

Lokring™ Fitting Installation Instructions (LP-105)

Pipe Fittings

316L Stainless Steel (SS)

4130 Alloy Steel (LTCS-333)

Microalloyed Steel (MAS)

70/30 Copper Nickel

90/10 Copper Nickel

Tube Fittings

316L Stainless Steel (SS)

70/30 Copper Nickel



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	Document Name	Revised document name to: LokringFittingInstallationInstructions(LP-105)_6090126_R1.6			
	Whole document	Renamed Figures (pictures) for improved clarification.			
	Section 2.2 and 2.3	Combined and simplified sections to refer to "Fitting Specification" documents. Added reference to Lokring Design Guide.			
	Section 3.0	Changed from "Maintenance Tool Kit" to "Multi-tool kit" (Ref: MTK).			
	Section 4.7.3	Removed Notes on requirements for using PST. Added guidance to installer on when to use.			
	Table 1 and 2	Added dimensions in metric (mm).			
	Section 6.9	Replaced Section "ITK100 Tooling Assembly" with new Section "Guide Rod Designed Installation Tools (IT100 and IT400)".			
	Section 6.11	Deleted Section ITK145 Tooling Assembly.			
	Section 7.13	Deleted Section ITK145-FR Installation.			
Appendix A	Addition of Envelope Dimensions and Space Requirements for the IT400 Installation Tool.				

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1.0 Scope

The handling, installation, and inspection of Lokring™ fittings should be carried out only by qualified, trained personnel. These *Lokring Fitting Installation Instructions* provide the necessary information to qualify an individual as a trained Lokring installer. Contact your authorized Lokring distributor for more information regarding installation training.

Lokring 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 fittings provide a cost effective alternative to field welding or flanging. By using couplings, tees, elbows, reducers, and flanges with matching straight pipe/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 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 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). Finally Lokring has developed these installation instructions to ensure that the final assembly and installation provides a joint that conforms to the ASME B31 codes.

In addition to these installation instructions, the following aids are available for installation training:

- [Lokring Installation Video](#)
- Lokring 5-Step Installation Guide
- Lokring Installer's Field Installation Guides (Tri-Folds)
- Lokring web address, www.lokring.com
- Hands-on Lokring certified installer training by a Lokring authorized representative

Contact your authorized Lokring distributor for more information.

Safe Selection

System design and system safety are the ultimate responsibilities of the end-user. Consideration to system function, material compatibility, product ratings, as well as other factors, must be given to ensure proper product selection and function. All information in these instructions has been compiled with regard to accuracy; however, the most up-to-date information should be verified before use of the product. Lokring reserves the right to change product dimensions, ratings, or other information.

2.0 Lokring Piping System Design Considerations

2.1 Lokring Fitting Design

Lokring mechanically attached fittings use a patented elastic strain preload® (ESP®) technology to create a permanent, metal-to-metal seal on 1/4 to 4 inch pipe and 1/4 to 2 1/2 inch tube without threading or welding. Following insertion of the pipe/tube into the fitting, hydraulic installation tooling advances each driver axially over the fitting body, radially compressing (swaging) the fitting body on to the outside diameter of the pipe/tube.

As the pipe/tube is compressed, first elastically and then plastically by the swaging action of the fitting, the circumferential sealing lands machined in the bore of the fitting body grip and seal on the pipe/tube. Compressive hoop stresses in the pipe/tube act in conjunction with the sealing lands to form a permanent, gas-tight, metal-to-metal seal without O-rings or other elastomeric seals.

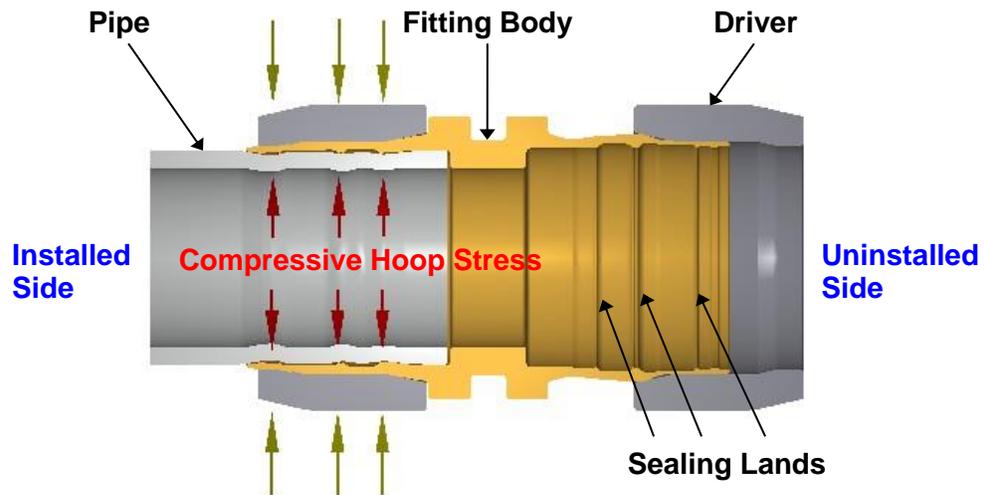


Figure 1: Installed and Sectioned Pipe Fitting

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

All other Lokring pipe and tube fittings have a center pipe/tube stop (see Figure 1).

2.2 Pressure-Temperature Ratings on Qualified Piping/Tubing

Lokring fitting specifications are available and provide fitting material specifications, pressure-temperature ratings, and a description of the qualified piping/tubing. Lokring fitting specifications are available for most materials.

316L Stainless Steel (SS40, SS3000, SS3300) Fitting Specifications

316L Stainless Steel Pipe Fittings (FS-40)

316L Stainless Steel Tube Fittings (FS-40-T)

Microalloyed Steel (MAS-3000) Fitting Specifications

Microalloyed Steel Pipe Fittings (FS-3000)

Microalloyed Steel Repair Couplings (FS-3000-RCPL)

Before using Lokring fittings on piping or tubing with material specifications or schedules other than those included in these specifications, contact your authorized Lokring distributor.

4130 Alloy Steel (LTCS-333) Fitting Specification

4130 Alloy Steel Pipe Fittings (FS-333)

Copper Nickel

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. These pipe fittings are rated to 250 psig (17.2 bar), -60 to 425 °F (-51 to 218 °C).

Lokring copper nickel pipe and tube fittings (CN-700) type 70/30 are designed for use on copper-nickel pipe and tube according to MIL-T-16420 (class 200, 90/10, class 200 70/30, and class 700 70/30). These pipe and tube fittings are rated to 700 psig (48.2 bar), -60 to 425 °F (-51 to 218 °C).

Lokring copper nickel tube fittings (CN-3300-XXX-T04) are designed for use on 70/30 copper nickel tube to MIL-T-16420 (class 3300 70/30). These tube fittings are rated to 3300 psig, -60 to 425 °F (-51 to 218 °C).

Brass Fitting Specification

Brass (BR)—Brass Tube Fittings (FS-BR)

See Lokring™ Brass Fitting Installation Instructions for Medical Gas and Vacuum Applications, LP-110, for information on brass (BR) Lokring tube fittings.

Also, please refer to the Lokring document “A Guideline for Designing ASME B31 Pressure Piping Using Lokring Fittings with Elastic Strain Preload (ESP®) Technology” for additional information on the product.

2.3 Installer Training

The handling, installation, and inspection of Lokring fittings must be carried out by qualified and trained personnel. Installers should be familiar with and use good pipe fitting practice. All installers must undergo a formal training session provided by an authorized Lokring trainer.

Once you undergo the formal training session you will receive a certification card. This card and your certification expire three years after the training date. **Appendix J** contains a sample certification training form and a sample certification card. Contact your authorized Lokring distributor 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.

2.4 Tool Selection and 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**.

2.5 Pipe/Tube Preparation

Lokring fittings will provide a permanent, gas-tight seal when installed on pipe/tube that is clean and free of 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 sanding the outside diameter as detailed under Section **4.0 Pipe/Tube End Preparation**.

