

Once more, visually examine the Sealing Zone prior to fit-up to verify that all necessary pipe/tube end preparation has been completed and that the **INSTALL** and **INSPECT** marks are visible.

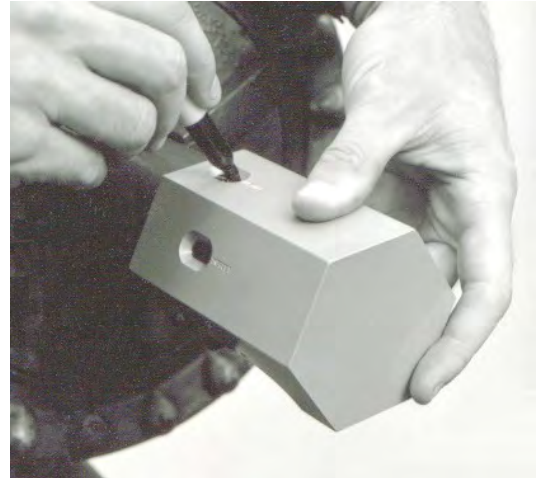


Figure 14: Marking Pipe/Tube Ends

Note: Always mark the pipe/tube prior to installation of LOKRING fittings, even for fittings with an inside shoulder which already acts as a positive stop for the pipe/tube end

5.5 How to Apply Anaerobic Sealant (Loctite PST 567)

Brush on or spread a thin bead of sealant uniformly around the pipe/tube end circumference. The PST should be applied just back from the end of the pipe/tube up to the inspect mark; care should be taken to prevent excess PST from entering the system at the pipe/tube end

If uniformly applied, a very thin layer is adequate; **DO NOT OVER APPLY.**

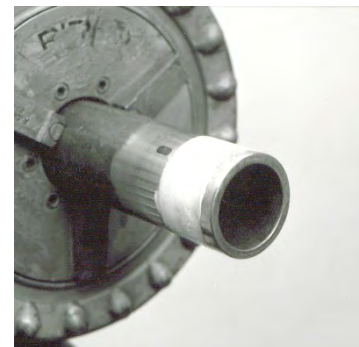


Figure 15: Sealant application

6.0 SELECTION & ASSEMBLY OF LOKTOOL INSTALLATION TOOLING

6.1 Select Installation Tooling

The installation tooling typically consists of a LOKTOOL head, two tool inserts (one body insert, one jaw insert), a multipurpose gauge (MPG), a marking pen, and a 5-step Installation Guide, a hydraulic hose, and a hydraulic pump.

Using **Appendix C** as a guide, select the appropriate LOKTOOL head, body and jaw inserts, and MPG for the fitting series and size, being installed (e.g., MAS 3000, SS40, etc.) The body inserts will fit into the LOKTOOL body, and the jaw inserts will fit into the LOKTOOL moving jaw.

Note: For 3" size fittings, the installation tool and procedures will be different, see section 6.9 for ITK100 Tool details

6.2 Secure Body Insert into LOKTOOL Body

Orient body insert into LOKTOOL body (IT60 shown) such that insert is flush with outside surface of tool body. Advance insert retention screws to secure insert into LOKTOOL body until they are finger tight. Do not over tighten screws.

Some tools may be equipped with spring loaded pins. These pins are permanently attached to the tool. To use, pull the ring to retract pin, adjust insert until jaw pin snaps into place.



Figure 16: Installation Tooling



LOKTOOL Body

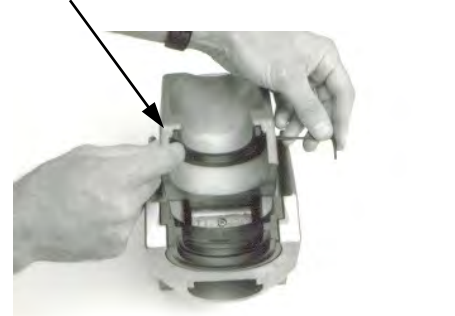
Figure 17: Installing Body Insert

6.3 Secure Jaw Insert into LOKTOOL Jaw

Orient the jaw insert into LOKTOOL jaw as shown. Secure insert into LOKTOOL jaw by advancing insert retention screw captured in tool jaw using allen wrench until they are finger tight. Do not over tighten screws.

Note: In the IT60 LOKTOOL head, insert retention screws are captured in the tool body and jaw. In all other tool heads, button head screws used to retain inserts are not captured, and must be completely removed to change inserts. Please contact LOKRING if you need replacement screws.

LOKTOOL Jaw



6.4 Connect Hose to Pump

Remove dust caps from hose nipple and pump coupler. Pull back coupler locking sleeve in pump and fully engage hose nipple into the pump coupler. Release locking sleeve to secure hose into pump.



6.5 Connect Hose to LOKTOOL Head

Remove dust caps from LOKTOOL nipple and hose coupler. Retract coupler locking sleeve and fully engage coupler axially onto the LOKTOOL nipple, then release locking sleeve (allowing sleeve to snap forward to complete connection).



Note: When using the Portable LOKTOOL, the tool Head will be directly connected to the pump, and No hoses are necessary

6.6 Advance Thread Locking Ring

If equipped advance the hose coupler thread locking ring manually against the coupler locking sleeve. This will prevent accidental separation of the installation tool from the hose during operation or transportation.

Before disconnecting, make sure thread locking ring is completely backed off. NEVER use wrenches to tighten or loosen the locking ring.



Figure 18: Installing Jaw insert and connecting tooling to pump

6.7 Cycle Assembled Hydraulic System

Advance and retract tool jaw several times without fitting to ensure that no air is trapped in system, and that hydraulic couplers are fully secured.

Keep fingers clear of the jaws during the activation cycle. Moving jaw creates pinch points, caution should be used during this process (Refer to Appendix D).

Note: If LOKTOOL jaw does not advance and retract smoothly while cycling, air may be trapped in the system, and must be removed prior to operation or the tool may require maintenance. Follow pump manufacturers instructions packaged with pump to bleed air from the system.



Figure 19: Cycling System

6.8 Routine Maintenance

Perform routine maintenance on the tooling components in accordance with **Appendix D**

6.9 ITK100 Tooling Assembly

The ITK100 Tool is unique in that the tool's design is different than the smaller tools. This tool has been designed to install 3" NPS carbon and stainless steel fittings only and does not require separate inserts. The tool comes in a kit with the following items, all of which are required for proper installation

- Tool head
- 5 foot hose (2 required)
- 15 foot hose
- "Y" adapter manifold block
- Gauge

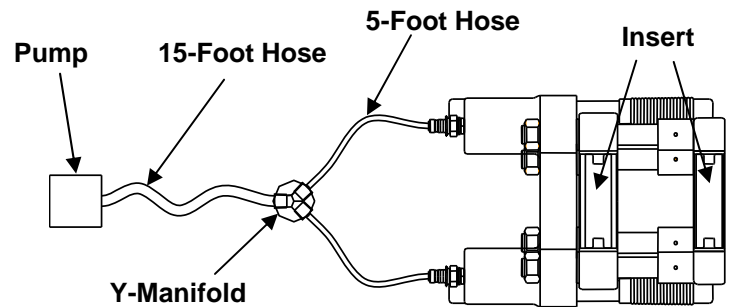
Note: On newer tools there is a direct, one hose, connection between pump and tool, there is no "Y" adapter and no 5 foot hose sections.



Figure 20: 3 inch Tooling

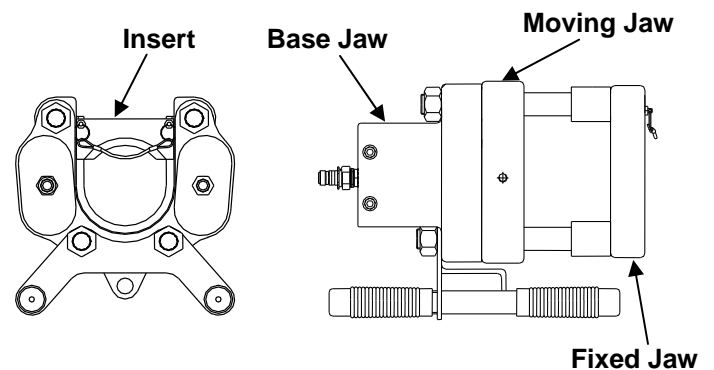
6.9.1 Connect Hose to Pump Manifold and LOKTOOL Head (Pre October 2004 models)

Connect the 5-foot hydraulic hoses to the IT100 and the “Y” manifold. Connect the 15-foot hydraulic hose to the “Y” manifold, and the hydraulic pump.



6.9.2 Advance thread locking rings

Advance the hose coupler thread locking rings manually against the coupler locking sleeves. This will prevent accidental separation of the installation tool from the hose during operation or transportation.



Before disconnecting, make sure thread locking ring is completely backed off. NEVER use wrenches to tighten or loosen the locking ring

6.9.3 Cycle Assembled Hydraulic System

Advance and retract tool jaw several times without fitting to ensure that no air is trapped in system, and that hydraulic couplers are fully secured.

Figure 21: 3 inch Tooling Assembly

Keep fingers clear of the jaws during the activation cycle. Moving jaw creates pinch points, caution should be used during this process (Refer to Appendix D).

Note: If LOKTOOL jaw does not advance and retract smoothly while cycling, air may be trapped in the system, and must be removed prior to operation or the tool may require maintenance. Follow pump manufacturers instructions packaged with pump to bleed air from the system

7.0 LOKRING FITTING INSTALLATION

7.1 Inspect Fitting

Inspect fitting to ensure grit and contaminants are not present on the interior surfaces, or on the exterior of the body where the drive ring advances.

7.2 Slide Fitting over Prepared Pipe/Tube End

Slide the LOKRING fitting over one pipe/tube end until the **INSTALL** mark (mark farthest from pipe/tube end) is partially covered by the fitting body.

Fitting should slide easily over the pipe/tube, and must not be forced. Forcing a fitting onto the pipe/tube end can damage the fitting sealing surfaces.

Note: For fittings with an internal center stop, the pipe/tube can be fully "bottomed out" against this stop. When the pipe/tube is properly cut within 5° square and bottomed out, approximately half the INSTALL mark will be covered by the fitting drive ring.

7.3 Couplings with a Thru-Bore Design

LOKRING Couplings (SS40 Series), (CN-200), (CN-700 Series), Carbon Steel Repair Couplings (MAS-3000-RCPL-PXX), and tube fitting couplings larger than 1/4" are designed with a "thru-bore" design which allows them to slide completely over the pipe/tube and eliminates the need to "spring" the pipe/tube to get the fitting position. These couplings do not have an internal center stop.

When installing these "thru-bore" design couplings, ALWAYS make sure at least part of the **INSTALL** mark is covered by the fitting before making up the LOKRING connection (1/2 coverage of the **INSTALL** mark is best).



Figure 22: Pre LOK Position

7.3.1 Using the MPG as a stop

To help in centering the pipe/tube in through bore couplings, the MPG's for stainless steel, copper nickel, tube, and carbon steel repair fittings have a handle or "plug" on one end. When installing the first end of one of these couplings on the pipe/tube, insert the plug as far as possible into one end of the coupling and the pipe/tube in the other. If you bottom the pipe into the plug, the plug will act as an artificial center stop for easier positioning of the pipe/tube.



Figure 23: Using Gauge as a stop

When the pipe/tube is bottomed out against the plug, part of the **INSTALL** mark should be covered by the fitting and part should be exposed.

Note: For information regarding installation of carbon steel repair couplings, please see Appendix F

7.4 Verify position on Pipe/Tube end

When properly inserted, at least some part of the **INSTALL** mark (mark furthest from tube end) should be visible.

Note: The length of the INSTALL mark is the pipe/tube insertion tolerance. Pipe/tube ends are properly inserted into the coupling provided that at least part of the INSTALL mark on both pipe ends is visible.

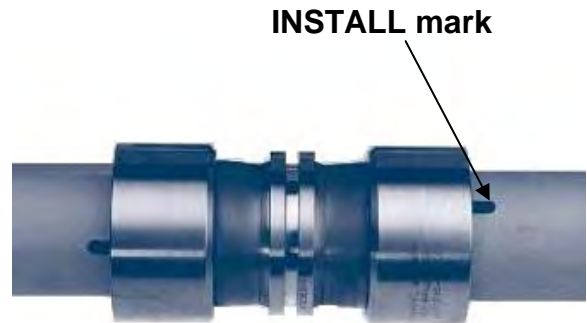


Figure 24: Verify Pre LOK Position

7.5 Engage LOKTOOL on Fitting

With the LOKTOOL jaw fully retracted, engage the tool head on the fitting.

The body insert slots into the groove between the fitting tool flanges, while the jaw insert cradles the fitting drive ring.

Newer tools are forward/reverse capable which allows for installation closer to objects that may be in the way of normal installation. Figure 25 shows a forward installation where the body insert engages the center of the coupling. With a reverse installation, the tool is rotated 180° and the jaw insert engages the coupling body and the body insert cradles the drive ring see **Appendix B**

Fitting Tool Flanges

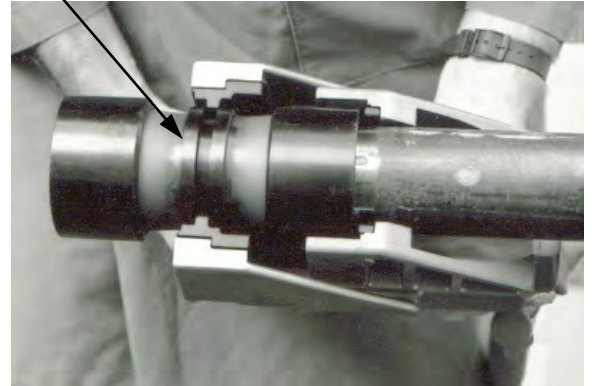


Figure 25: Tool Engaged on Fitting

Note: The LOKRING fitting must be fully engaged (bottomed out / “fully nested”) on the LOKTOOL head before hydraulic actuation. If the fitting is "cocked" in the jaws, or not fully engaged, the fitting and/or tool may be damaged during fitting installation.

7.6 Verify Marks and Fit before Actuation

Verify that fitting is properly positioned on the **INSTALL** mark on the pipe/tube one last time before actuating hydraulic power.

7.7 Actuate Hydraulic Power

This will cause the LOKTOOL jaw to advance the drive ring axially over the fitting body until it contacts the tool flange. When this happens, stop actuation of hydraulic power.

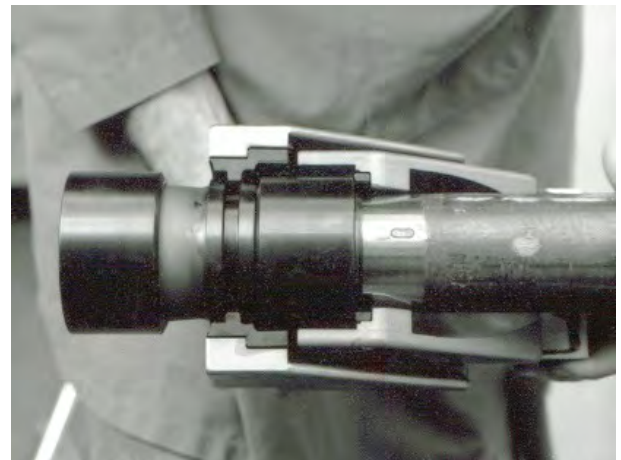


Figure 26: Drive Ring driven to Contact tool flange

Keep fingers clear of the jaws during the activation cycle.
Moving jaw creates pinch points, caution should be used during this process.