The use of anaerobic sealant, such as Loctite sealant may enhance certain installations such as Lokring fittings on ASTM-A53 Type F furnace butt weld carbon steel pipe and on galvanized carbon steel pipe.

Final determination of compatibility with Loctite sealants is the sole responsibility of the user. Use of PST sealant limits temperature rating to 400 °F (204 °C) maximum. See **Appendix E** for service guidelines.

2.6 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/tube (see Figure 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/tube, nor should fittings be used to fixture, hold or align misaligned pipe/tube ends prior to creating or installing the fitting. Pipe/tube should be aligned, supported, and clamped into place before installing Lokring fittings.

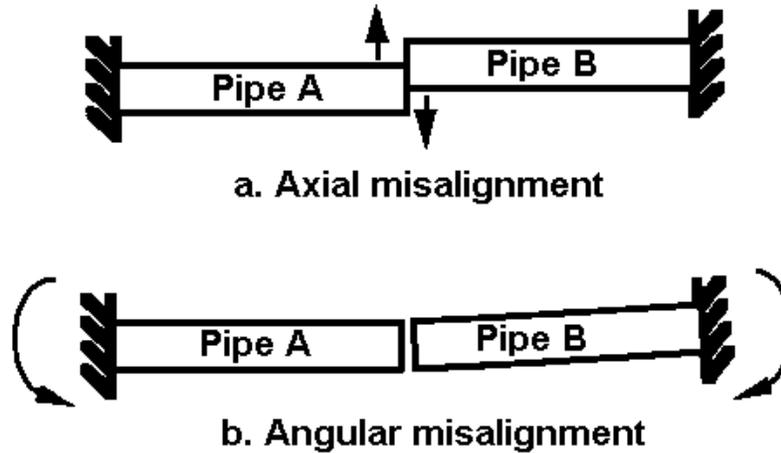


Figure 2: Examples of Pipe/Tube End Misalignment

2.7 Torsional Abuse

Excessive application of torque after installation can cause the pipe/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/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 Figure 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.

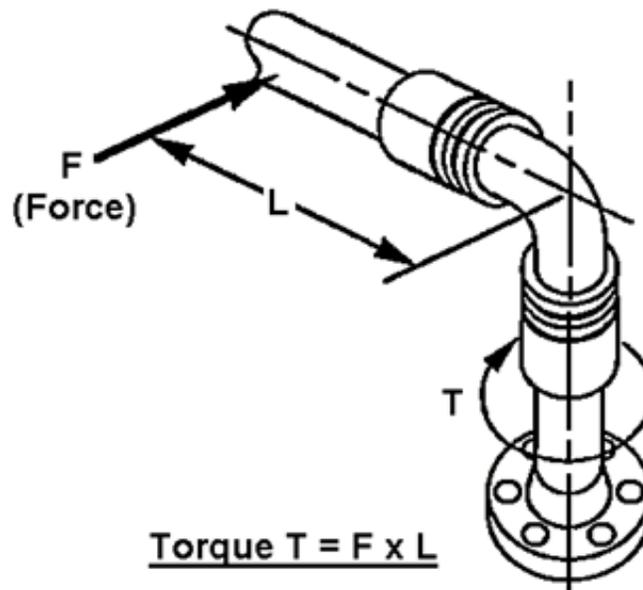


Figure 3: Application of Torque Loads During Fit-Up

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 installed. 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.

2.8 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 installation.

For example: Bolt-up the Lokring flange to the valve or pump for alignment and optimal flange sealing before installing 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 fitting 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 install the final Lokring connections and inspect the installations.

3. Following these Lokring fitting installation instructions 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. By far the most common installation error is inadequate pipe/tube end preparation (section 4.0).
 - b. The pipes/tubes are not adequately inserted into the fitting (sections 7.2, 7.3, and 7.4)
 - c. There is a misalignment or lack of proper pipe/tube support or both (sections 2.5, 2.6, and 2.7).

3.0 Lokring Installation Tooling

3.1 Loktool® Multi-Tool Kit (MTK) (See Appendix C)

MTK (multi-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 inch 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 such as Loctite 567 PST thread sealant

NOTICE: *Most pipe and tube outside diameter surfaces can be sanded by hand. However, for ease of preparing pipe that has poor surface, has a thick epoxy coating, or is large diameter pipe, a belt sander made for sanding outside diameter of pipe is recommended. Lokring suggests using a powered sanding unit (such as model Flex LRP 1503 VRA, or similar) for sanding 1 inch and larger piping. Other powered abrasive heads can be used to prepare the pipe/tube outside diameter surface. However, care must be taken in the selection and use of all equipment and abrasives so as not to create a flat or an undersized pipe/tube outside diameter.*

Since Lokring fittings seal on the pipe/tube, this area must be clean and free of longitudinal scratches to ensure a leak free, metal-to-metal seal. The lack of proper pipe preparation is by far the most common cause of Lokring fitting leakage. The proper preparation of the outside diameter is the responsibility of the system designer and user.



Figure 4: Multi-Tool Kit



Figure 5: Accessories for Pipe/Tube Preparation

3.3 Hydraulic Pump and 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 several manufacturers through Lokring or direct. All pumps must be single acting, automatic dump (Electric pumps only), with a 10 000 psig (689 bar) rating. When supplied by Lokring these pumps come equipped with quick-connect hydraulic fittings that mate to hydraulic hose and Loktool installation tooling. Consult your authorized Lokring representative for replacement fittings.



Figure 6: Hydraulic Pump and 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 and (bottom right) PUMP XA Series: Foot operated, lightweight, pneumatic pump, operates off shop air (80 psig [5.6 bar]/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 Loktool installation tooling (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. Limited to Loktool tooling sizes IT04/IT10/IT20 only.

Hydraulic Hose Assembly (bottom center) HH15-QD: 15 ft (4.5 m) 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 7.

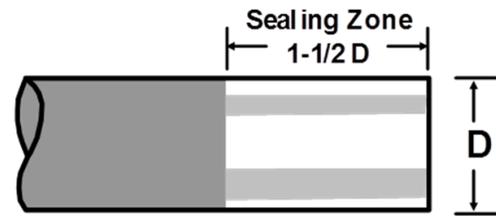


Figure 7: Sealing Zone

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.

NOTICE: *The lack of proper pipe preparation is by far the most common cause of Lokring fitting leakage. While the robust design of the Lokring fitting may initially seal on pipe that is not properly prepared, the remnants of pipe that has not been prepared properly such as longitudinal scratches can promote leakage in the long term.*

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 ± 5°

Cut pipe/tube squarely with hacksaw, cutting wheel, reciprocating saw, or portable band saw to no more than 5° off-square. See Figure 8. 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 inch (** 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**.

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 excessive OD burrs).
- 3) Not over tighten the cutter on each turn or rotation. Too much pressure results in a larger burr.

Note: If the application or piping system requires a minimum gap between the pipe/tube ends or the internal shoulder of the fitting, a pipe facing tool can be used or both. A tool, such as those offered by Tri-Tool (www.tritool.com) or other pipe facing tool can be used to control the

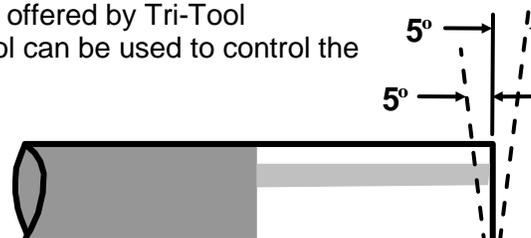


Figure 8: Squareness of Cut

4.3 Deburr Pipe/Tube ID and OD

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 9.



Figure 9: 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 10. If deep scratches, pits or other surface incongruities persist; use of 60-grit aluminum oxide abrasive cloth followed by 120-grit cloth is recommended.

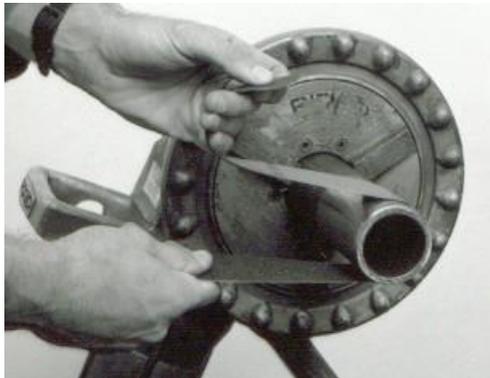


Figure 10: Sand

NOTICE: *Always sand around the circumference of the pipe/tube. See Figure 11. DO NOT sand along the longitudinal axis of the pipe/tube. This can result in unacceptable flat spots on the sealing surface. The lack of proper pipe preparation is by far the most common cause of fitting leakage.*

NOTICE: *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.*

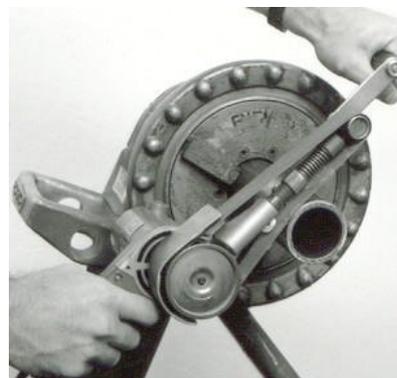


Figure 11: Sanding Tools

4.5 Inspect Sealing Zone

Visually inspect Sealing Zone for deep scratches, flat spots, etc. See Figure 12. 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 12: 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. Check for surface scratches by running a thumbnail perpendicular to the pipe/tube surface completely around its circumference. See Figure 13. 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.

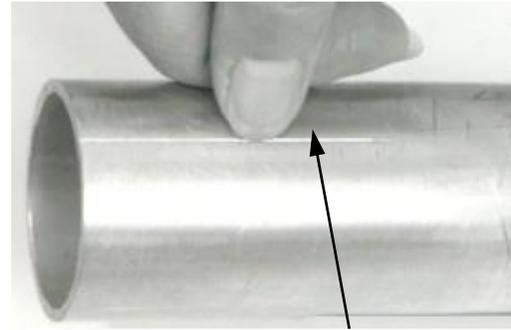


Figure 13: Longitudinal Scratches



Figure 14: Weld Suck-Back

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

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 14). 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/tube end preparation is required; go to paragraph 4.7

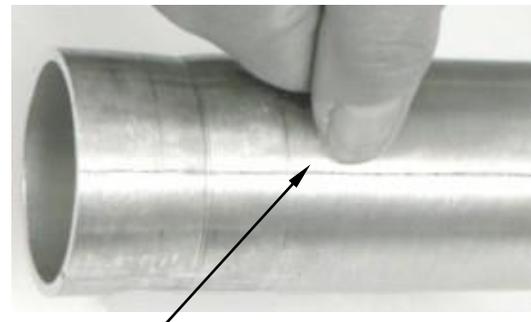


Figure 15: Weld Seam Suck-Back

4.6.2.2 Flat Spots

On ERW (electric resistance welded) pipe/tube, poor OD 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 16). 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 the tube's OD. Further pipe/tube end preparation is required; go to Paragraph 4.7.

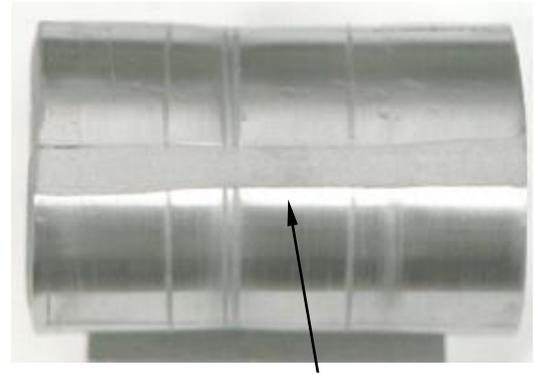


Figure 16: Flat Spots

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 OD (see Figure 17). 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.



Figure 17: 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 18) 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.

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 may be used.

NOTICE: *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.



Figure 18: Seam Reinforcement

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, 60-grit, aluminum oxide cloth as according to 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 Section 4.0 Pipe/Tube End Preparation is adhered to and found not to be effective in removing the Bad Pipe/tube Conditions, an anaerobic pipe/tube thread sealant such as Loctite 567 PST thread sealant may be applied to the pipe/tube surface within the Sealing Zone to enhance the seal. When used, anaerobic sealant is applied following Pipe/tube Gauging and Marking (Ref: paragraph 5.4).

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

The proper preparation of the outside diameter is the responsibility of the system designer or user.

Contact Your Authorized Lokring Distributor

If there are any further concerns, contact your local Lokring distributor (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 and Marking

5.1 The Lokring Multi-Purpose Gauges (MPG)

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 pipes or tubes outside diameter. 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 exists for use with each of the product lines that Lokring manufactures. The gauges for Lokring product lines can be seen in Figure 19.

Use only the MPG for a specific product with that product line, i.e. use the 316L stainless steel (SS) MPG for 316L stainless steel fittings (SS) only, NEVER interchange the gauges across product lines.

NOTICE: *The correct MPG must be used.*



Figure 19: Multi-Purpose Gauges (MPG). The MPGs are shown with the Lokring product lines they are used to install.

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/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.

NOTICE: *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.*

No gap should appear

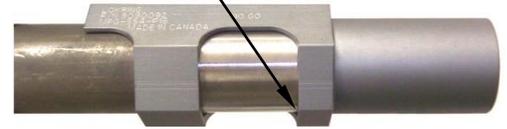


Figure 20: Squareness Check

5.3 Check for Minimum Pipe/Tube Outside Diameter

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

If the pipe/tube outside diameter 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 outside diameter 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.

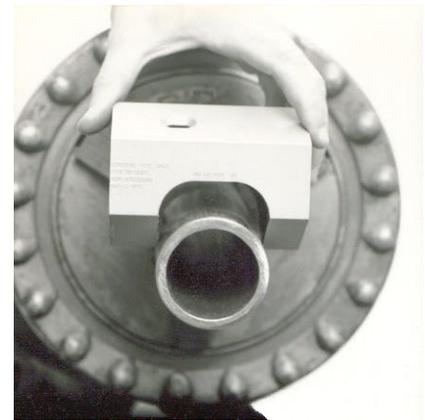


Figure 21: NO-GO Gauge

Note: Lokring fittings are designed to be installed on the full outside diameter tolerance range of qualified matching pipe/tube specifications.

Do not use pipe/tube whose outside diameter is outside of the range listed in Tables 1 and 2 below.

Table 1: Pipe Outside Diameter (OD) Requirements

Pipe Size NPS (Lokring end designation)	Nominal O.D. inches (mm)	Minimum Outside Diameter OD inches (mm)				Maximum Outside Diameter OD inches (mm)			
		CS	SS	CuNi	Cu	CS	SS	CuNi	Cu
1/4 (P04)	0.54 (13.7)	0.509 (12.9)	0.509 (12.9)	0.535 (13.6)	0.538 (13.7)	0.555 (14.1)	0.555 (14.1)	0.54 (13.7)	0.542 (13.8)
3/8 (P06)	0.675 (17.1)	0.644 (16.4)	0.644 (16.4)	0.67 (17.0)	0.673 (17.1)	0.69 (17.5)	0.69 (17.5)	0.675 (17.1)	0.678 (17.2)
1/2 (P08)	0.84 (21.3)	0.809 (20.5)	0.809 (20.5)	0.834 (21.2)	0.838 (21.3)	0.855 (21.7)	0.855 (21.7)	0.84 (21.3)	0.843 (21.4)
3/4 (P12)	1.05 (26.7)	1.019 (25.9)	1.019 (25.9)	1.044 (26.5)	1.047 (26.6)	1.065 (27.1)	1.065 (27.1)	1.05 (26.7)	1.053 (26.7)
1 (P16)	1.315 (33.4)	1.284 (32.6)	1.284 (32.6)	1.307 (33.2)	1.312 (33.3)	1.33 (33.8)	1.33 (33.8)	1.315 (33.4)	1.318 (33.5)
1 1/4 (P20)	1.66 (42.2)	1.629 (41.4)	1.629 (41.4)	1.652 (42.0)	1.657 (42.1)	1.675 (42.5)	1.675 (42.5)	1.66 (42.2)	1.663 (42.2)
1 1/2 (P24)	1.9 (48.3)	1.869 (47.5)	1.869 (47.5)	1.892 (48.1)	1.897 (48.2)	1.915 (48.6)	1.915 (48.6)	1.9 (48.3)	1.903 (48.3)
2 (P32)	2.375 (60.3)	2.344 (59.5)	2.344 (59.5)	2.365 (60.1)	2.371 (60.2)	2.406 (61.1)	2.406 (61.1)	2.375 (60.3)	2.379 (60.4)
2 1/2 (P40)	2.875 (73.0)	2.844 (72.2)	N/A			2.906 (73.8)	N/A		
3 (P48)	3.5 (88.9)	3.465 (88.0)	3.469 (88.1)	N/A		3.535 (89.8)	3.531 (89.7)	N/A	
4 (P64)	4.5 (114.3)	4.455 (113.2)	N/A			4.545 (115.4)	N/A		