Note: During installation make certain that the coupling does not move relative the pipe/tube. Release hydraulic power when drive ring contacts the fitting tool flange.

THE FIRST PIPE/TUBE END CONNECTION IS NOW COMPLETE

7.8 Inspect First End

Remove the LOKTOOL head from the installed coupling and inspect the first end installation. The **INSTALL** mark should now be largely or completely visible, and the **INSPECT** mark must be partially covered by the trailing edge of the fitting.



Figure 27: Inspection of Installed Fitting

7.9 Insert Second Pipe/Tube End into Fitting

Verify that the second pipe/tube end is properly gauged and marked. Insert the second end into the open coupling end; it should slide easily into the fitting.



Figure 28: Insert Second End into Fitting

Again, make sure at least some part of the **INSTALL** mark (mark furthest from pipe/tube end) is visible before installing the fitting. (see section 7.4)

Note: If the pipe/tube must be forced into the fitting, it is possible that the pipe/tube ends are misaligned. Prior to hydraulic actuation, check that the pipes/tubes are properly aligned and supported to avoid pre-stressing the connection during LOK-ing (see paragraph 2.6, 2.7, & 2.8)

7.10 Engage LOKTOOL on Fitting

Turn the LOKTOOL head 180°, (or move forward to use the reverse install technique with the reversible tooling) and with the jaw fully retracted, engage the head on the uninstalled fitting end(s) and repeat steps 7.4 through 7.8.

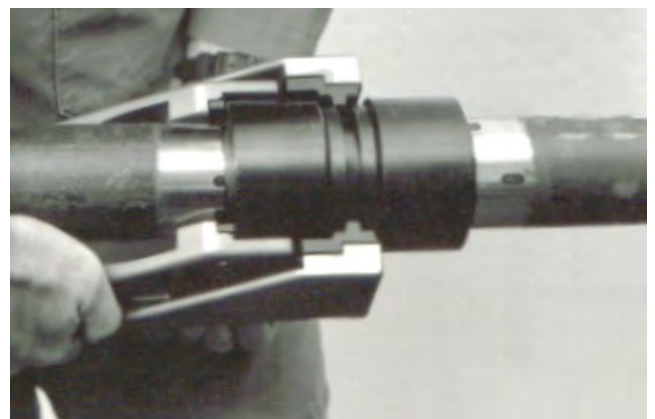


Figure: 29: Tooling Turned and Re-Engaged

THE COUPLING JOINT IS NOW COMPLETE

7.11 ITK100 Installation

Note: This section, deals only with the fitting installation for the 3 inch tooling, all other installation is discussed in section 7.0-7.10

1. Pull the lanyards to retract the spring pins on the Inserts, and remove the Inserts from the Fixed and Moving Jaws (Reverse Installation).
2. Position the P48 Fitting Body into either the Fixed Jaw (Forward Installation) or the Moving Jaw (Reverse Installation)
3. Install the Inserts into the Moving and Fixed Jaws, the spring pins will lock them into position.
4. Pressurize the IT100 until the Driver fully contacts the Connector body
5. Remove the Inserts as in step 1 and remove the P48 Fitting

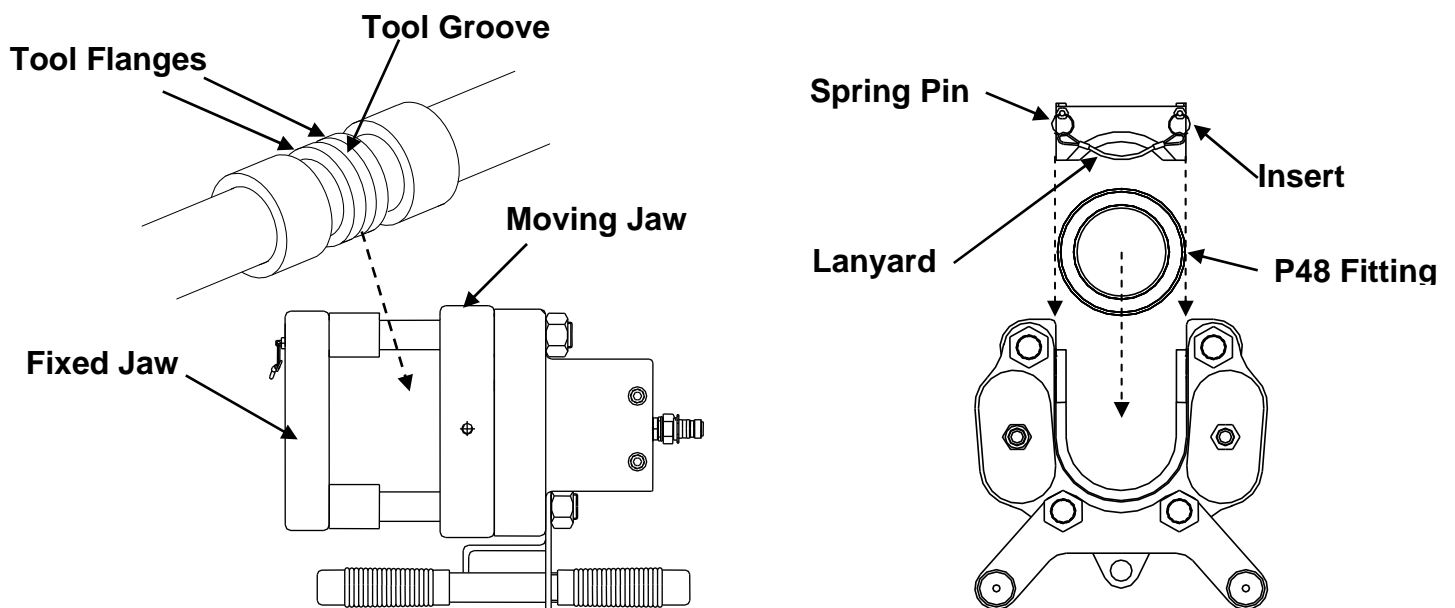


Figure 30: 3 inch Fitting Assembly

8.0 POST-INSTALLATION QUALITY CONTROL

The quality of the LOKRING connection is determined by visual inspection only; no post-installation gauge verification or dimensional check is required.

8.1 Post Installation Visual Inspection

Only a simple, three point visual check of each LOKRING connection is needed to verify a successful installation.

1. Check to see if the trailing edge of the fitting body protrudes from underneath the end of the swag ring.
2. Check to see if the **INSPECT** mark is partially covered by the fitting and that most or all of the **INSTALL** mark is exposed.
3. Check to see that the drive ring butts up against the tool flange. A small gap is acceptable as long as conditions 1 and 2 are met

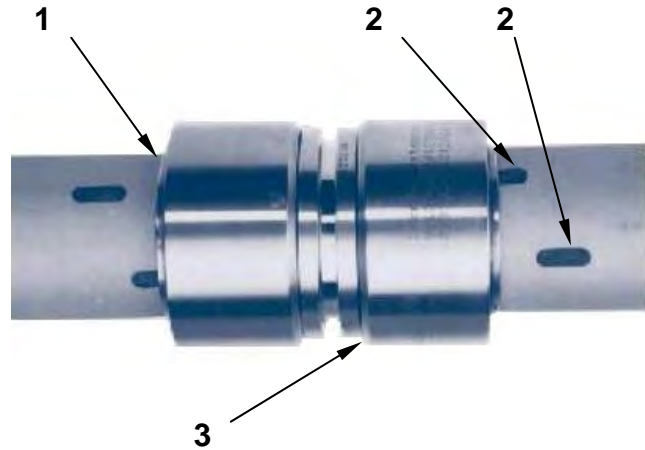


Figure 31: Post Installation Inspection

8.2 Good Installation

Each drive ring should be fully drawn up over the fitting body, and the trailing edge of the fitting should protrude from underneath the drive ring completely around its circumference. The **INSTALL** mark may be partially or completely uncovered; however, the **INSPECT** mark must be partially covered by the fitting trailing edge.

Note: A small gap between the swaging ring and tool flange is acceptable provided the fitting body extends from underneath the trailing edge of the swaging ring at all points around the circumference of the fitting.

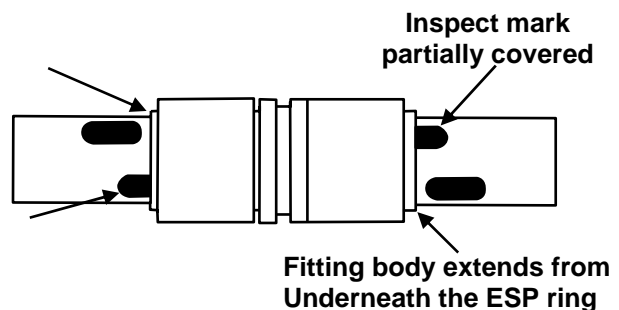
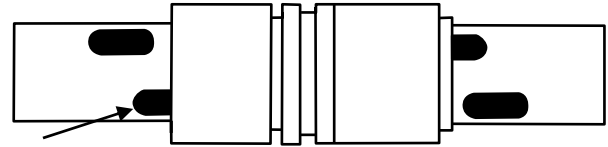


Figure 32: Good Installation

8.3 Incomplete Installation

One of the swaging rings is not fully LOK-ed onto the fitting body. The trailing edge of one side of the fitting is not fully visible underneath the trailing edge of the drive ring.

The LOKTOOL head should be re-engaged onto the incomplete side and recycled to complete the installation.



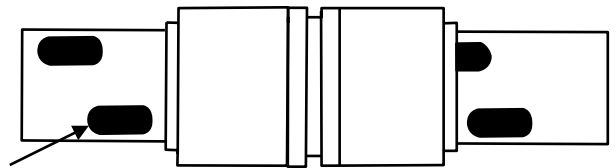
**Fitting body does not extend
 From underneath the ESP ring**

Figure 33: Incomplete Installation

8.4 Bad Installation

The **INSPECT** mark on each pipe/tube end must be partially covered by the fitting body. If the **INSPECT** mark is fully visible, the pipe/tube on that fitting leg was insufficiently inserted into the fitting and the fitting must be removed.

Note: When using stainless steel, copper nickel, and tube couplings with the thru-bore design, it is possible that 100% of the INSPECT mark on one end of the connection could be covered by the fitting body.



**Inspect mark
 not partially covered**

Figure 34: Bad Installation

This is a bad installation because it indicates that the first pipe/tube has been inserted too far into the fitting. As a result, it will not be possible for the second pipe/tube to be inserted far enough into the fitting to meet the installation requirements. Therefore, the fitting must be removed.

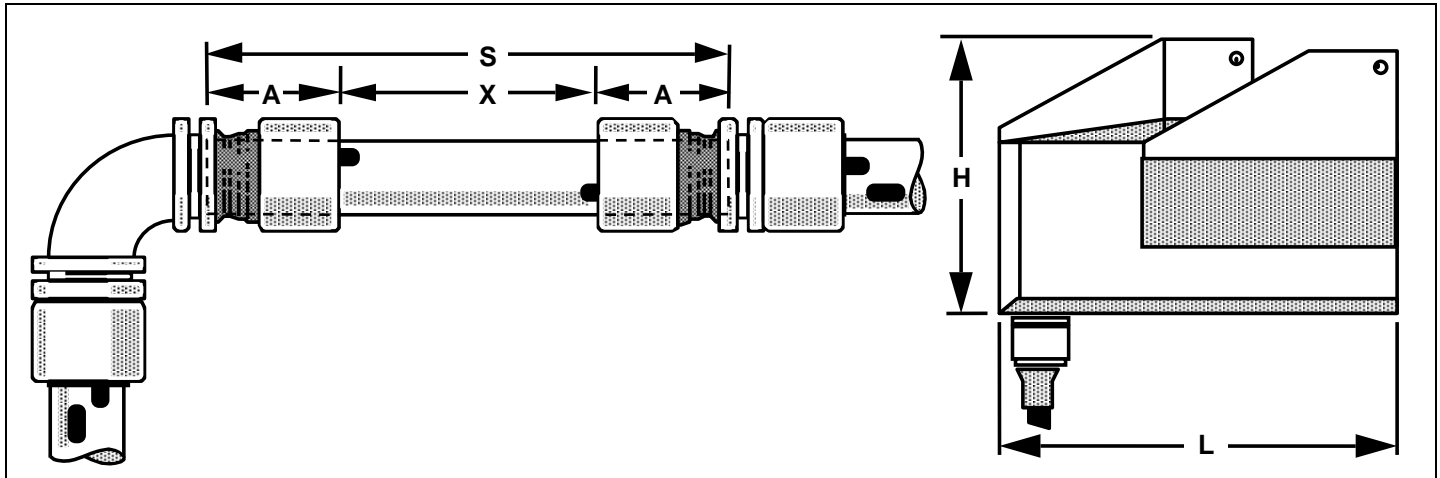
For installation procedures regarding carbon steel repair couplings, please refer to **Appendix F**.