Table 2: Tube Outside Diameter (OD) Requirements

Tube Size inches (Lokring end designation)	Nominal O.D. inches (mm)	Minimum Outside Diameter OD inches (mm)		Maximum Outside Diameter OD inches (mm)	
		SS	CuNi	SS	CuNi
1/4 (T04)	0.25 (6.4)	0.246 (6.2)	0.245 (6.2)	0.254 (6.5)	0.25 (6.4)
3/8 (T06)	0.375 (9.5)	0.371 (9.4)	N/A	0.379 (9.6)	N/A
1/2 (T08)	0.5 (12.7)	0.496 (12.6)	0.495 (12.6)	0.504 (12.8)	0.5 (12.7)
5/8 (T10)	0.625 (15.9)	0.621 (15.8)	N/A	0.629 (16.0)	N/A
3/4 (T12)	0.75 (19.1)	0.746 (18.9)	N/A	0.754 (19.2)	N/A
7/8 (T14)	0.875 (22.2)	0.871 (22.1)	N/A	0.879 (22.3)	N/A
1 (T16)	1 (25.4)	0.994 (25.2)	N/A	1.006 (25.6)	N/A
1 1/4 (T20)	1.25 (31.8)	1.244 (31.6)	N/A	1.256 (31.9)	N/A
1 1/2 (T24)	1.5 (38.1)	1.494 (37.9)	N/A	1.506 (38.3)	N/A
2 (T32)	2 (50.8)	1.99 (50.5)	N/A	2.01 (51.1)	N/A
2 1/2 (T40)	2.5 (63.5)	2.488 (63.2)	N/A	2.512 (63.8)	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.

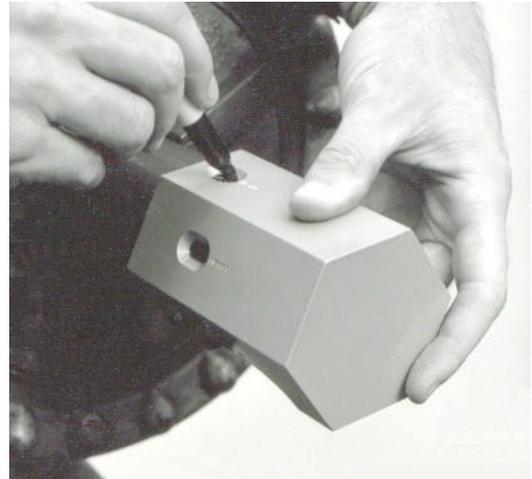


Figure 22: Marking Pipe/Tube OD

NOTICE: 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 optional Anaerobic Sealant (Loctite® 567™ PST® Thread Sealant)

If it is determined to apply an anaerobic sealant, brush on or spread a thin bead of sealant uniformly around the pipe/tube end circumference. The thread sealant should be applied just back from the end of the pipe/tube up to the inspect mark; care should be taken to prevent excess thread sealant from entering the system at the pipe/tube end.

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

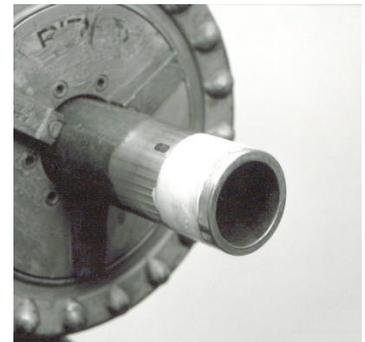


Figure 23: Sealant Application

6.0 Selection and 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 being installed (e.g. 1/2-inch stainless steel, 2-inch microalloyed steel, etc.) The body inserts will fit into the Loktool body, and the jaw inserts will fit into the Loktool moving jaw.

NOTICE: *The installation tool is different for the 2 1/2-, 3-, and 4-inch size fittings. See section 6.9 for installation 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 24: Installation Tooling



Figure 25: Installing Body Insert

Loktool Jaw

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 an allen wrench until they are finger tight. Do not over tighten screws.

NOTICE: *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 your authorized Lokring distributor if you need replacement screws.*

6.4 Connect Hose to Pump

Remove dust caps from hose nipple and pump quick-connect. Pull back quick-connect locking sleeve in pump and fully engage hose nipple into the pump quick-connect. Release locking sleeve to secure hose into pump. Make sure the locking sleeve slides forward completely.

6.5 Connect Hose to Loktool Head

Remove dust caps from Loktool nipple and hose quick-connect. Retract quick-connect locking sleeve and fully engage quick-connect axially onto the Loktool nipple, then release locking sleeve (allowing sleeve to snap forward to complete connection). Make sure the locking sleeve slides forward completely.

Note: When using the Portable Loktool installation tool, the tool head will be directly connected to the pump, and no hoses are necessary.

6.6 Advance Thread Locking Ring

If there is a hose quick-connect thread locking ring, advance it manually against the quick-connect locking sleeve. This will prevent accidental separation of the installation tool from the hose during operation or transportation.

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

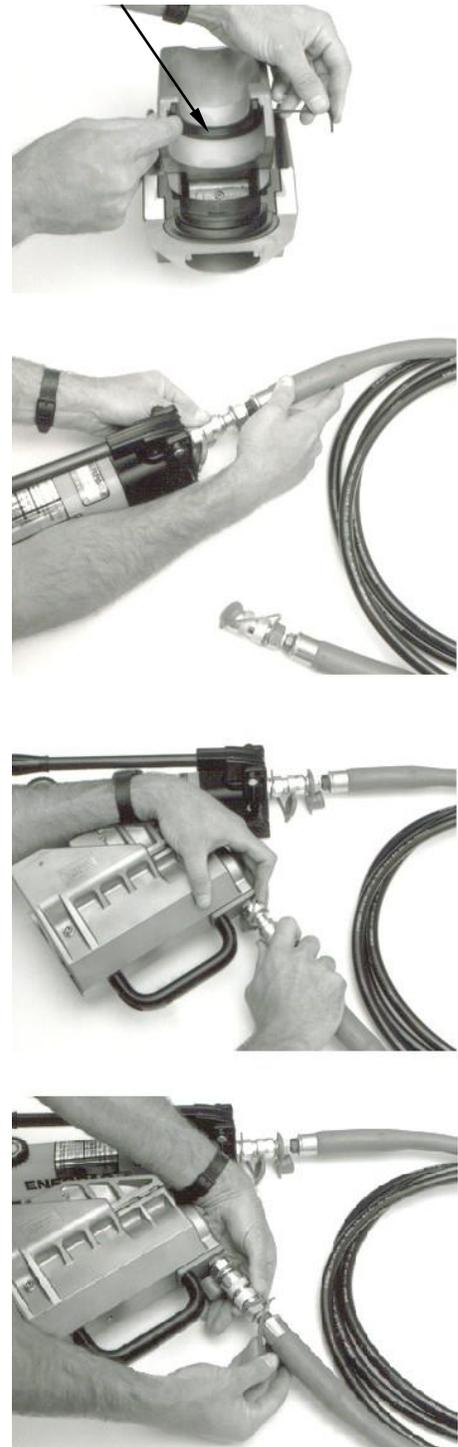


Figure 26: Installing Jaw Insert and Connecting Tool to Pump

- 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 quick-connects are fully secured.