8.5 The LOKRING connection is now ready to hydrostatically test.

9.0 REFERENCE DOCUMENTS

1. Qualification of a Non-Standard Product Form for ASME Code for Pressure Piping, B31 Applications", published in Codes and Standards and Applications for Design and Analysis of Pressure Vessel and Analysis of Pressure Vessel and Piping components, PVP-Vol. 210-1, American Society of Mechanical Engineers, New York, 1991.
2. FS-3000 Product Specification for Series MAS-3000 Carbon Steel Fittings
3. FS40 Product Specification for Series SS40 Stainless Steel Fittings
4. FS40-T Product Specification for Tube Fittings

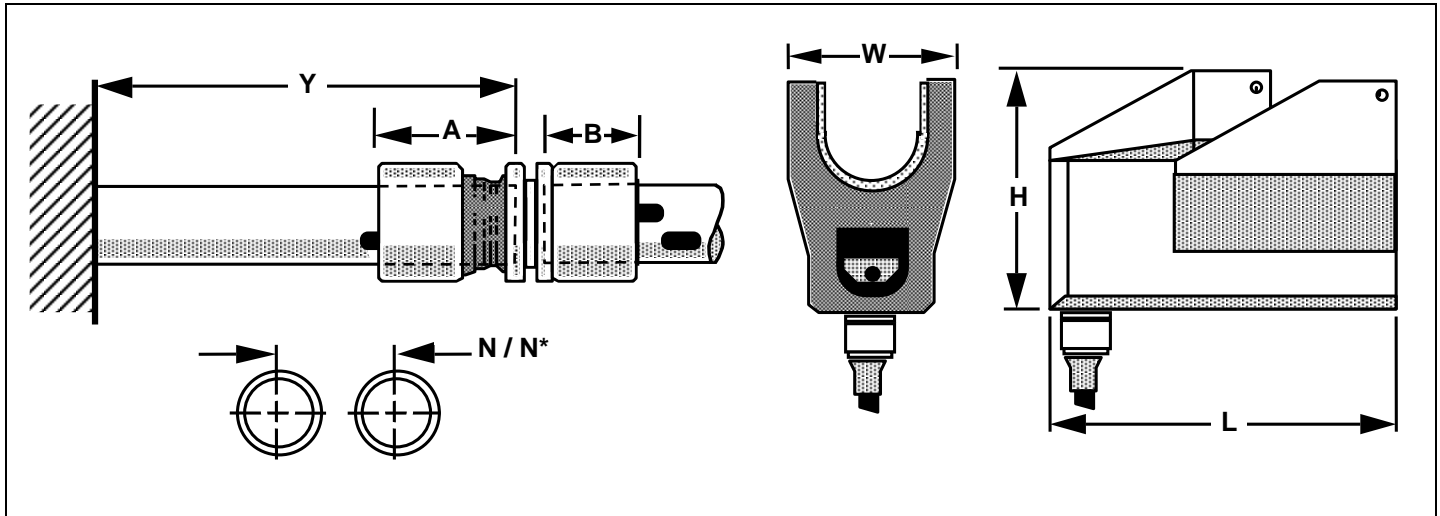
APPENDIX A:
Envelope Dimensions and Space requirements
MAS-3000 Series Carbon Steel Pipe Fittings



Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" NPS (P04)	0.540	IT20	3.07	0.59	1.24	5.00	3.20
3/8 NPS (P06)	0.675	IT30	3.39	0.65	1.37	6.45	3.97
3/8 NPS (P06)	0.675	IT45	3.39	0.65	1.37	6.38	4.91
3/8 NPS (P06)	0.675	IT50	3.39	0.65	1.37	7.29	5.33
1/2" NPS (P08)	0.840	IT30	3.50	0.65	1.43	6.45	3.97
1/2" NPS (P08)	0.840	IT45	3.50	0.65	1.43	6.38	4.91
1/2" NPS (P08)	0.840	IT50	3.50	0.65	1.43	7.29	5.33
3/4" NPS (P12)	1.050	IT45	3.92	0.65	1.64	6.38	4.91
3/4" NPS (P12)	1.050	IT50	3.92	0.65	1.64	7.29	5.33
1" NPS (P16)	1.315	IT45	4.78	0.82	1.98	6.38	4.91
1" NPS (P16)	1.315	IT50	4.66	0.70	1.98	7.29	5.33
1" NPS (P16)	1.315	IT60	4.75	0.79	1.98	8.59	5.84
1-1/4" NPS (P20)	1.660	IT45	5.62	1.19	2.21	6.38	4.91
1-1/4" NPS (P20)	1.660	IT50	5.24	0.81	2.21	7.29	5.33
1-1/4" NPS (P20)	1.660	IT60	5.47	1.04	2.21	8.59	5.84
1-1/2" NPS (P24)	1.900	IT60	5.63	0.85	2.39	8.59	5.84
2" NPS (P32)	2.375	IT60	7.17	1.34	2.92	8.59	5.84

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

APPENDIX A:
Envelope Dimensions and Space requirements
MAS-3000 Series Carbon Steel Pipe Fittings

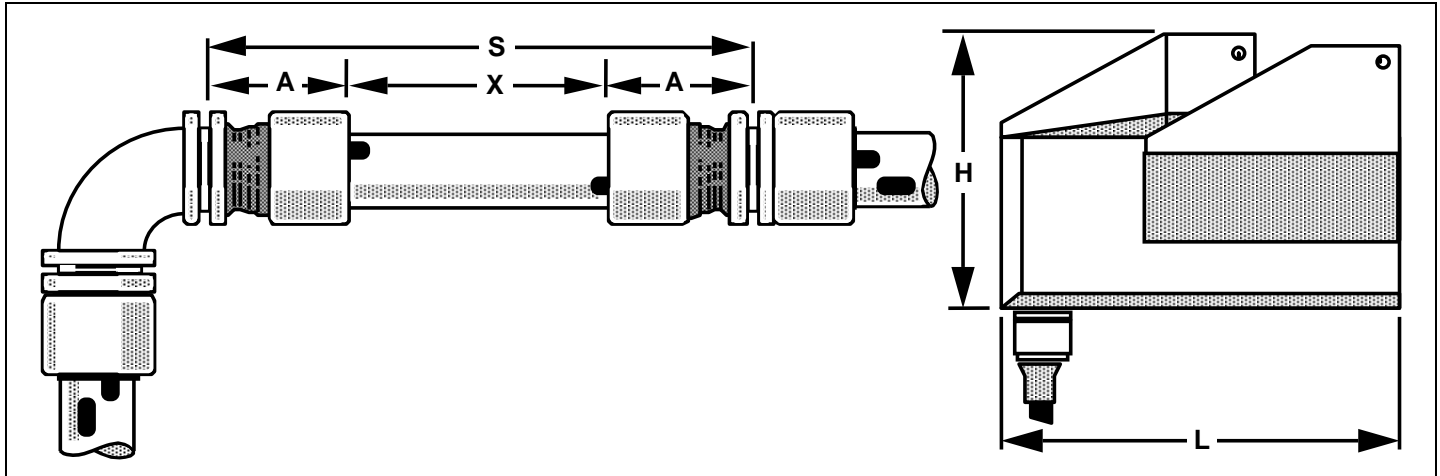


Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" NPS (P04)	0.540	IT20	2.36	1.58	1.83	1.83	0.85
3/8 NPS (P06)	0.675	IT30	2.66	1.80	2.08	2.02	0.95
3/8 NPS (P06)	0.675	IT45	3.91	2.43	2.70	2.02	0.95
3/8 NPS (P06)	0.675	IT50	4.21	2.58	2.85	2.02	0.95
1/2" NPS (P08)	0.840	IT30	2.66	1.88	2.19	2.07	1.01
1/2" NPS (P08)	0.840	IT45	3.91	2.51	2.81	2.07	1.01
1/2" NPS (P08)	0.840	IT50	4.21	2.66	2.96	2.07	1.01
3/4" NPS (P12)	1.050	IT45	3.91	2.61	2.88	2.28	1.17
3/4" NPS (P12)	1.050	IT50	4.21	2.76	3.03	2.28	1.17
1" NPS (P16)	1.315	IT45	3.91	2.75	3.06	2.80	1.41
1" NPS (P16)	1.315	IT50	4.21	2.90	3.21	2.68	1.41
1" NPS (P16)	1.315	IT60	5.01	3.30	3.61	2.77	1.41
1-1/4" NPS (P20)	1.660	IT45	3.91	2.92	3.23	3.40	1.57
1-1/4" NPS (P20)	1.660	IT50	4.21	3.07	3.38	3.02	1.57
1-1/4" NPS (P20)	1.660	IT60	5.01	3.47	3.78	3.26	1.57
1-1/2" NPS (P24)	1.900	IT60	5.01	3.59	3.94	3.24	1.72
2" NPS (P32)	2.375	IT60	5.01	3.83	4.26	4.26	2.16

Note: "Y" assumes that the tool is operated in Reverse Mode.

APPENDIX A:
 Envelope Dimensions and Space requirements

SS40 and SS-3300 Series Stainless Steel Pipe Fittings

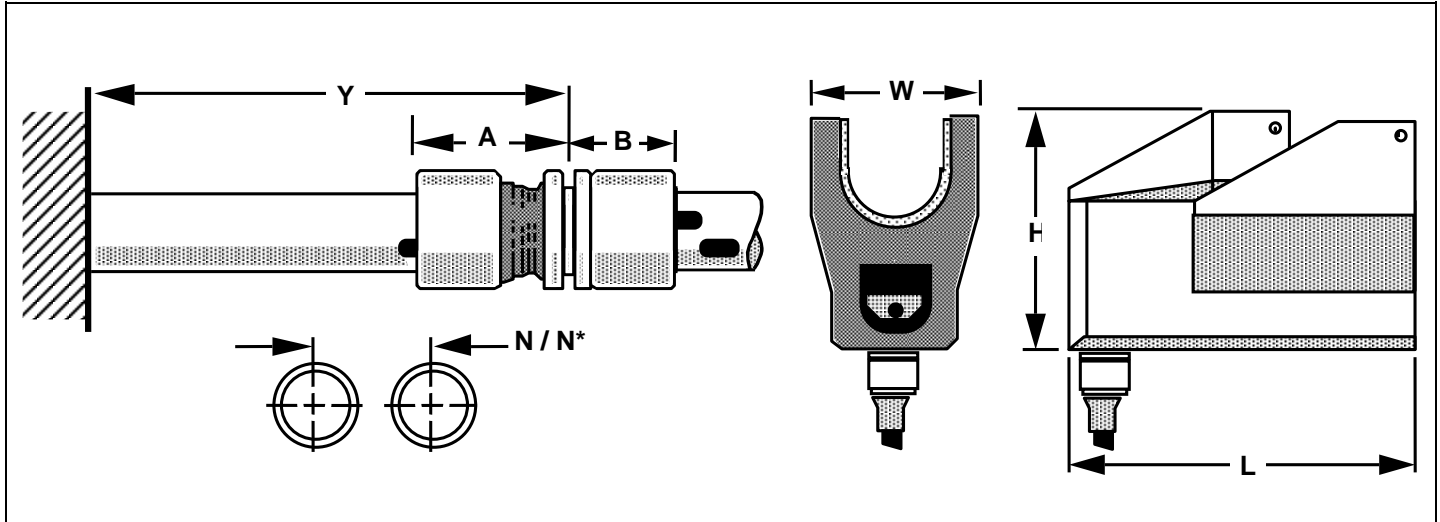


Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" (P04)	0.540	IT20	3.47	0.59	1.44	5.00	3.20
3/8" (P06)	0.675	IT30	3.84	0.65	1.60	6.45	3.97
3/8" (P06)	0.675	IT45	3.84	0.65	1.60	6.38	4.91
3/8" (P06)	0.675	IT50	3.84	0.65	1.60	7.29	5.33
1/2" (P08)	0.840	IT30	4.09	0.65	1.72	6.45	3.97
1/2" P(08)	0.840	IT45	4.09	0.65	1.72	6.38	4.91
1/2" P(08)	0.840	IT50	4.09	0.65	1.72	7.29	5.33
3/4" (P12)	1.050	IT30	4.52	0.65	1.94	6.45	3.97
3/4" (P12)	1.050	IT45	4.52	0.65	1.94	6.38	4.91
3/4" (P12)	1.050	IT50	4.52	0.65	1.94	7.29	5.33
1" (P16)	1.315	IT45	5.21	0.82	2.20	6.38	4.91
1" (P16)	1.315	IT50	5.10	0.70	2.20	7.29	5.33
1" (P16)	1.315	IT60	5.18	0.79	2.20	8.59	5.84
1-1/4" (P20)	1.660	IT50	5.83	0.81	2.51	7.29	5.33
1-1/4" (P20)	1.660	IT60	6.07	1.04	2.51	8.59	5.84
1-1/2" (P24)	1.900	IT50	6.19	0.59	2.80	7.29	5.33
1-1/2" (P24)	1.900	IT60	6.45	0.85	2.80	8.59	5.84
2" (P32)	2.375	IT60	7.64	1.08	3.28	8.59	5.84

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

APPENDIX A:
Envelope Dimensions and Space requirements

SS40 and SS-3300 Series Stainless Steel Pipe Fittings

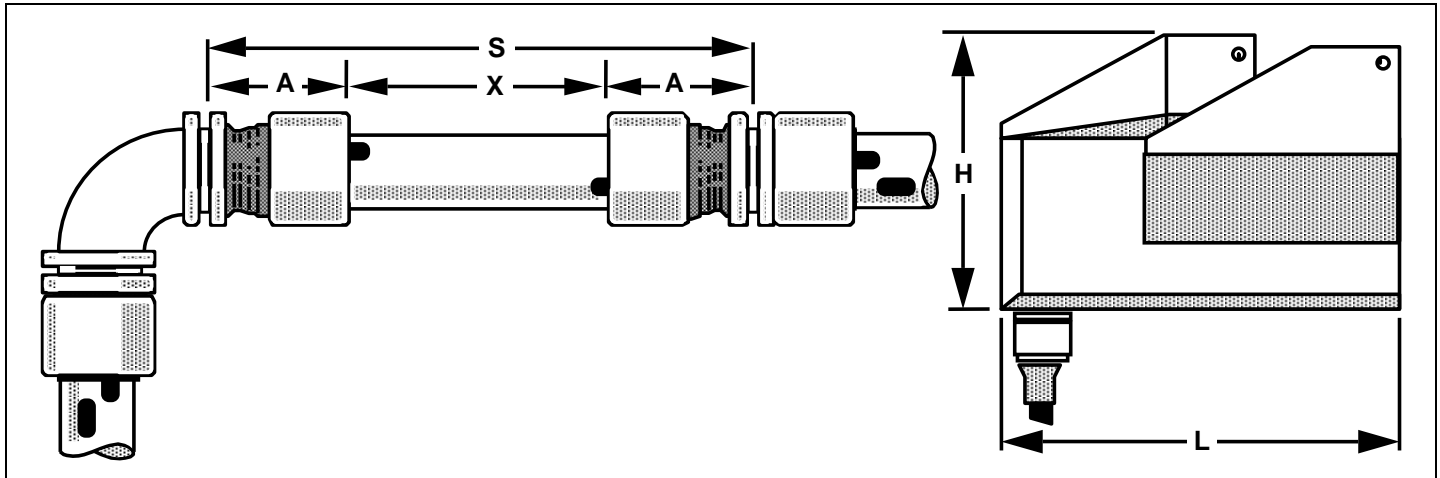


Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" (P04)	0.540	IT20	2.36	1.58	1.83	2.03	1.05
3/8" (P06)	0.675	IT30	2.66	1.80	2.08	2.24	1.18
3/8" (P06)	0.675	IT45	3.91	2.43	2.70	2.24	1.18
3/8" (P06)	0.675	IT50	4.21	2.58	2.85	2.24	1.18
1/2" (P08)	0.840	IT30	2.66	1.88	2.19	2.37	1.29
1/2" P(08)	0.840	IT45	3.91	2.51	2.81	2.37	1.29
1/2" P(08)	0.840	IT50	4.21	2.66	2.96	2.37	1.29
3/4" (P12)	1.050	IT30	2.66	1.99	2.27	2.58	1.44
3/4" (P12)	1.050	IT45	3.91	2.61	2.90	2.58	1.44
3/4" (P12)	1.050	IT50	4.21	2.76	3.05	2.58	1.44
1" (P16)	1.315	IT45	3.91	2.75	3.06	3.02	1.66
1" (P16)	1.315	IT50	4.21	2.90	3.21	2.90	1.66
1" (P16)	1.315	IT60	5.01	3.30	3.61	2.98	1.66
1-1/4" (P20)	1.660	IT50	4.21	3.07	3.41	3.32	1.90
1-1/4" (P20)	1.660	IT60	5.01	3.47	3.81	3.56	1.90
1-1/2" (P24)	1.900	IT50	4.21	3.19	3.52	3.39	2.05
1-1/2" (P24)	1.900	IT60	5.01	3.59	3.92	3.65	2.05
2" (P32)	2.375	IT60	5.01	3.83	4.19	4.36	2.53

Note: "Y" assumes that the tool is operated in Reverse Mode.

**APPENDIX A:
 Envelope Dimensions and Space requirements**

CN-200 Series Copper Nickel Pipe Fittings

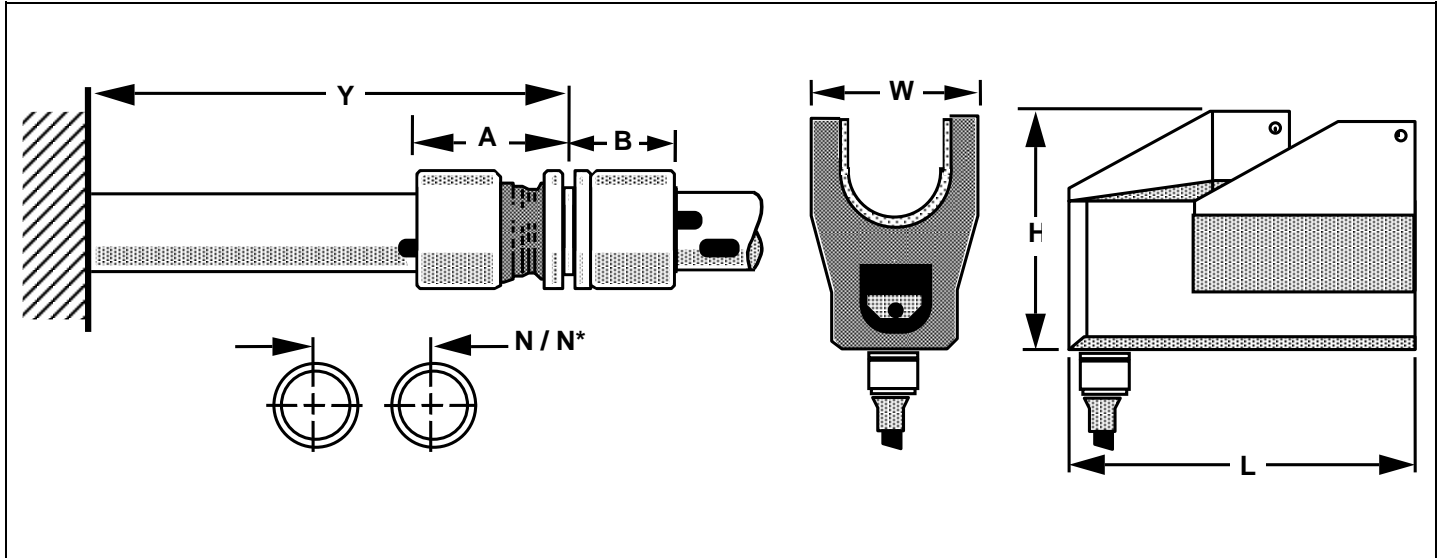


Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" (P04)	0.540	IT10	3.14	0.57	1.29	5.01	3.21
1/4" (P04)	0.540	IT20	3.14	0.57	1.29	5.01	3.21
3/8" (P06)	0.675	IT20	3.37	0.56	1.40	5.01	3.21
1/2" (P08)	0.840	IT20	3.79	0.58	1.61	5.01	3.21
3/4" (P12)	1.050	IT30	4.31	0.59	1.86	6.46	3.98
3/4" (P12)	1.050	IT45	4.54	0.82	1.86	6.38	4.91
1" (P16)	1.315	IT45	4.95	0.62	2.17	6.38	4.91
1" (P16)	1.315	IT50	4.95	0.62	2.17	7.29	5.33
1-1/4" (P20)	1.660	IT45	5.83	0.63	2.60	6.38	4.91
1-1/4" (P20)	1.660	IT50	5.84	0.64	2.60	7.29	5.33
1-1/2" (P24)	1.900	IT50	6.55	0.66	2.94	7.29	5.33
1-1/2" (P24)	1.900	IT60	6.55	0.66	2.94	8.59	5.84
2" (P32)	2.375	IT50	7.69	0.75	3.47	7.29	5.33

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

APPENDIX A:
Envelope Dimensions and Space requirements

CN-200 Series Copper Nickel Pipe Fittings

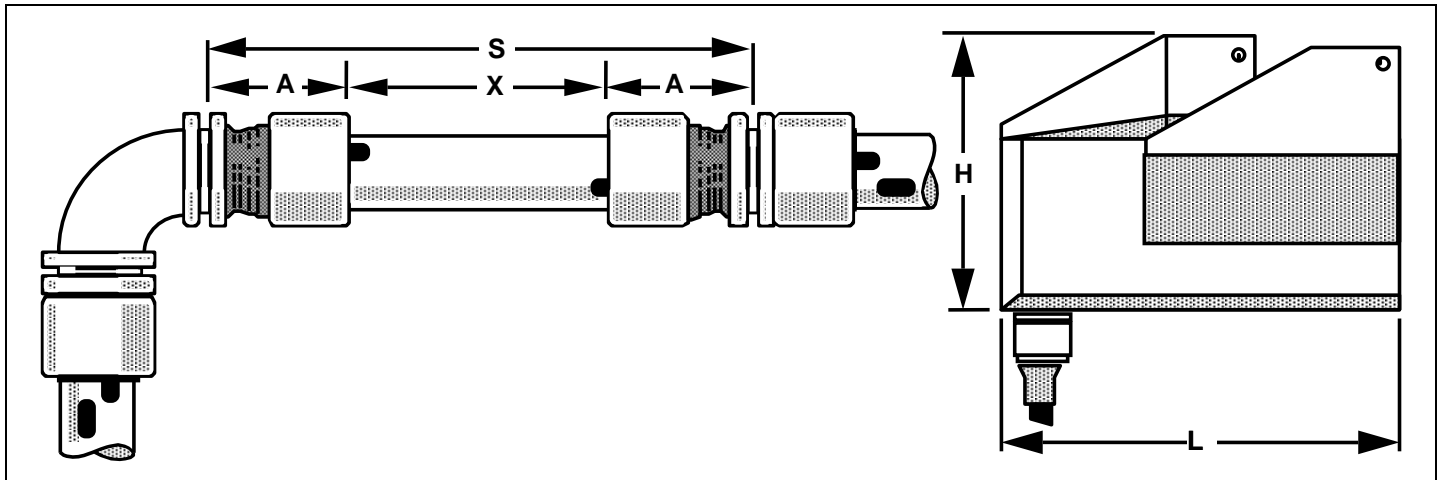


Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" (P04)	0.540	IT10	1.67	1.23	1.38	1.85	0.95
1/4" (P04)	0.540	IT20	2.36	1.58	1.73	1.85	0.95
3/8" (P06)	0.675	IT20	2.36	1.64	1.83	1.96	1.04
1/2" (P08)	0.840	IT20	2.36	1.73	1.94	2.18	1.18
3/4" (P12)	1.050	IT30	2.66	1.98	2.20	2.45	1.36
3/4" (P12)	1.050	IT45	3.91	2.61	2.83	2.68	1.36
1" (P16)	1.315	IT45	3.91	2.74	2.98	2.78	1.57
1" (P16)	1.315	IT50	4.21	2.89	3.13	2.78	1.57
1-1/4" (P20)	1.660	IT45	3.91	2.91	3.16	3.23	1.88
1-1/4" (P20)	1.660	IT50	4.21	3.06	3.31	3.24	1.88
1-1/2" (P24)	1.900	IT50	4.21	3.18	3.44	3.61	2.11
1-1/2" (P24)	1.900	IT60	5.01	3.58	3.84	3.61	2.11
2" (P32)	2.375	IT50	4.21	3.42	3.73	4.22	2.68

Note: "Y" assumes that the tool is operated in Reverse Mode.

**APPENDIX A:
 Envelope Dimensions and Space requirements**

CN-700 Series Copper Nickel Pipe and Tube Fittings

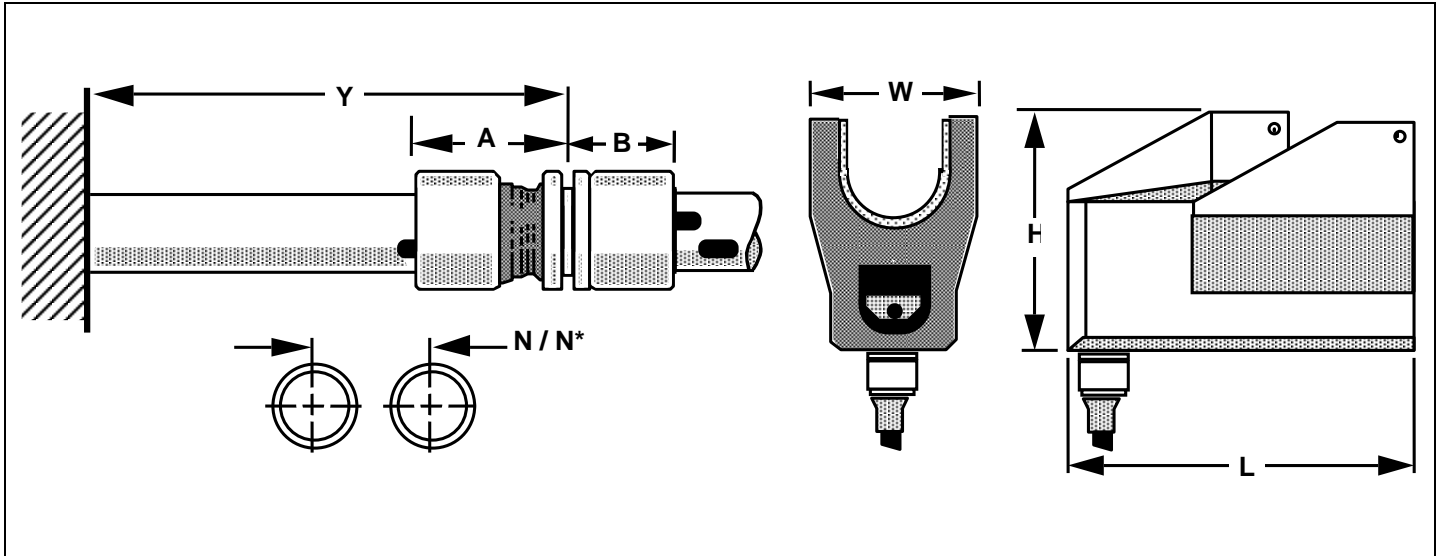


Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/2" (T08)	0.500	IT10	3.14	0.57	1.29	5.01	3.21
1/2" (T08)	0.500	IT20	3.14	0.57	1.29	5.01	3.21
1/4" (P04)	0.540	IT10	3.14	0.57	1.29	5.01	3.21
1/4" (P04)	0.540	IT20	3.14	0.57	1.29	5.01	3.21
3/8" (P06)	0.675	IT20	3.36	0.56	1.40	5.01	3.21
1/2" (P08)	0.840	IT20	3.79	0.58	1.61	5.01	3.21
3/4" (P12)	1.050	IT30	4.31	0.59	1.86	6.46	3.98
3/4" (P12)	1.050	IT45	4.54	0.82	1.86	6.38	4.91
1" (P16)	1.315	IT45	4.94	0.62	2.16	6.38	4.91
1" (P16)	1.315	IT50	4.94	0.62	2.16	7.29	5.33
1-1/4" (P20)	1.660	IT45	5.82	0.63	2.59	6.38	4.91
1-1/4" (P20)	1.660	IT50	5.83	0.64	2.59	7.29	5.33
1-1/2" (P24)	1.900	IT60	6.81	0.85	2.98	8.59	5.84
2" (P32)	2.375	IT60	7.88	1.34	3.27	8.59	5.84

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

APPENDIX A:
Envelope Dimensions and Space requirements

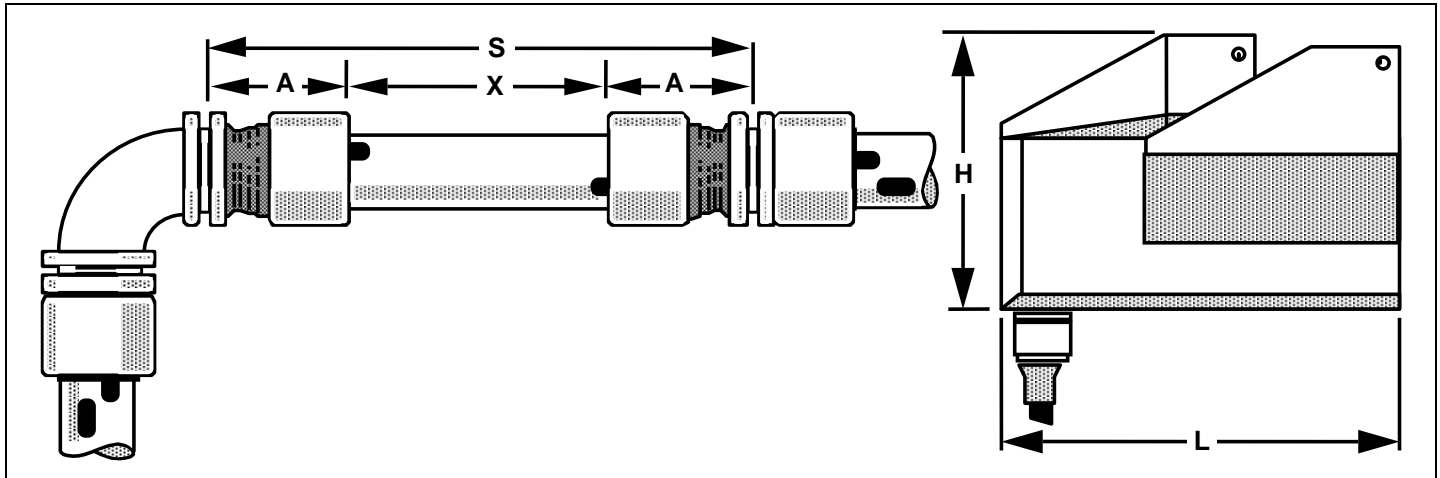
CN-700 Series Copper Nickel Pipe and Tube Fittings



Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/2" (T08)	0.500	IT10	1.67	1.21	1.38	1.85	0.95
1/2" (T08)	0.500	IT20	2.36	1.56	1.73	1.85	0.95
1/4" (P04)	0.540	IT10	1.67	1.23	1.38	1.85	0.95
1/4" (P04)	0.540	IT20	2.36	1.58	1.73	1.85	0.95
3/8" (P06)	0.675	IT20	2.36	1.64	1.83	1.96	1.04
1/2" (P08)	0.840	IT20	2.36	1.73	1.94	2.18	1.18
3/4" (P12)	1.050	IT30	2.66	1.98	2.20	2.45	1.36
3/4" (P12)	1.050	IT45	3.91	2.61	2.83	2.68	1.36
1" (P16)	1.315	IT45	3.91	2.74	2.98	2.78	1.57
1" (P16)	1.315	IT50	4.21	2.89	3.13	2.78	1.57
1-1/4" (P20)	1.660	IT45	3.91	2.91	3.13	3.23	1.88
1-1/4" (P20)	1.660	IT50	4.21	3.06	3.28	3.24	1.88
1-1/2" (P24)	1.900	IT60	5.01	3.58	3.84	3.83	2.16
2" (P32)	2.375	IT60	5.01	3.82	4.15	4.61	2.37
Note:		"Y" assumes that the tool is operated in Reverse Mode.					