⚠ CAUTION
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 manufacturer's instructions packaged with pump to bleed air from the system.



Figure 27: Cycling the System

- 6.8 Preventative Maintenance**
Perform preventative maintenance on the tooling components in accordance with Appendix D.

6.9 Guide-Rod Designed Installation Tools (IT100 and IT400)

The guide-rod designed installation tools provide the resilience needed to install larger diameter fittings, while minimizing the tool envelope to facilitate installation in tight spots.

Included in the ITK and MTK tool kits are:

- A fully-assembled installation tool
- Multi-purpose gauge(s) for the pipe size(s) indicated in the tool kit description
- A *User Guide*

6.9.1 Operation and Use

Below are the basic steps for proper and safe operation of the guide-rod tools.

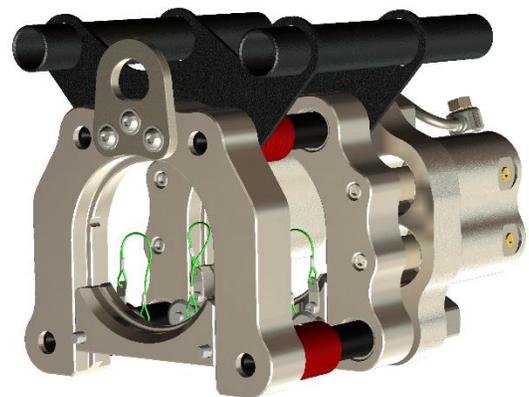


Figure 28: Installation Tool (IT400)

6.9.2 Powering the tool

The guide-rod tools utilize ultra-high-pressure quick-connect couplings for safe, secure, and speedy connection to hydraulic power in the field.

To safely connect the tool to the hydraulic supply:

1. Pull back on the locking ring and push the female end (hose) onto the male end (tool) until the coupling locks in place.
2. Once positive connection is made, meaning the male end is fully inserted and the coupling resists separation when pulled in the opposite direction, slide the locking ring up and thread it on until it stops.

The tool is now safely connected and ready for use. *Reverse the steps to disconnect.*

NOTICE: *The use of wrenches to tighten or loosen the locking rings may damage the quick-connect coupling; only tighten or loosen the locking rings by hand.*

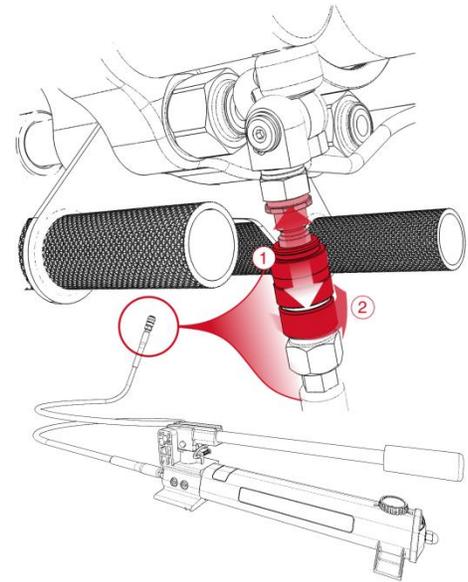


Figure 29: Connecting to Hydraulic Power Using the Quick-Connect Coupling

Note: The other end of the hose must be connected to a hydraulic power source; connect this end according to the pump manufacturer's recommendations.

6.9.3 Test-cycling the tool

Before installing any fitting, it is important to test-cycle the tool. Cycle the tool a few times without a fitting to ensure the tool is in good working order and confirm the hydraulic connections are secure and free from leaks.

To cycle the tool:

- Apply hydraulic pressure – this will cause the tool's moving jaw to advance towards the fixed jaw.



CAUTION

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).

- When the moving jaw reaches the end of its natural stroke, release pressure and allow it to fully retract.

Note: Whenever possible, it is good practice to elevate the pump *above* the tool during test-cycling to allow any trapped air to exit the hydraulic system. Lokring tools are bled of all air at the factory and come ready to use; this practice simply ensures any air which may have been introduced through use is given a chance to escape the system.

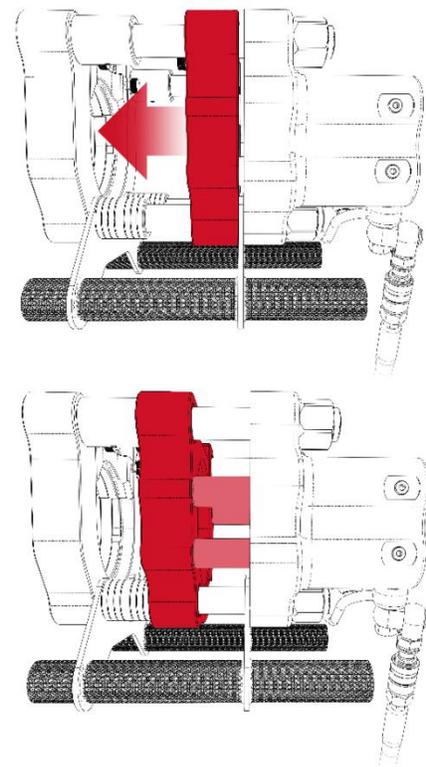


Figure 30: Cycling the Tool

6.9.4 Installing Lokring Fittings

The guide-rod tools are used to permanently install Lokring fittings quickly and easily following these five steps:

1. Disengage the retention pins and remove the inserts from the fixed and moving jaws.
2. Position the tool onto the fitting body so that the fixed jaw (forward installation) or moving jaw (reverse installation) engages the groove between the fitting tool flanges.

NOTICE: Some fittings will require the use of lower inserts as well. See Appendix C: Loktool Installation Tool Selection Guide.

3. Re-install the inserts into the fixed and moving jaws (reverse of step one) and engage the retention pins.

Note: Inserts are identical and can be used in either jaw.

⚠ CAUTION
Operation of the tool without inserts installed could cause damage to the tool and will likely result in an improperly installed Lokring fitting.

If the retention pins will not engage, then the tool is not properly positioned; adjust the position of the tool and ensure that it is fully seated in the tool groove, then try again.

4. Apply hydraulic pressure. The moving jaw will advance, pulling the driver and fitting body together. Continue to apply pressure until the driver contacts the tool flange, then release pressure and wait for the moving jaw to fully retract before attempting to remove the tool.

⚠ CAUTION
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).

5. Remove the inserts (same as step one) and proceed to inspect the installation as outlined in 8.1 Post Installation Visual Inspection. Once the inserts are removed,

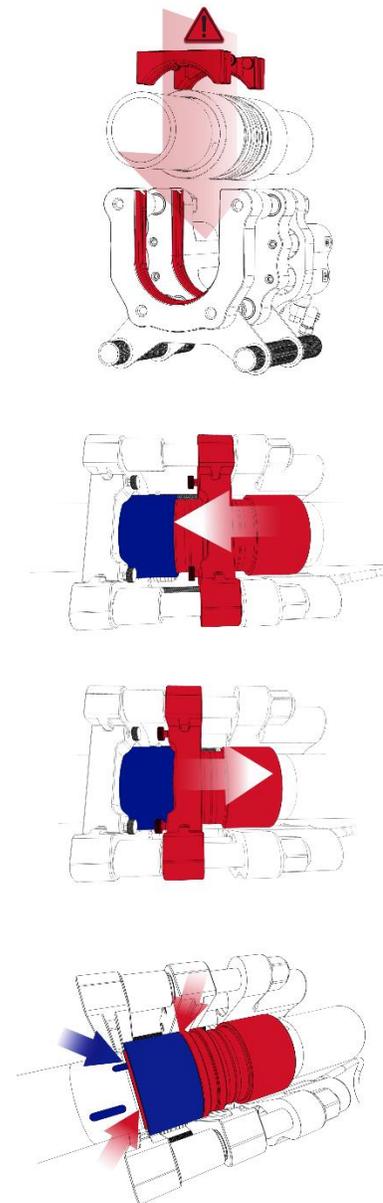


Figure 31: Lokring Fitting Installation Using the Guide-Rod Tools

you may remove the tool as well.