APPENDIX A:
Envelope Dimensions and Space requirements

SS40 & SS-3000, SS-3300, CN-3300 Series Tube Fittings



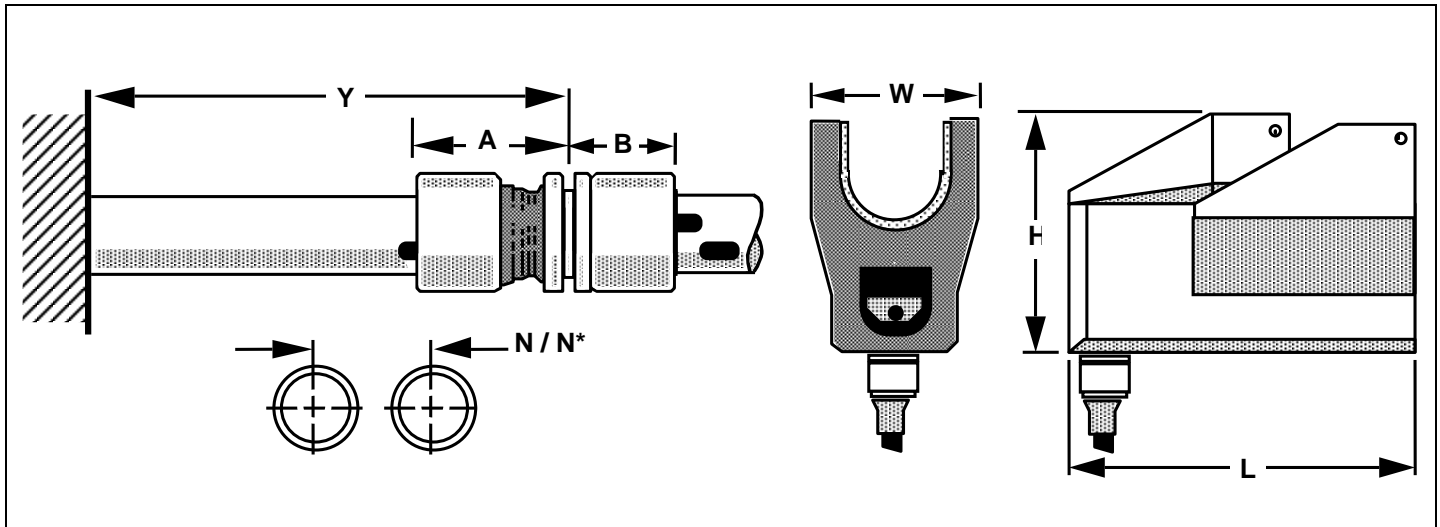
Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" (T04)	0.25	IT04	2.17	0.41	0.88	2.98	1.75
1/4" (T04)	0.25	IT10	2.17	0.41	0.88	5.01	3.21
3/8" (T06)	0.375	IT10	3.00	0.48	1.26	5.01	3.21
3/8" (T06)	0.375	IT20	3.00	0.48	1.26	5.01	3.21
1/2" (T08)	0.50	IT10	3.18	0.50	1.34	5.01	3.21
1/2" (T08)	0.50	IT20	3.18	0.50	1.34	5.01	3.21
5/8" (T10)	0.625	IT10	3.60	0.54	1.53	5.01	3.21
5/8" (T10)	0.625	IT20	3.63	0.57	1.53	5.01	3.21
3/4" (T12)	0.75	IT20	3.72	0.59	1.56	5.01	3.21
7/8" (T14)	0.875	IT20	3.49	0.54	1.48	5.01	3.21
1" (T16)	1.00	IT20	3.77	0.60	1.59	5.01	3.21
1-1/4" (T20)	1.25	IT45	4.70	0.63	2.04	6.38	4.91
1-1/2" (T24)	1.50	IT45	4.89	0.65	2.12	6.38	4.91
1-1/2" (T24)	1.50	IT50	4.88	0.64	2.12	7.29	5.33
2" (T32)	2.00	IT50	5.96	0.65	2.65	7.29	5.33
2" (T32)	2.00	IT60	5.96	0.65	2.65	8.59	5.84
2-1/2" (T40)	2.50	IT60	7.88	1.34	3.27	8.59	5.84

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

APPENDIX A:

Envelope Dimensions and Space requirements

SS40 & SS-3000, SS-3300, CN-3300 Series Tube Fittings

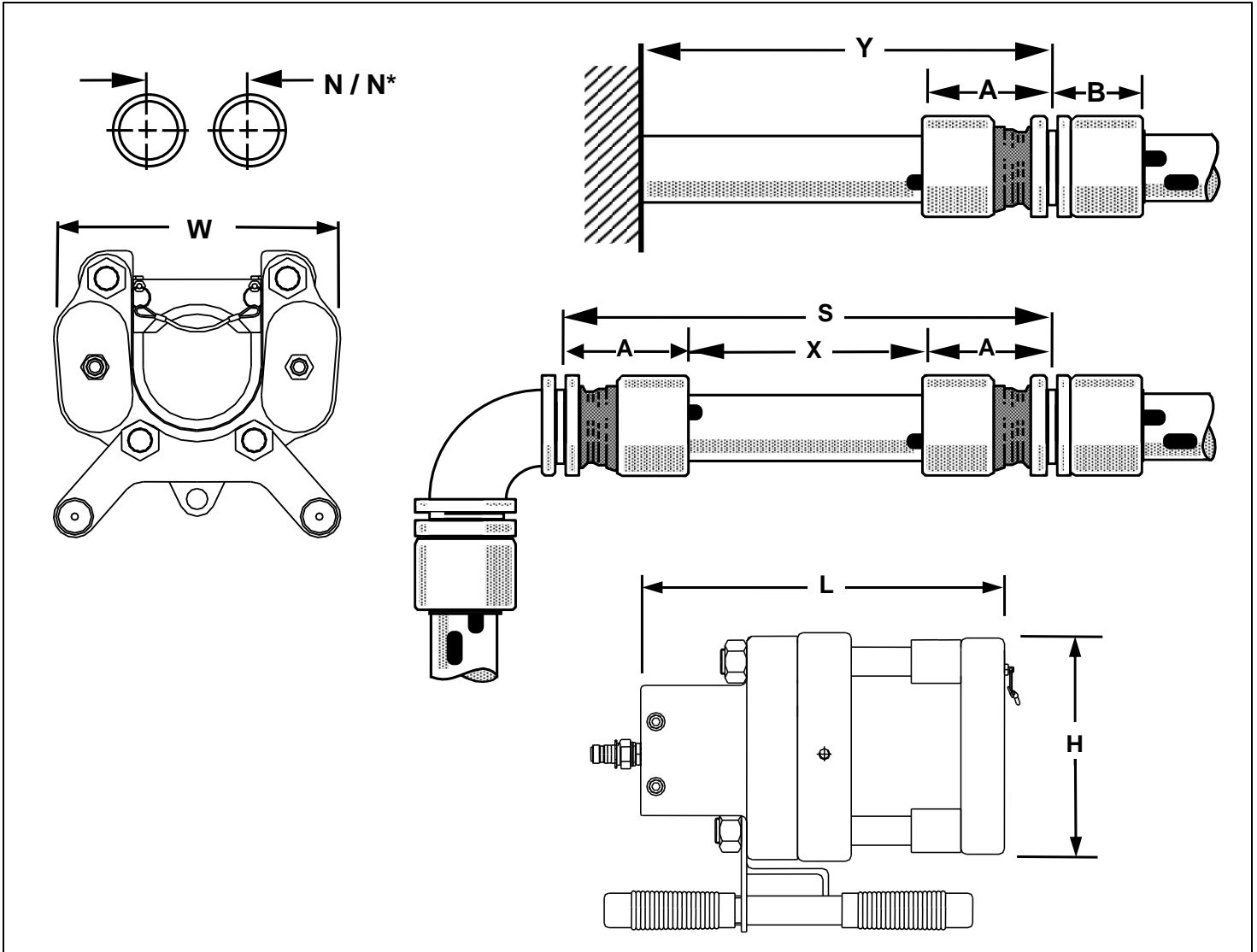


Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" (T04)	0.25	IT04	1.21	0.85	1.00	1.29	0.73
1/4" (T04)	0.25	IT10	1.67	1.09	1.23	1.29	0.73
3/8" (T06)	0.375	IT10	1.67	1.15	1.32	1.74	0.92
3/8" (T06)	0.375	IT20	2.36	1.49	1.67	1.74	0.92
1/2" (T08)	0.50	IT10	1.67	1.21	1.40	1.84	1.00
1/2" (T08)	0.50	IT20	2.36	1.56	1.74	1.84	1.00
5/8" (T10)	0.625	IT10	1.67	1.27	1.49	2.07	1.12
5/8" (T10)	0.625	IT20	2.36	1.62	1.83	2.10	1.12
3/4" (T12)	0.75	IT20	2.36	1.68	1.89	2.15	1.17
7/8" (T14)	0.875	IT20	2.36	1.74	1.91	2.01	1.13
1" (T16)	1.00	IT20	2.36	1.81	1.99	2.18	1.21
1-1/4" (T20)	1.25	IT45	3.91	2.71	2.99	2.67	1.51
1-1/2" (T24)	1.50	IT45	3.91	2.83	3.14	2.77	1.58
1-1/2" (T24)	1.50	IT50	4.21	2.98	3.29	2.76	1.58
2" (T32)	2.00	IT50	4.21	3.23	3.51	3.31	1.97
2" (T32)	2.00	IT60	5.01	3.63	3.91	3.31	1.97
2-1/2" (T40)	2.50	IT60	5.01	3.88	4.21	4.61	2.46

Note: "Y" assumes that the tool is operated in Reverse Mode.

APPENDIX A:
Envelope Dimensions and Space requirements

MAS-3000, SS40 Series Pipe Fittings ITK100 3 inch Tooling



Dimensions in Inches	L	W	H	N	N*	Y	S	X	B	A
Fitting Size	Tool Length	Tool Width	Tool Height	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Minimum Spool Length	Minimum Spacing Between Fittings	Installed Insertion Depth, Nominal	Pre-Installed Insertion Depth, Nominal
MAS-3000	12.52	10.18	7.89	6.98	7.39	5.54	9.83	1.25	2.99	4.29
SS40	12.52	10.18	7.89	6.98	7.47	5.97	10.68	1.25	3.41	4.71

Note: Spool lengths are for reverse operation, except where noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.
 "Y" assumes that the tool is operated in Reverse Mode.

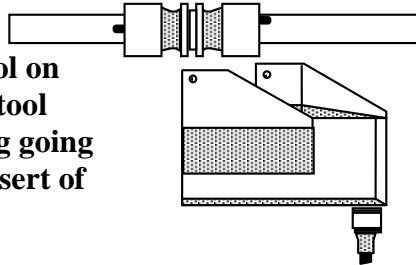
APPENDIX B:

LOKRING Tool Placement Options

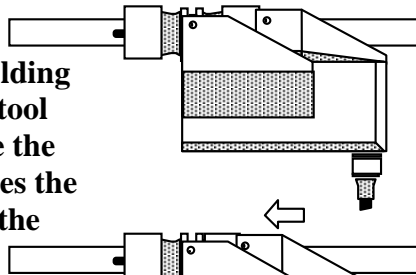
LOKRING™ Reverse Tool Installation Technique

Normal Tool Use

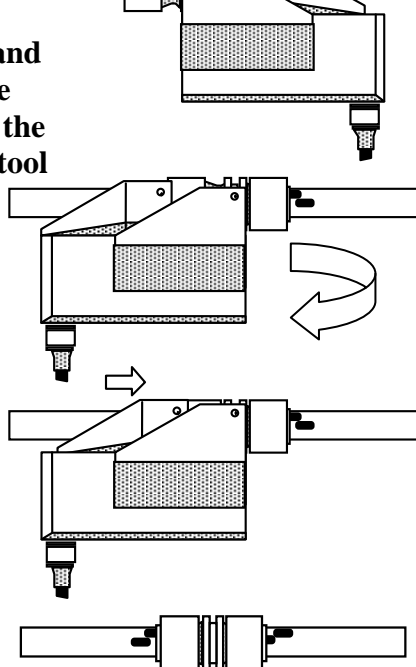
Fully engage tool on fitting with the tool groove on fitting going into the body insert of the tool



Actuate tool, holding the body of the tool stationary while the tool jaw advances the drive ring onto the fitting body



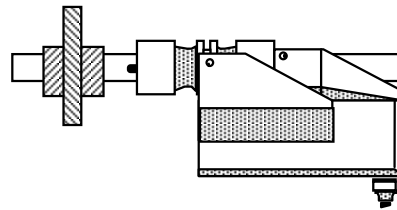
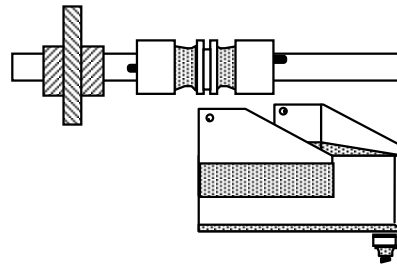
Turn tool 180° and re-engage on the opposite side of the fitting. Repeat tool operation as described above



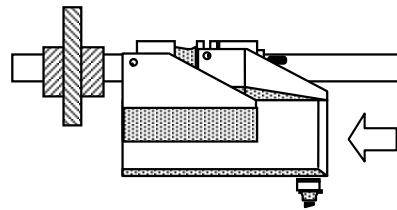
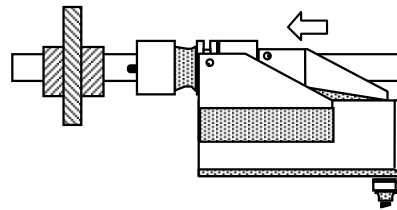
Reverse Tool Use

(where space constrained by bulkhead or adjacent fitting)

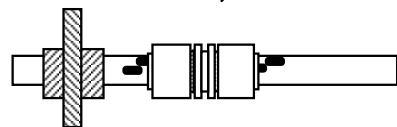
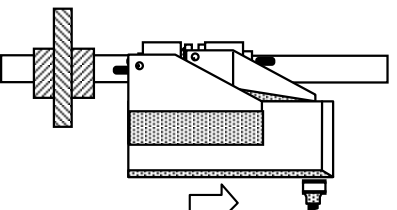
For the first side of the fitting engage and actuate tool as described to the left



For the second space constrained joint, advance and re-engage tool with fitting groove in the jaw insert



Actuate tool, allowing the tool body to travel and advance the drive ring while the tool jaw remains stationary



Note:

1. Using the tool in reverse requires special attention to make sure the fitting does not move during tool actuation. For this reason it is recommended that where possible the first joint is pulled up in normal fashion to lock the fitting in place
2. Not all LOKRING tools will work in reverse. If the fitting will go into tool in reverse position, then this tool is reverse capable. Contact your local LOKRING distributor or LOKRING Technology (for specifics see us at our website, www.lokring.com) for details on this capability