Repeat for each end of the Lokring fitting.

6.9.4 Lifting and Rigging

The guide-rod tools are equipped with a designated lift point. This lift point is the only authorized point to attach a tether or lifting device.

- On the IT100 tool, the lift point is integral to the handle.
- On the IT400 tool, the lift point is attached to the fixed jaw.

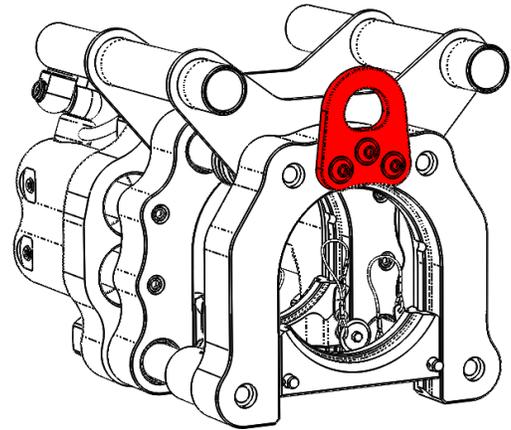


Figure 32: IT400 Lift Point

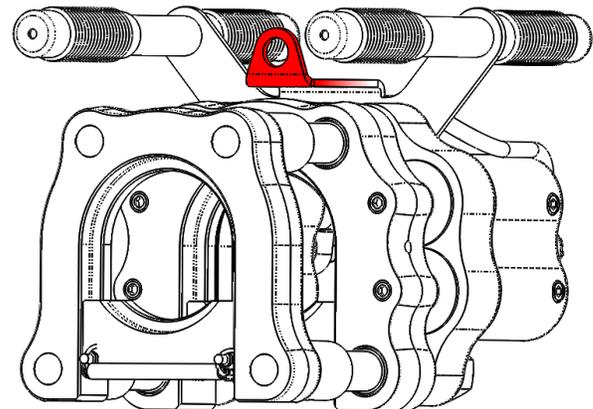


Figure 33: IT100 Lift Point

6.10 ITK140 Tool Assembly

This tool has been designed to install Lokring

3 and 4 inch NPS carbon and stainless steel fittings

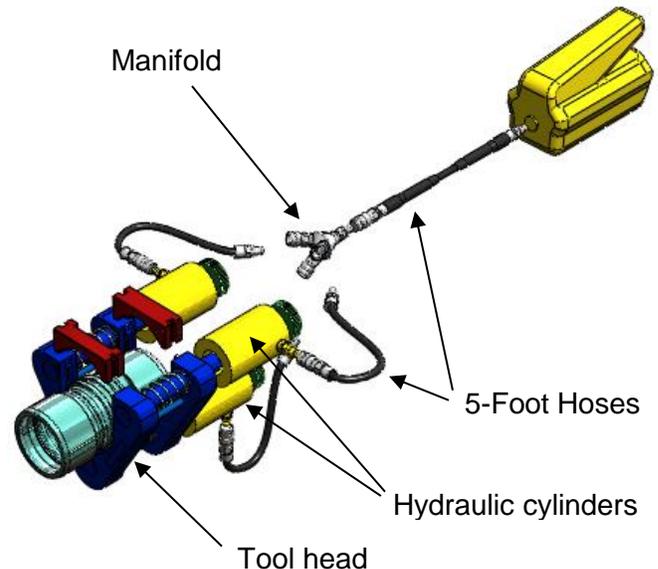
This tool can only install fittings in the Forward Only configuration.

The tool comes in a kit with the following items

(All of these items are required for proper installation).

- tool head
- hydraulic cylinders (3)
- 5-foot (1.5 m) hoses (4)
- manifold

Figure 34: ITK140



6.10.1 Assemble Hydraulic System

Place hydraulic cylinders onto guide rods (make sure that the plunger side is facing towards the jaw).

Hand tighten nut with the larger flat side facing toward the hydraulic cylinder.

Connect the 5-foot hydraulic hoses to the hydraulic cylinders and the manifold.

Connect the manifold to the hydraulic pump.

6.10.2 Cycle Assembled Hydraulic System

Advance and retract tool jaw several times without the fitting. This will ensure no air is trapped in the system and that the hydraulic quick-connects are fully secured.



CAUTION

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).

NOTICE: *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. The tool may require maintenance. Follow pump manufacturer's instructions packaged with pump to bleed air from the system.*

Note: For ease of installing a fitting the hydraulic cylinders can be placed onto the guide rods after the tool head has been positioned onto the fitting. Refer to Section 7.12

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 driver advances.

7.2 Slide Fitting Over the 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.

NOTICE: *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 driver.*



Figure 35: Pre-Installation Process

7.3 Couplings with a Thru-Bore Design

The following Lokring couplings larger than 1/4 inch are designed without a center stop giving them a "thru-bore" design:

- 316L stainless steel couplings
- copper nickel couplings
- microalloyed steel repair couplings
- all tube couplings

This design allows the coupling to slide completely over the pipe/tube. It also eliminates the need to "spring" the pipe/tube to get the fitting into position.

When installing these "thru-bore" design couplings, ALWAYS make sure at least part of the **INSTALL** mark is covered by the driver before installing the Lokring connection. It is best to cover half of the **INSTALL** mark.

7.4 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 36: Using the 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**.

7.5 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.

NOTICE: *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 37: Verify Pre Install Position

7.6 Engage Loktool Installation Tooling on the 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 driver.

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 driver see **Appendix A**.

Fitting Tool Flanges

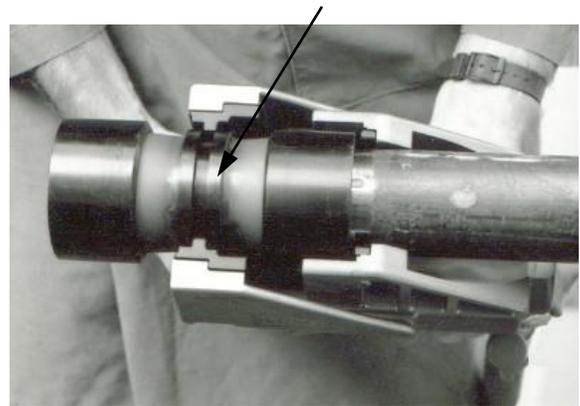


Figure 38: Tool Engaged on Fitting

CAUTION

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 or tool or both may be damaged during fitting installation and may leak or separate in use.

7.7 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.

7.8 Actuate Hydraulic Power

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

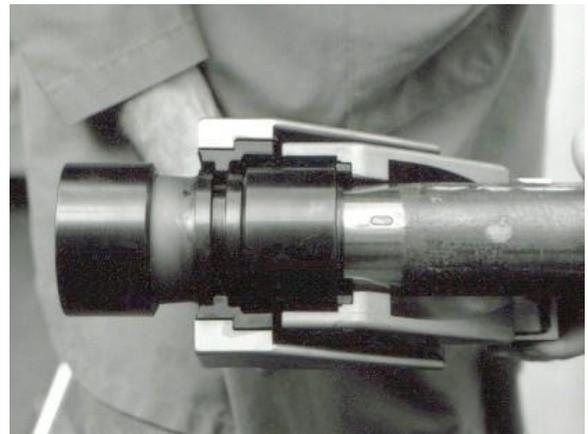


Figure 39: Driver Driven to Contact Tool Flange

CAUTION

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**).

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

The first pipe/tube end connection is now complete.

7.9 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.

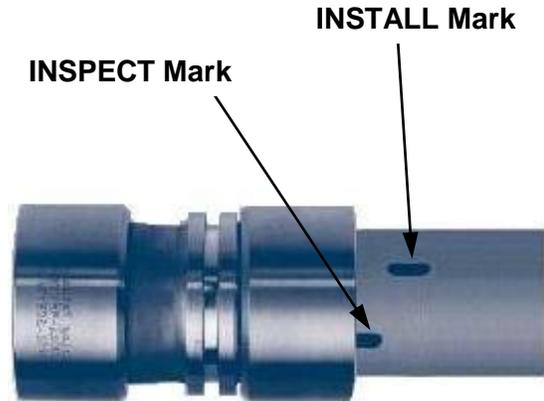


Figure 40: Inspection of Installed Fitting

7.10 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.

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)



Figure 41: Insert Second End into Fitting

NOTICE: *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 installation (see paragraph 2.6, 2.7, and 2.8)*

7.11 Engage Loktool Installation Tooling on the 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.

THE COUPLING JOINT IS NOW COMPLETE

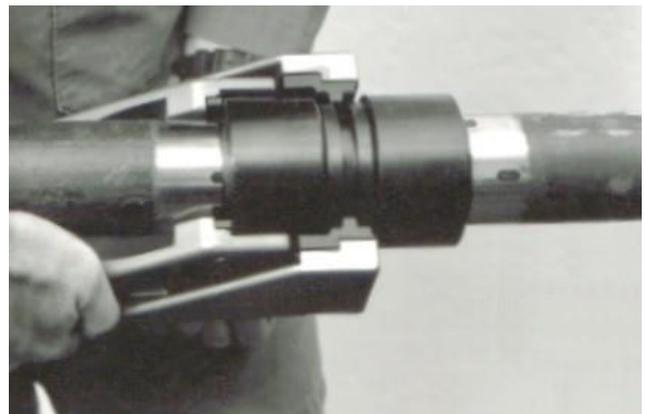


Figure 42: Tooling Turned and Re-Engaged

7.12 IT100 Installation

For the installation of 2 ½ inch NPS (P40) and 3 inch NPS (P48) fittings using the ITK100 installation tool, proceed using the following steps.

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 P40 or 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 and cycle the IT100 Installation Tool until the Driver fully contacts the Connector body.



CAUTION

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).

5. Remove the Inserts as in step 1 and remove the tool from the P40 or P48 Fitting.

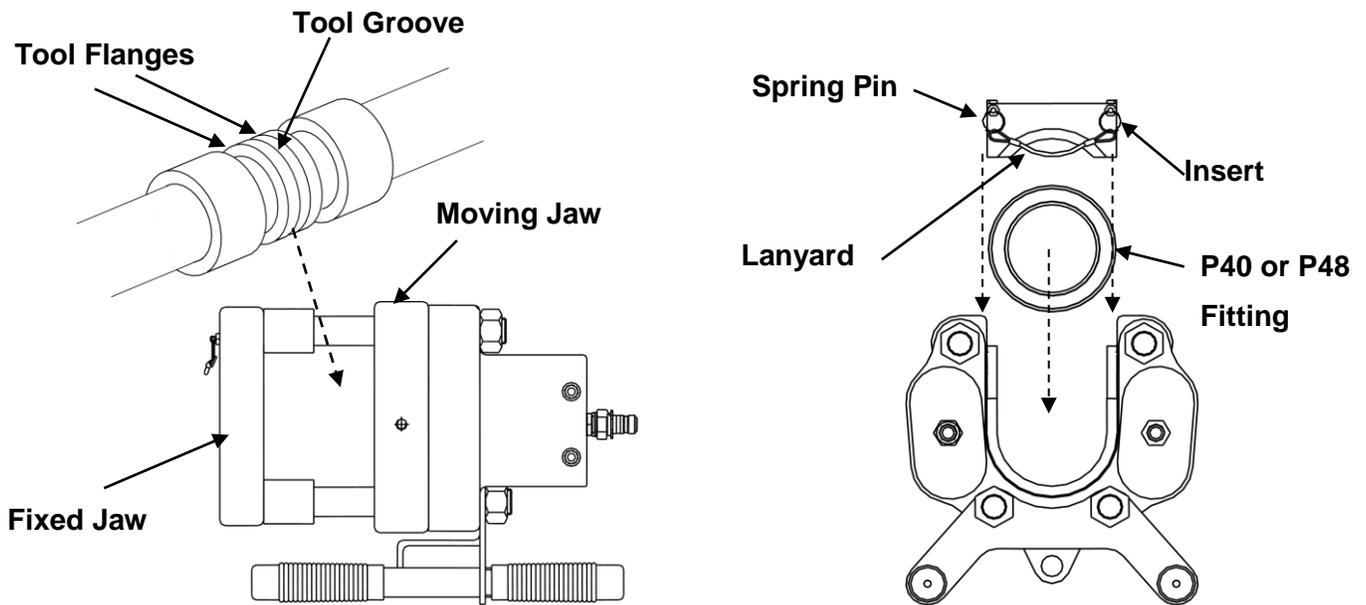


Figure 43: 2 1/2- and 3-Inch Fitting Assembly

7.13 3- and 4-Inch Fitting Installation with the IT140 Tool

For the installation of 3 inch NPS (P48) and 4 inch NPS (P64) fittings using the ITK140 installation tool, proceed using the following steps.

1. Rotate Locking Spring Plunger and remove the Inserts from the Fixed and Moving Jaws.
2. Position the P48 or P64 Fitting Body into the Fixed Jaw (Forward Installation). To install P48 fittings, Fixed and Moving Jaw Inserts are required to be assembled in the Fixed and Moving Jaws.
3. Install the Inserts into the Moving and Fixed Jaws, the Locking Spring pins will lock them into position.
4. Pressurize the IT140 until the Driver fully contacts the Fitting Body.



CAUTION

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).