**APPENDIX C:
 LOKTOOL Installation Tool Selection Guide**

Carbon Steel Pipe Fittings² MAS-3000-XXX-PXX						
Pipe Size NPS	Fittings¹	Preferred Maintenance Tool Kits (MTK)³	LOKTOOL Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4"	P04	* See Below	IT20	BI20-MAS/SS4-M14/P04-FR	JI20-MAS/SS4-M14/P04-FR	MPG-MAS-P04
3/8"	P06	* See Below	IT30	BI30-MAS/SS4-P06/M15-FR	JI30-MAS/SS4-P06/M15-FR	MPG-MAS-P06
			IT45	BI45-MAS/SS4-P06/M15-FR	JI45-MAS/SS4-P06/M15-FR	
			IT50	BI50-MAS/SS4-P06/M15-FR	JI50-MAS/SS4-P06/M15-FR	
1/2"	P08	MTK45-SS4/MAS-P08/P12/P16-FR	IT45	BI45-MAS/SSX-P08-FR	JI45-MAS/SSX-P08-FR	MPG-MAS-P08
			IT50	BI50-MAS/SSX-P08-FR	JI50-MAS/SSX-P08-FR	
3/4"	P12	MTK45-SS4/MAS-P08/P12/P16-FR	IT45	BI45-MAS/SSX-P12-FR	JI45-MAS/SSX-P12-FR	MPG-MAS-P12
			IT50	BI50-MAS/SSX-P12-FR	JI50-MAS/SSX-P12-FR	
1"	P16	MTK45-SS4/MAS-P08/P12/P16-FR MTK60-MAS/SS4-P16/P24/P32-FR	IT45	BI45-MAS/SS4-P16-FR	JI45-MAS/SS4-P16-FR	MPG-MAS-P16
			IT50	BI50-MAS/SS4-P16-FR	JI50-MAS/SS4-P16-FR	
			IT60	BI60-MAS/SS4-P16-FR	JI60-MAS/SS4-P16-FR	
1-1/4"	P20	* See Below	IT50	BI50-MAS/SS4-P20-FR	JI50-MAS/SS4-P20-FR	MPG-MAS-P20
			IT60	BI60-MAS/SS4-P20-FR	JI60-MAS/SS4-P20-FR	
1-1/2"	P24	MTK60-MAS/SS4-P16/P24/P32-FR	IT60	BI60-MAS/SS4/CN7-P24-FR	JI60-MAS/SS4/CN7-P24-FR	MPG-MAS-P24
2"	P32	MTK60-MAS/SS4-P16/P24/P32-FR	IT60	BI60-MAS/SS4/CN7-P32-FR	NO JAW INSERT REQUIRED	MPG-MAS-P32
3"	P48	ITK-100-MAS/SS4-P48-F/R	IT100	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-MAS/SS40-P48
<p>* Consult LOKRING for other Maintenance Tool Kit Options Note 1: XXX = CPL (Coupling); EL90 (90 Degree Elbow); EL45 (45 Degree Elbow); TEE (Straight Tee), etc Note 2: Qualified ASTM Pipe = Carbon Steel Pipe to A106 and A53 Note 3: Other Maintenance Tool Kits besides those listed are available</p>						
<u>Pumps and Hoses</u>		<u>Description</u>	<u>Actuated</u>		MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only	
PUMP-OTC-QTRHRSE-ELEC		Electric Pump	Foot Pedal			
PUMP-TURBO-AIR-QD		Pneumatic Pump	Foot Pedal			
PUMP-P-19-QD or Pump-P-392-QD		Manual Pump	Manual			
Portable LOKTOOL		Manual Pump	Manual			
HH15-QD		15 ft Hydraulic Hose Assembly				



**APPENDIX C:
 LOKTOOL Installation Tool Selection Guide**

Stainless Steel Pipe Fittings² SS40 and SS-3300-XXX-PXX						
Pipe Size NPS	Fittings ¹	Preferred Maintenance Tool Kits (MTK) ³	LOKTOOL			Multi-Purpose Gauge
			Head	Body Insert	Jaw Insert	
1/4"	P04	* See Below	IT20	BI20-MAS/SS4-M14/P04-FR	JI20-MAS/SS4-M14/P04-FR	MPG-SS4-P04
3/8"	P06	* See Below	IT30	BI30-MAS/SS4-P06/M15-FR	JI30-MAS/SS4-P06/M15-FR	MPG-SS4-P06
			IT45	BI45-MAS-SS4-P06/M15-FR	JI45-MAS/SS4-P06/M15-FR	
			IT50	BI50-MAS/SS4-P06/M15-FR	JI50-MAS/SS4-P06/M15-FR	
1/2"	P08	MTK45-SS4/MAS-P08/P12/P16-FR	IT45	BI45-MAS/SSX-P08-FR	JI45-MAS/SSX-P08-FR	MPG-SS4/SS3-P08
			IT50	BI50-MAS/SSX-P08-FR	JI50-MAS/SSX-P08-FR	
3/4"	P12	MTK45-SS4/MAS-P08/P12/P16-FR	IT45	BI45-MAS/SSX-P12-FR	JI45-MAS/SSX-P12-FR	MPG-SS4/SS3-P12
			IT50	BI50-MAS/SS4-P12-FR	JI50-MAS/SS4-P12-FR	
1"	P16	MTK45-SS4/MAS-P08/P12/P16-FR MTK60-MAS/SS4-P16/P24/P32-FR	IT45	BI45-MAS/SS4-P16-FR	JI45-MAS/SS4-P16-FR	MPG-SS4-P16
			IT50	BI50-MAS/SS4-P16-FO	JI50-MAS/SS4-P16-FO	
			IT60	BI60-MAS/SS40-P16-FR	JI60-MAS/SS40-P16-FR	
1-1/4"	P20	* See Below	IT50	BI50-MAS/SS4-P20-FR	JI50-MAS/SS4-P20-FR	MPG-SS4-P20
			IT60	BI60-MAS/SS4-P20-FR	JI60-MAS/SS4-P20-FR	
1-1/2"	P24	MTK60-MAS/SS4-P16/P24/P32-FR	IT60	BI60-MAS/SS4/CN7-P24-FR	JI60-MAS/SS4/CN7-P24-FR	MPG-SS4-P24
2"	P32	MTK60-MAS/SS4-P16/P24/P32-FR	IT60	BI60-MAS/SS4/CN7-P32-FR	NO JAW INSERT REQUIRED	MPG-SS4-P32
3"	P48	ITK100	IT100	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-MAS/SS40-P48
<p>* Consult LOKRING for other Maintenance Tool Kit Options Note 1: XXX = CPL (Coupling); EL90 (90 Degree Elbow); EL45 (45 Degree Elbow); TEE (Straight Tee), etc Note 2: Qualified ASTM Pipe = Stainless Steel Pipe to A312 and Carbon Steel Pipe to A106 and A53 Note 3: Other Maintenance Tool Kits besides those listed are available</p>						
<u>Pumps and Hoses</u>		<u>Description</u>	<u>Actuated</u>		MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only	
PUMP-OTC-QTRHRSE-ELEC		Electric Pump	Foot Pedal			
PUMP-TURBO-AIR-QD		Pneumatic Pump	Foot Pedal			
PUMP-P-19-QD or Pump-P-392-QD		Manual Pump	Manual			
Portable LOKTOOL		Manual Pump	Manual			
HH15-QD		15 ft Hydraulic Hose Assembly				

**APPENDIX C:
 LOKTOOL Installation Tool Selection Guide**

Copper Nickel Pipe Fittings² CN-200-XXX-PXX					
Pipe Size NPS	Fittings¹	LOKTOOL Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4"	P04	IT10	BI10-CN3/7-P04/T08-FR	JI10-CN3/7-P04/T08-FR	MPG-CN-200-P04
		IT20	BI20-CN3/7-P04/T08-FR	JI20-CN3/7-P04T/T08-FR	
3/8"	P06	IT20	BI20-CN3/7-P06-FR	JI20-CN3/7-P06-FR	MPG-CN-200-P06
1/2"	P08	IT20	BI20-CN3/7-P08-FR	JI20-CN3/7-P08-FR	MPG-CN-200-P08
3/4"	P12	IT30	BI30-CN3/7-P12-FR	JI30-CN3/7-P12-FR	MPG-CN-200-P12
		IT45	BI45-CN3/7-P12-FR	JI45-CN3/7-P12-FR	
1"	P16	IT45	BI45-CN3/7-P16-FR	JI45-CN3/7-P16-FR	MPG-CN-200-P16
		IT50	BI50-CN3/7-P16-FR	JI50-CN3/7-P16-FR	
1-1/4"	P20	IT45	BI45-CN3/7-P20-FR	JI45-CN3/7-P20-FR	MPG-CN-200-P20
		IT50	BI50-CN3/7-P20-FR	JI50-CN3/7-P20-FR	
1-1/2"	P24	IT50	BI50-CN3-P24-FR	JI50-CN3-P24-FR	MPG-CN-200-P24
		IT60	BI60-CN3-P24-FR	JI60-CN3-P24-FR	
2"	P32	IT50	BI50-CN3-P32-FR	IT50-JAW-MACH-CN2-P32-FR	MPG-CN-200-P32

Note 1: XXX = CPL (Coupling); EL90 (90 Degree Elbow); EL45 (45 Degree Elbow); TEE (Straight Tee), etc
Note 2: Qualified Pipe = Copper pipe to MIL-T-24107 and 90/10 copper nickel pipe to MIL-T-16420

Maintenance Tool Kits for Copper Nickel Fittings are available

Pumps and Hoses	Description	Actuated	
PUMP-OTC-QTRHRSE-ELEC	Electric Pump	Foot Pedal	MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only
PUMP-TURBO-AIR-QD	Pneumatic Pump	Foot Pedal	
PUMP-P-19-QD or Pump-P-392-QD	Manual Pump	Manual	
Portable LOKTOOL	Manual Pump	Manual	
HH15-QD	15 ft Hydraulic Hose Assembly		



**APPENDIX C:
 LOKTOOL Installation Tool Selection Guide**

Copper Nickel Type 70/30 Pipe and Tube Fittings² CN-700-XXX-PXX / CN-700-XXX-TXX																									
Pipe Size NPS or Tube O.D.	Fittings¹	LOKTOOL Head	Body Insert	Jaw Insert	Multi-Purpose Gauge																				
1/2" OD	T08	IT10	BI10-CN3/7-P04/T08-FR	JI10-CN3/7-P04/T08-FR	MPG-CN7-T08																				
		IT20	BI20-CN3/7-P04/T08-FR	JI20-CN3/7-P04/T08-FR																					
1/4" NPS	P04	IT10	BI10-CN3/7-P04/T08-FR	JI10-CN3/7-P04/T08-FR	MPG-CN-200-P04																				
		IT20	BI20-CN3/7-P04/T08-FR	JI20-CN3/7-P04/T08-FR																					
3/8" NPS	P06	IT20	BI20-CN3/7-P06-FR	JI20-CN3/7-P06-FR	MPG-CN-200-P06																				
1/2" NPS	P08	IT20	BI20-CN3/7-P08-FR	JI20-CN3/7-P08-FR	MPG-CN-200-P08																				
3/4" NPS	P12	IT30	BI30-CN3/7-P12-FR	JI30-CN3/7-P12-FR	MPG-CN-200-P12																				
		IT45	BI45-CN3/7-P12-FR	JI45-CN3/7-P12-FR																					
1" NPS	P16	IT45	BI45-CN3/7-P16-FR	JI45-CN3/7-P16-FR	MPG-CN-200-P16																				
		IT50	BI50-CN3/7-P16-FR	JI50-CN3/7-P16-FR																					
1-1/4" NPS	P20	IT45	BI45-CN3/7-P20-FR	JI45-CN3/7-P20-FR	MPG-CN-200-P20																				
		IT50	BI50-CN3/7-P20-FR	JI50-CN3/7-P20-FR																					
1-1/2" NPS	P24	IT60	BI60-MAS/SS4/CN7-P24-FR	JI60-MAS/SS4/CN7-P24-FR	MPG-CN7-P24																				
2" NPS	P32	IT60	BI60-MAS/SS4/CN7-P32-FR	NO JAW INSERT REQUIRED	MPG-CN7-P32																				
<p>Note 1: XXX = CPL (Coupling); EL90 (90 Degree Elbow); EL45 (45 Degree Elbow); TEE (Straight Tee), etc Note 2: Qualified Pipe = Copper-Nickel pipe per MIL-T-16420 (class 200, 90/10, class 200 70/30, and class 700 70/30)</p> <p>Maintenance Tool Kits for Copper Nickel Fittings are available</p> <table border="1"> <thead> <tr> <th><u>Pumps and Hoses</u></th> <th><u>Description</u></th> <th><u>Actuated</u></th> <th></th> </tr> </thead> <tbody> <tr> <td>PUMP-OTC-QTRHRSE-ELEC</td> <td>Electric Pump</td> <td>Foot Pedal</td> <td rowspan="5"> MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only </td> </tr> <tr> <td>PUMP-TURBO-AIR-QD</td> <td>Pneumatic Pump</td> <td>Foot Pedal</td> </tr> <tr> <td>PUMP-P-19-QD or Pump-P-392-QD</td> <td>Manual Pump</td> <td>Manual</td> </tr> <tr> <td>Portable LOKTOOL</td> <td>Manual Pump</td> <td>Manual</td> </tr> <tr> <td>HH15-QD</td> <td>15 ft Hydraulic Hose Assembly</td> <td></td> </tr> </tbody> </table>						<u>Pumps and Hoses</u>	<u>Description</u>	<u>Actuated</u>		PUMP-OTC-QTRHRSE-ELEC	Electric Pump	Foot Pedal	MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only	PUMP-TURBO-AIR-QD	Pneumatic Pump	Foot Pedal	PUMP-P-19-QD or Pump-P-392-QD	Manual Pump	Manual	Portable LOKTOOL	Manual Pump	Manual	HH15-QD	15 ft Hydraulic Hose Assembly	
<u>Pumps and Hoses</u>	<u>Description</u>	<u>Actuated</u>																							
PUMP-OTC-QTRHRSE-ELEC	Electric Pump	Foot Pedal	MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only																						
PUMP-TURBO-AIR-QD	Pneumatic Pump	Foot Pedal																							
PUMP-P-19-QD or Pump-P-392-QD	Manual Pump	Manual																							
Portable LOKTOOL	Manual Pump	Manual																							
HH15-QD	15 ft Hydraulic Hose Assembly																								



**APPENDIX C:
 LOKTOOL Installation Tool Selection Guide**

Stainless Steel and Copper Nickel Tube Fittings² SS40 & SS-3000 and SS-3300-XXX-TXX and CN-3300-XXX-TXX						
Tube Size OD	Fittings ¹	Preferred Maintenance Tool Kits (MTK) ³	LOKTOOL Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4" (Copper Nickel) ⁴	T04	* See Below	IT04	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-SS4-T04
			IT10	BI10-SS4/CN4-T04/M06-RO	J110-SS4/CN4-T04/M06-FR	
1/4"	T04	* See Below	IT04	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-SS4-T04
			IT10	BI10-SS4/CN4-T04/M06-RO	J110-SS4/CN4-T04/M06-FR	
3/8"	T06	MTK20-SS4-T06/T08	IT10	BI10-SS4-T06-FR	J110-SS4-T06-FR	MPG-SS4-T06
			IT20	BI20-SS4-T06-FR	J120-SS4-T06-FR	
1/2"	T08	MTK20-SS4-T06/T08	IT10	BI10-SS4-T08/M12-FR	J110-SS4-T08/M12-FR	MPG-SS4-T08
			IT20	BI20-SS4-T08/M12-FR	J120-SS4-T08/M12-FR	
5/8"	T10	* See Below	IT10	BI10-SS3-T10-FO	J110-SS3-T10-FO	MPG-SS4-T10
			IT20	BI20-SS4-T10-FR	J120-SS4-T10-FR	
3/4"	T12	MTK20-SS3-T12/T14/T16	IT10	BI10-SS3-T12-FO	J110-SS3-T12-FO	MPG-SS4-T12
			IT20	BI20-SSX-T12-FR	J120-SSX-T12-FR	
7/8"	T14	MTK20-SS3-T12/T14/T16	IT20	BI20-SS3-T14-FR	J120-SS3-T14-FR	MPG-SS3-T14
1"	T16	MTK20-SS3-T12/T14/T16	IT20	BI20-SS3-T16-FO	J120-SS3-T16-FO	MPG-SS3-T16
1-1/4"	T20	MTK45-SS3-T20/T24	IT45	BI45-SS3-T20-FR	J145-SS3-T20-FR	MPG-SS3-T20
1-1/2"	T24	MTK45-SS3-T20/T24	IT45	BI45-SS3-T24-FR	J145-SS3-T24-FR	MPG-SS3-T24
			IT50	BI50-SS3-T24-FO	J150-SS3-T24-FO	
			IT60	BI60-SS3-T24	J160-SS3-T24-FR	
2"	T32	ITK60-SS4-T32-FR	IT50	BI50-SSX-T32-FO	J150-SS3-T32-FO	MPG-SS4-T32
			IT60	BI60-SS4-T32-FR	J160-SS4-T32-FR	
2-1/2"	T40	* See Below	IT60	BI60-SS4-T40	NO JAW INSERT REQUIRED	MPG-SS4-T40

*** Consult LOKRING for other Maintenance Tool Kit Options**
Note 1: XXX = CPL (Coupling); EL90 (90 Degree Elbow); EL45 (45 Degree Elbow); TEE (Straight Tee), etc
Note 2: Qualified Tube for Stainless Steel Fittings = Stainless Steel tube to ASTM A269 or A213 and MIL-P-24691/3 or MIL-T-8606
Qualified Tube for Copper Nickel Fittings = 70/30 Copper-Nickel tube per MIL-T-16420
Note 3: Other Maintenance Tool Kits besides those listed are available
Note 4: 1/4" Copper Nickel size as noted, all other sizes are Stainless Steel SS40 and SS-3300 Series

<u>Pumps and Hoses</u>	<u>Description</u>	<u>Actuated</u>	
PUMP-OTC-QTRHRSE-ELEC	Electric Pump	Foot Pedal	MTK – Multipurpose tool kit ITK – Individual too kit FR Denotes Forward Reverse capable FO Denotes Forward Only RO Denotes Reverse Only
PUMP-TURBO-AIR-QD	Pneumatic Pump	Foot Pedal	
PUMP-P-19-QD or Pump-P-392-QD	Manual Pump	Manual	
Portable LOKTOOL	Manual Pump	Manual	
HH15-QD	15 ft Hydraulic Hose Assembly		

APPENDIX D:

Safety & Maintenance Instructions for LOKTOOL Installation Tools

LOKTOOL System General Safety Instructions

1. LOKTOOL system components (head, couplers, hoses, pumps) are fully rated for 10,000 psi operating pressure. Do not substitute non-approved components without prior authorization of LOKRING.
2. Make sure Quick Disconnects are fully secured, and that threaded locking ring on the hose coupler is fully advanced to ensure against accidental separation of installation tool from hose during operation or transportation.

Note: Loose couplers will act as a partial or complete line restriction causing little or no oil flow and resulting in equipment damage or failure.

3. Cycle tool several times without fitting to assure that quick disconnects are fully secured, and no air is trapped in the system.

Note: If the LOKTOOL jaw does not advance and retract smoothly, air might be trapped in system and must be bled prior to operation. Follow manufacturer's instructions included with hydraulic pump.

4. On the IT-30, IT-45, IT-50 and IT-60 tool heads, while the jaw is fully advanced, ensure the shoulder bolt that connects the jaw to the piston is tight.
5. Be sure that LOKRING fittings are fully seated / bottomed out / “fully nested” in the LOKTOOL jaws before actuating hydraulic pressure. Fittings that are "cocked" or not fully seated can damage fitting and/or tool.
6. Keep fingers clear of the jaws during the activation cycle. Moving jaw creates pinch points, caution should be used during this process.
7. NEVER ATTEMPT TO DISASSEMBLE LOKTOOL HEADS. Call your local LOKRING Distributor or the Factory immediately if any problems with the tools are encountered.
8. Do not drop heavy objects on hoses, and make sure that the hoses are never kinked or sharply bent. Always provide adequate clearance for hoses and coupler to avoid moving objects, abrasion, or sharp objects.
9. Keep hydraulic equipment and hoses away from flames and heat. For optimum performance, do not expose equipment to temperatures of 150°F or higher.
10. Do not use LOKTOOL components that show signs of damage, abuse, or excessive wear.
11. Clean LOKTOOL head and lubricate bearing surfaces on a daily basis after use. Although the LOKTOOL does not contact wetted surfaces, it is best to ensure that contamination cannot be sourced to the tool. Clean accordingly.
12. Do not attempt to install LOKRING fittings with broken or damaged inserts nor with inserts of the wrong size.
13. If there is any sign of hydraulic fluid leakage, consult your local LOKRING Distributor or the Factory for assistance.

APPENDIX D:

Safety & Maintenance Instructions for LOKTOOL Installation Tools

LOKTOOL Head Maintenance & Cleaning Instructions:

The LOKTOOL body and jaw (and body and jaw inserts) are manufactured from high strength materials, precision machined for many years of reliable service. Assembled tools require no calibration. However, regular cleaning and lubrication of the bearing surfaces is required for proper maintenance of the tools.

The following general cleaning procedures are recommended on a daily basis following use:

1. Clean installation tooling jaws of all foreign material. Brush or blow debris out of jaw cavity from top (looking down between the tool jaws).
2. Rag wipe front bearing pad or bushing, and apply Moly-lube, all-purpose lubricant as needed to the pad after cleaning.

Note: LOKTOOL head sizes IT30, IT45, IT50, and IT60, have a flat bronze wear pad between the LOKTOOL jaw and body, visible when looking down into the tool cavity from above. IT04 has no separate wear pad, and IT10 and IT20 have bronze bushings.

3. Advance the LOKTOOL jaw (without fitting) until it is in the closed position. Clean and Moly-lube the sliding (bearing) surfaces on the tool body and behind the advanced jaw (if applicable to specific tool model).
4. Make sure that body and jaw inserts are properly oriented in LOKTOOL head and secured with set screws.
5. Return LOKTOOL head to equipment case for storage after use.

Power Supply Maintenance Instructions

1. Follow manufacturer's recommendations regarding periodic maintenance. Check reservoir oil level once hose, pump, and LOKTOOL head are connected. For manual pump, fill to indicator mark on the end cap. Replace the fill cap and be sure it is closed.

Note: Always use pump manufacturer's recommended fluid only. Introduction of other brand hydraulic fluids into the system may contaminate the system, and may void pump warranty.

2. Always cover disconnect coupler halves with dust caps. As with any hydraulic system, use every precaution to guard LOKTOOL head, hose, and pump against entrance of dirt.

APPENDIX E:

Guidelines for use of Loctite® PST Sealant #567

Loctite® compound #567 is a white creamy paste which has excellent solvent resistance, and is compatible with a wide range of process fluids and gasses^{1,2}. It has a maximum operating temperature range of 400°F.

1. Loctite® Compound #567 is recommended for concentrations of 10% or less:

- Acetic Acid
- Battery Acid
- Carbolic Acid
- Chloroacetic Acid
- Chrome Liquor
- Hydrobromic Acid
- Hydrogen Fluoride
- Nitric Acid 10%
- Polyphosphoric Acid
- Sulfonic Acid
- Barium Hydroxide
- Butyric Acid
- Carbonic Acid
- Chrome Acid Cleaning
- Chrome Plating Bath
- Hydrocyanic Acid
- Nicotinic Acid
- Perchloric Acid
- Potash

2. Loctite® Compound #567 is not recommended of the following chemicals:

- Ammonia Anhydrous
- Ammonia Solutions
- Aqua Regia
- Chlorinated Sulphuric Acids
- Chlorosulfonic Acid
- Chromic Acid 50% Hot
- Fuming Nitric Red
- Fuming Oleum
- Hydrofluoric Acid
- LOX (Liquid Oxygen)
- Lye
- Mixed Acid, Nitric / Sulfuric
- Nitration Acid (s)
- Nitric Acid
- Nitric Acid Anhydrous
- Nitric Acid Fuming
- Ozone Wet
- Permanganic Acid
- Persulfuric Acid
- Phosphoric Acid 85% Hot
- Potassium Hydroxide
- Soap Lye
- Sodium Hydroxide
- Sodium Hydroxide 50% Hot
- Sodium Hydroxide 70% Hot
- Sodium Peroxide
- Sulfuric Acid 75%-95%
- Sulfuric Acid 95%-100%
- Chlorine Wet
- Oxygen
- Ozone
- Sulfur Trioxide Gas

Note 1: For a complete listing of Loctite® compatible fluids, see "Loctite® Fluid Compatibility Chart for metal threaded fittings sealed with Loctite® Sealants". Available from the Loctite® website: <http://www.loctite.com/pdf/lt836a.pdf>

Note 2: It is the user's responsibility to determine suitability for the user's application of any Loctite® sealant, and to adopt such precautions as may be advisable for the protection of property and persons against any hazards that may be involved in the handling and use thereof. We recommend that each prospective user test his proposed application before use, use this data as a guide only.

APPENDIX F:

Installation Procedure for the LOKRING Carbon Steel Repair Coupling

Description

The LOKRING Carbon Steel Repair Coupling is designated as MAS-3000-RCPL-PXX, and uses the exact same LOKTOOL equipment (LOKTOOL head, inserts, MPG) as the standard MAS-3000 carbon steel products. However, it differs in two important ways from the standard MAS carbon steel coupling:

1. The fitting body is manufactured from 316L stainless steel, not from carbon steel.
2. It has a "thru-bore" design, which means it does not have an internal center stop.

The "thru-bore" design permits the Carbon Steel Repair Coupling to slide entirely over the pipe O.D., allowing the installer to connect two lengths of pipe without having to "spring" the pipe ends apart axially to insert them into the coupling. As a result, it is ideal for "tie-ins" of new spool pieces to existing piping where space constraints prohibit the use of regular Carbon Steel Coupling (which has a center stop).

If for any reason a carbon steel repair coupling is unavailable, a stainless steel coupling may be substituted.

Installation Procedure:

The Repair Coupling can be installed employing identical procedures used to install standard MAS-3000 fittings. However, because the repair fitting is the same length as the standard fitting, but has no center stop, there will normally be a gap between the pipe ends when installed in this manner.

Because of greater insertion tolerance of the Repair Coupling, pipe ends may be inserted further into the coupling than is indicated in Section 7.4 of LP-105, and still result in an acceptable installation. Installers wishing to take advantage of this greater insertion allowance, or wishing to butt the pipe ends fully together inside the Repair Coupling can do so by following the Installation Procedure Option #1 below.

1.0 Install First Pipe End

Verify that the first pipe end is properly prepared, gauged and marked (please see LP-105 Installation Procedure, Sections 4 & 5). As with all LOKRING fittings, NEVER install any fittings on pipe that is not properly prepared, gauged and marked.

APPENDIX F:

Installation Procedure for the LOKRING Carbon Steel Repair Coupling

Section 7.4 of LP-105 requires that 100% of the **INSPECT** mark be covered by the fitting and that part of the **INSTALL** mark be visible prior to making-up the first end. With the Repair Coupling, engage the pipe end further into the fitting until nearly all of the **INSTALL** mark is covered. However, do not completely cover the **INSTALL** mark. Cycle the LOKTOOL head to LOK the first end.

2.0 Inspect First Installed Pipe End

Remove the LOKTOOL head from the installed end of the Repair Coupling and inspect the installation. Some part of the **INSPECT** mark should be visible; however, as long as any part of the **INSTALL** mark is visible, the first end connection is good.

3.0 Install Second Pipe Connection

Verify that the second pipe end is properly prepared, gauged and marked.

Because the Carbon Steel Repair Coupling has a greater insertion tolerance than the standard coupling, the second pipe end may be inserted further into the coupling than normally specified in the LP-105 Installation Procedure. Further Insertion allows the second end to "take-up" the remaining tolerance inside the Repair Coupling by butting up against the first pipe end, and will in no way adversely affect the quality of the installation.

Insert the second pipe end into the coupling until it butts up against the first pipe end inside the Repair Coupling. The **INSTALL** mark must be partially or completely covered by the fitting body prior to installation; cycle LOKTOOL head to LOK second end.

4.0 Inspect Second Installed Pipe End

Remove the LOKTOOL head, and inspect the installation. Due to Repair Coupling's greater insertion tolerance, the second pipe end may be inserted far enough into it so that all of the **INSPECT** mark is covered by the fitting after installation. With the Repair Coupling, this is acceptable provided some part of the **INSTALL** mark is visible.

Check to see that at least some part of the **INSTALL** mark is visible. If it is, go to Section 8.1 of LP-105, and continue the post-installation procedures.

If 100% of both **INSTALL** and **INSPECT** marks are visible, then the second pipe end was not inserted far enough into the coupling, and must be removed.

APPENDIX G:

Fire-Hardened Fittings Policy

1. Fire-hardened fittings are required in the systems listed below where piping is located with compartments which are served by CO₂ fixed flooding or Halon 1301 fire extinguishing systems. Services not listed do not require fire-hardened fittings. Note that when steel or CRES piping is used in groups G-3 through G-7, J-1 through J-4, J-7, and K-5, fire-hardened fittings are required, as shown in paragraph 2.

<u>MIL-STD-777 CATEGORY & GROUP</u>	<u>SERVICE</u>
G-3 through G-7	Hydraulic Oil (Cu and Cu-Ni piping)
H-2	Contaminated Aviation Lube Oil
J-2 through J-4, J-7, J-8	Air (Cu and Cu-Ni piping)
K-3, K-5, K-7	Gaseous Oxygen, Liquid Oxygen, Propane (Cu and Cu-Ni Piping)

2. Fire hardened fittings are required throughout the ship in the systems listed below.

<u>MIL-STD-777 CATEGORY & GROUP</u>	<u>SERVICE</u>
A-1 through A-7, A-9, A-10	Steam and Steam Drains
B-1 and B-2	Feed Systems
E-1 through E-4	Fuel
F-1	Lubricating Oil
G-1 through G-7	Hydraulic Oil (steel and CRES piping)
H-1	Gasoline
I-1	JP-5
J-1	Air
J-2 through J-7, J-9	Air (steel and CRES piping)
K-2	Gaseous Oxygen
K-4 through K-6	Liquid Oxygen, Mixed Gas (CRES piping)
N-1	Sprinkling System (dry)
N-2	Magazine Sprinkling System (wet)
S-1	AFFF and AFFF/seawater
T-2 and T-3	Halon and Halon Actuation
U-1	Fuel Stripping

3. Fire-hardened fittings are defined as either (1) welded fittings listed in MIL-STD-777 or (2) fittings which comply with ASTM F1387 and have passed NAVSEA approved fire testing.

4. Miscellaneous seawater sprinkling systems (sprinkling other than AFFF, magazine and countermeasure washdown) shall comply with Category and Group N-2. However, miscellaneous sprinkling system piping within spaces which are wet-sprinkled does not require fire-hardened fittings.



APPENDIX H:

LOKRING Fitting Installation Training Certification Test

Installer Information

Name _____ **Date** _____

Employee Number _____ **Company** _____

Plant _____

Questions

1. Define the LOKRING Sealing Zone. _____

2. How do you check for proper squareness of the cut pipe/tube end? _____

3. What grit sanding cloth is used to prep the pipe or tube Sealing Zone for Lokring fittings? _____

4. In what direction should you sand the pipe/tube ends? _____
Why do you not sand pipe along the axis of the pipe/tube? _____

5. After initial sanding, how do you know if a scratch on the pipe/tube surface in the Sealing Zone is too deep?

6. What three options / alternatives do you have if you have a deep scratch in the Sealing Zone?

7. How do you check for pipe/tube that is undersized (outside of specification) or excessively oval?

8. When using the multi-purpose gauge, the name of the two marks you put on the pipe/tube are:
1) _____ 2) _____

9. When the pipe/tube is properly inserted into the uninstalled (un-LOK-ed) fitting, what portion of the two marks should you be able to see? _____
When the fitting has been completed what portion of the two marks should then be revealed?

When the pipe/tube is inserted into the repair fitting, what amount of the **INSTALL** mark should be showing?



APPENDIX H:

LOKRING Fitting Installation Training Certification Test

When the repair fitting has been completed, what amount of the **INSPECT** mark should be showing?

10. How can you check for proper alignment of two pipe/tube ends before making up the fitting? _____

11. After connecting the hose coupler to the LOKTOOL head, what two things should be done before installing any fitting? 1) _____ 2) _____

12. Before actuating hydraulic power to LOK a fitting, what two things should you check for?

1) _____ 2) _____

13. What is likely to happen if the LOKTOOL head is not fully engaged on the fitting?

1) _____ and/or 2) _____

14. After making-up the fitting, what are three visual checks for proper installation?

- 1) _____
- 2) _____
- 3) _____

15. Can you use stainless steel fittings on a carbon steel pipe? _____ A carbon steel fitting on a stainless steel pipe/tube? _____ Can you use a copper nickel fitting on carbon steel or stainless steel pipe? _____ Can you use a carbon steel or stainless steel fitting on copper nickel pipe? _____

16. If you are planning to install LOKRING fittings, and would like to review the installation procedures, what is available to help you do this?

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____

17. What are the three areas in which installation errors can occur when installing LOKRING fittings?

- 1) _____
- 2) _____
- 3) _____

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers

1. Define the LOKRING Sealing Zone

The Sealing Zone is defined as the area on the surface of the pipe/tube extending 1 and 1/2 pipe/tube diameters from the end of the pipe/tube.

2. How do you check for proper squareness of the cut pipe/tube end?

End cut cannot be greater than +/- 5° from square. Verification of end cut tolerance can be obtained from either a Tri-Tool or diameter specific LOKRING Multi Purpose Gauge.

3. What grit sanding cloth is used to prep the pipe or tube Sealing Zone for Lokring fittings?

120# grit aluminum oxide cloth

4. In what direction should you sand the pipe/tube ends?

Always sand around the circumference of the pipe/tube

Why do you not sand the pipe/tube along the axis of the pipe/tube?

This can result in undesirable flat spots on the sealing surface in the Sealing Zone.

5. After initial sanding, how do you know if a scratch on the pipe/tube surface in the Sealing Zone is too deep?

If your thumbnail "catches" while running it perpendicular completely around the pipes/tube circumference.

6. What three options/alternatives do you have if you have a deep scratch in the Sealing Zone?

- 1) Cut the pipe/tube back to an area clear of surface condition problems, and repeat Sealing Zone preparation steps.
- 2) Continue to sand the Sealing Zone circumferentially with course grit (60#) aluminum oxide cloth and finish sand with 120# aluminum oxide cloth. If doing so causes pipe/tube to fail the Multipurpose Gauge Tool test, cut the pipe/tube back again and repeat all end pipe/tube qualifications.
- 3) If sanding is not effective in removing the bad pipe/tube conditions, or is too time consuming, an anaerobic pipe/tube thread sealant such as Loctite® PST #567 may be applied to the pipe/tube surface within the Sealing Zone in lieu of further sanding.

If this method is selected the sealant must only be used following pipe/tube gauging and marking.

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers

7. How do you check for pipe/tube that is undersized (outside of specification), or excessively oval?

- 1) Using the Multipurpose Gauging Tool (MPG), and the NO-GO section of the gauge, place it lightly against the pipe/tube at two points 90° apart from each other. If the pipe/tube end does not pass through the NO-GO section of the gauge then it is not undersized, or excessively oval.
- 2) You may also measure the pipe/tube O.D. with a caliper or other suitable device and compare with the minimum specification values for that specific pipe/tube diameter.

8. When using the multi-purpose gauge, the names of the two marks you put on the pipe/tube are?

- 1) Install Mark
- 2) Inspect mark

9. When the pipe/tube is properly inserted into the uninstalled (un-LOK-ed) fitting, what portion of the two marks should you be able to see?

1/2 of the install

When the fitting has been completed, what portion of the two marks should then be revealed?

1 1/2 or 1 and a portion

When the pipe/tube is inserted into the repair fitting, what amount of the INSTALL mark should be showing?

A portion

When the repair fitting has been completed, what amount of the INSPECT mark should be showing?

A portion

10. How can you check for proper alignment of two pipe/tube ends before making up the fitting?

Verify pipe/tube orientation inside the fitting by inspecting install and inspect marks. If using a repair fitting, it should slide easily from pipe to pipe or tube to tube.



APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers

11. After connecting the hose coupler to the LOKRING tool head, what two things should be done before installing any fittings?

- 1) Advance the hose coupler thread locking ring manually against the coupler locking sleeve. **Secure thread locking ring**
- 2) Advance and retract tool jaw several times **without** fitting to ensure that no air is trapped in system, and that all hydraulic couplers are fully secured

12. Before actuating hydraulic power to LOK a fitting, what two things should you check for?

- 1) Fitting is secure in tool head
- 2) A portion of the installation mark is showing

13. What is likely to happen if the LOKTOOL head is not fully engaged on the fitting?

The fitting and/or tool may be damaged during LOK-ing

14. After making-up a fitting, what are the three visual checks for proper installation?

- 1) Check to see if the trailing edge of the fitting body protrudes from underneath the end of the drive ring.
- 2) Check to see if a portion of the **INSPECT** mark is covered by the fitting **and** that most or all of the **INSTALL** mark is exposed.
- 3) Check to see that the drive ring is fully seated against the inner land of the fitting body (a small gap on one side is acceptable if "1" and "2" are met)

15. Can you use stainless steel fittings on carbon steel pipe? YES

Can you use a carbon steel fitting on stainless steel pipe/tube? NO

Can you use a copper nickel fitting on carbon steel or stainless steel pipe? NO

Can you use a carbon steel or stainless steel fitting on copper nickel pipe? NO

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers

16. If you are planning to install LOKRING fittings, and would like to review the installation procedures, what is available to help you do this?

- 1) LP-105 Installation Procedure For LOKRING Carbon & Stainless Steel Fittings
- 2) LOKRING Installation Procedures Video
- 3) LOKRING Pipefitter's Field Installation Guide
- 4) LOKRING Kit Mounted 5 Step Installation Guide
- 5) Hands-on LOKRING training session by LOKRING or authorized personnel
- 6) LOKRING internet site www.lokring.com

17. What are the three areas in which installation errors occur when installing LOKRING fittings?

- 1*) One of the drive rings is not fully seated against the fitting body, resulting in the trailing edge of the fitting body not protruding.
- 2**) The fitting's **INSPECT** mark on either end of the pipe/tube is completely exposed
- 3***) The repair fitting's **INSPECT** mark is not visible at all on one end of the pipe/tube.

*Solution: Position and engage the LOKTOOL again until the drive ring has become fully seated and continue post LOK inspection procedure

**Solution: Pipe/tube was not sufficiently inserted into fitting and must be cut out and replaced

***Solution: Pipe/tube was over inserted into the repair fitting and must be cut out and replaced.



APPENDIX I:

Alternate LOKRING Fitting Installation Training Certificate Test

Name _____ Emp # _____ Date _____

1. The fittings are approved for use on what pipe material _____
2. What is the maximum pressure and temperature rating for LOKRING Class 200 Copper Nickel fittings?
 - a. 3000 psi and 775° F
 - b. 250 psi and 425° F
 - c. 1000 psi and 200° F
 - c. 250 psi and 1000° F
3. What is the maximum pressure and temperature rating for LOKRING SS-3300 Stainless Steel fittings?
 - a. 3300 psi and 500° F
 - b. 3300 psi and 425° F
 - c. 3300 psi and 200° F
 - c. 3300 psi and 775° F
4. You don't need to mark the end of the pipe with the gauge if you have already LOK-ed the other side of the fitting (circle one).

TRUE FALSE
5. List the points of visual inspection after installation.
 - a.
 - b.
 - c.
6. Prior to LOK of the LOKRING fitting the pipe should be
 - a. properly aligned and supported
 - b. checked for correct O.D. & wall
 - c. free of all chips, burrs, & metal filings
 - d. free of flat spots, pits, & scratches.
 - e. all of the above.
7. Pipe should be cut
 - a. within 15° of square
 - b. within 5° of square
 - c. pointed for easy penetration
 - d. completely square
8. The no-go cut out on the multi-purpose gauge allows you to check to see if the pipe is
 - a. out of round or undersize
 - b. too thin walled
 - c. too long
 - d. pipe material
9. If the pipe fits completely into the no-go slot of the multipurpose gauge,
 - a. check gauge to see that it is not worn or bent & verify pipe O.D. is undersized with a caliper.
 - b. Use a different piece of pipe or cut back to a pipe portion which isn't undersize or out of round.
 - c. notify a supervisor prior to LOK of any pipe fittings.
 - d. all of the above.
10. When tightening up a union or a union-ended valve you should
 - a. not use an "O" ring & back-up ring at the union interface.
 - b. always install the LOKRING end prior to assembling the nut to the thread piece end.
 - c. use a back-up wrench on union body or hold the valve body to prevent turning.
11. All personnel who install LOKRING fittings must
 - a. have completed LOKRING training, and installed 1 fitting in the presence of supervision, and have a LOKRING certification card.
 - b. keep a record of location of all LOKRING installations.
 - c. have at least a brazer certification.
 - d. install no less than 25 fittings to become a LOKRING instructor.



APPENDIX I:

Alternate LOKRING Fitting Installation Training Certificate Test Answers

1. The fittings are approved for use on what pipe material

Carbon Steel Fittings: carbon steel pipe to ASTM A106 and A53

Stainless Steel Fittings: carbon steel pipe to ASTM A106 and A53; stainless steel pipe to ASTM A312

Stainless Steel Tube Fittings: stainless steel tube to ASTM A269 or A213 and MIL-P-24691/3 or MIL-T-8606

Copper Nickel Fittings: copper pipe to MIL-T-24107 and 90/10 copper nickel pipe to MIL-T-16420

Copper Nickel Tube Fittings: 70/30 copper nickel tube to MIL-T-16420

2. What is the maximum pressure and temperature rating for LOKRING Class 200 Copper Nickel fittings?

b. 250 psi and 425° F

3. What is the maximum pressure and temperature rating for LOKRING SS-3300 Stainless Steel fittings?

a. 3300 psi and 500° F

4. You don't need to mark the end of the pipe with the gauge if you have already LOK-ed the other side of the fitting (circle one).

FALSE

5. List the points of visual inspection after installation.

- Check to see if the trailing edge of the fitting body protrudes from underneath the end of the drive ring.
- Check to see if a portion of the **INSPECT** mark is covered by the fitting **and** that most or all of the **INSTALL** mark is exposed.
- Check to see that the drive ring is fully seated against the inner land of the fitting body (a small gap on one side is acceptable if "a" and "b" are met)

6. Prior to LOK of the LOKRING fitting the pipe should be e. all of the above.

7. Pipe should be cut b. within 5° of square

8. The no-go cut out on the multi-purpose gauge allows you to check to see if the pipe is

a. out of round or undersize

9. If the pipe fits completely into the no-go slot of the multipurpose gauge,

d. all of the above.

10. When tightening up a union or a union-ended valve you should

c. use a back-up wrench on union body or hold the valve body to prevent turning.

11. All personnel who install LOKRING fittings must

- have completed LOKRING training, and installed 1 fitting in the presence of supervision, and have a LOKRING certification card.



APPENDIX J:

LOKRING Training and Certification documents

NAVSEA Compliance Document

This document is forwarded to NAVSEA 03Y3 as the official notification that this activity has received training from LOKRING Technology in the proper installation of LOKRING ESP[®] Mechanically Attached Couplings. The training program includes fabrication, safety, quality control, storage, inventory, installation and issuing of LOKRING fittings

Personnel Trained

Cert. #	Name	SSN or Emp. #	Company	Trainer	Date	Type of Cert.	Send Certs To
Activity						Date:	
Authorized Signature						Title:	
Company:						Ph:	
A copy of this document will remain on file at the activity listed above							
Please email this form to Customer Service at lfleming@lokring.com or fax to 440-942-1186. If you have questions please call Customer Service at 440-942-0880 x142							

APPENDIX J:

LOKRING Training and Certification documents

Individual Certificate

Employee Name _____ Badge No. _____ Shop _____

The above named employee has successfully completed an approved ESP® Training program.

Employee Certification Classification:

____ Instructor

____ Inspector

____ Installer

Training conducted by: _____

Company _____ Date _____

Instructor's Signature _____

INSTALLER CERTIFICATE

Five Simple Steps to a LOKRING® End Connection

Name:

Company:

Date Trained:

Certification Number:

Authorized Signature: _____

1. Cut and prepare pipe ends.
 2. Check pipe ends for square cut, check pipe O.D. and mark pipe ends with gauge (MPG).
 3. Inspect, assemble and cycle installation tooling.
 4. Position fitting on Install mark, fully engage tool onto fitting and cycle tool (**Beware of Pinch Points**).
 5. Post installation inspection (3 point visual check).
- Note: A thin coat of Loctite® 567 PST (Pipe Sealant with Teflon) is required in automotive paint applications and is strongly recommended for other applications which must seal gas tight where the pipe/tube wall thickness to OD ratio is less than 0.07.