5. Remove the Inserts as in step 1 and remove the tool from the Fitting.

Fully engage tool onto fitting

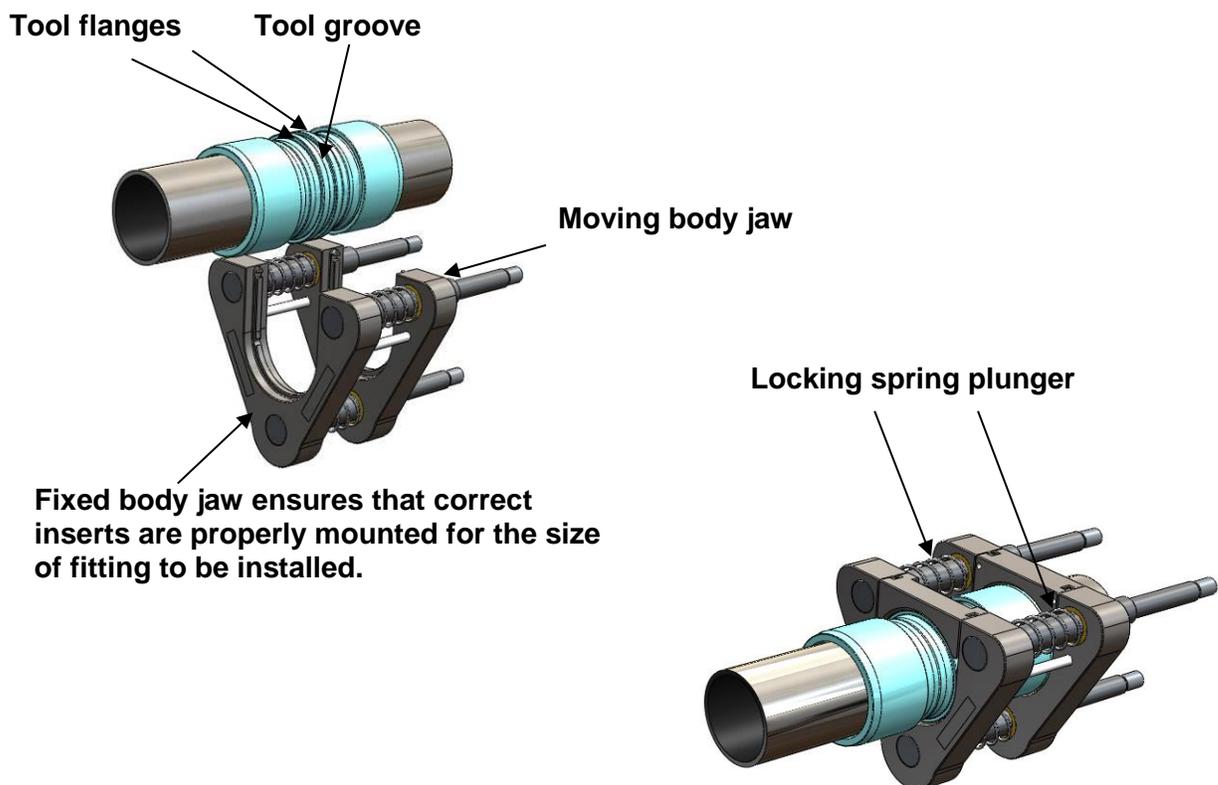


Figure 44: 3 inch and 4 Inch Fitting Assembly

7.14 3- and 4-Inch Fitting Installation with the IT400 Tool

For the installation of 3 inch NPS (P48) and 4 inch NPS (P64) fittings using the IT400 installation tool, proceed using the following steps.

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 or P64 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 and cycle the IT400 Installation Tool until the Driver fully contacts the Connector body.



CAUTION

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).

5. Remove the Inserts as in step 1 and remove the tool from the P48 or P64 Fitting.

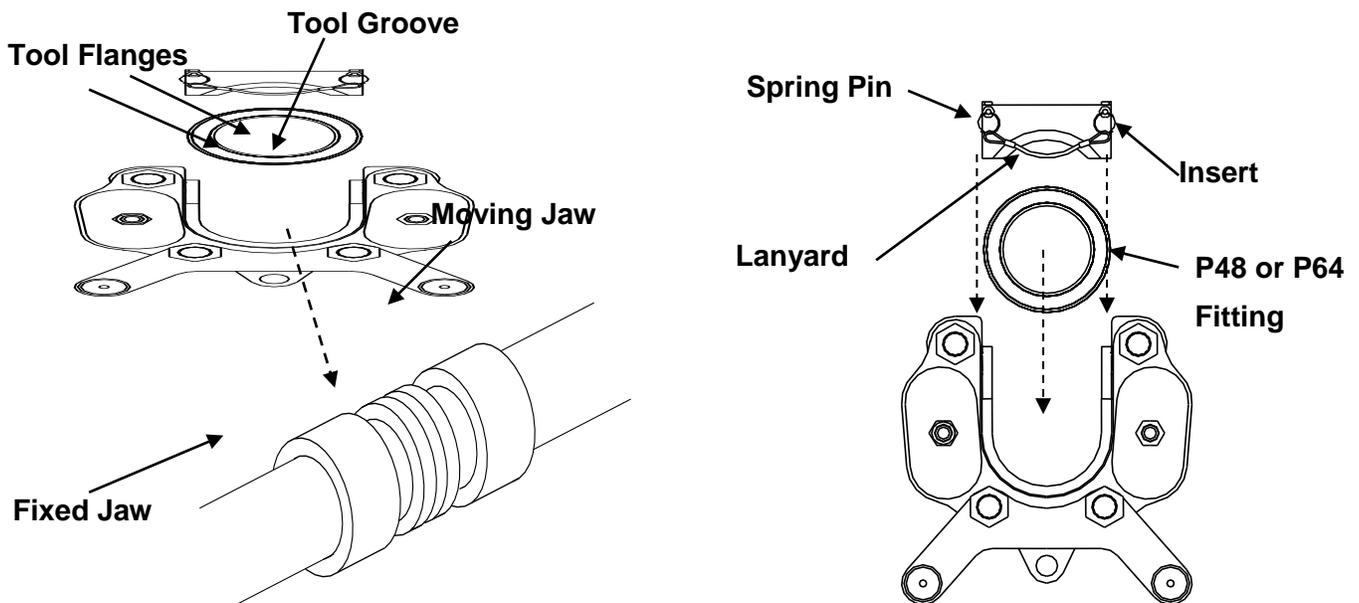


Figure 32: 3- and 4-Inch Fitting Assembly

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 driver.

2. Check to see if the **INSPECT** mark is partially covered by the fitting and that most or all the **INSTALL** mark is exposed.

3. Check to see that the driver butts up against the tool flange. A small gap is acceptable if conditions 1 and 2 are met.

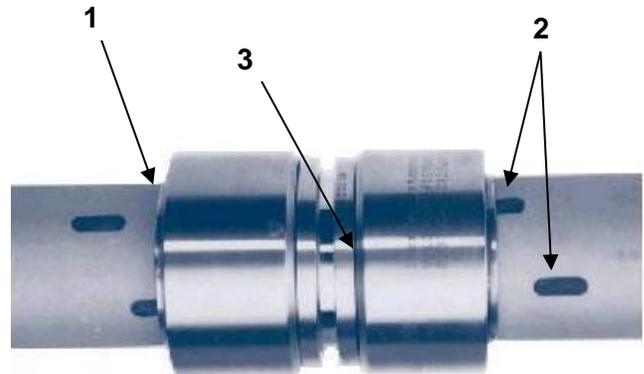


Figure 45: Post-Installation Inspection

8.2 Good Installation

Each driver should be fully drawn up over the fitting body, and the trailing edge of the fitting should protrude from underneath the driver 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 driver and tool flange is acceptable provided the fitting body extends from underneath the trailing edge of the driver at all points around the circumference of the fitting.

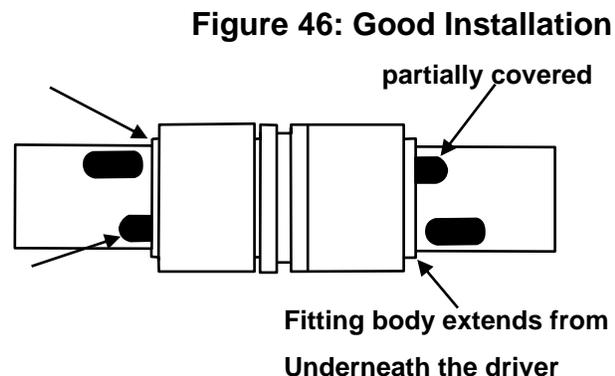


Figure 46: Good Installation

8.3 Incomplete Installation
One of the drivers is not fully installed onto the fitting body. The trailing edge of one side of the fitting is not fully visible underneath the trailing edge of the driver. The Loktool head should be re-engaged onto the incomplete side and recycled to complete the installation.

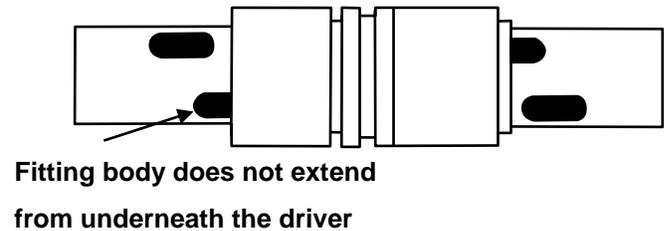


Figure 47: Incomplete Installation

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.

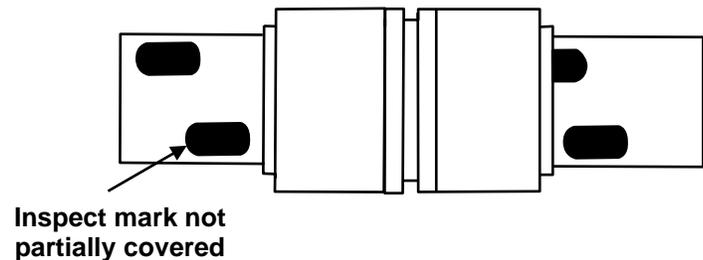


Figure 48: Bad Installation

NOTICE: *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. 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 ready for Hydrostatic Testing

8.6 QA/QC Record of Assembly and Installation

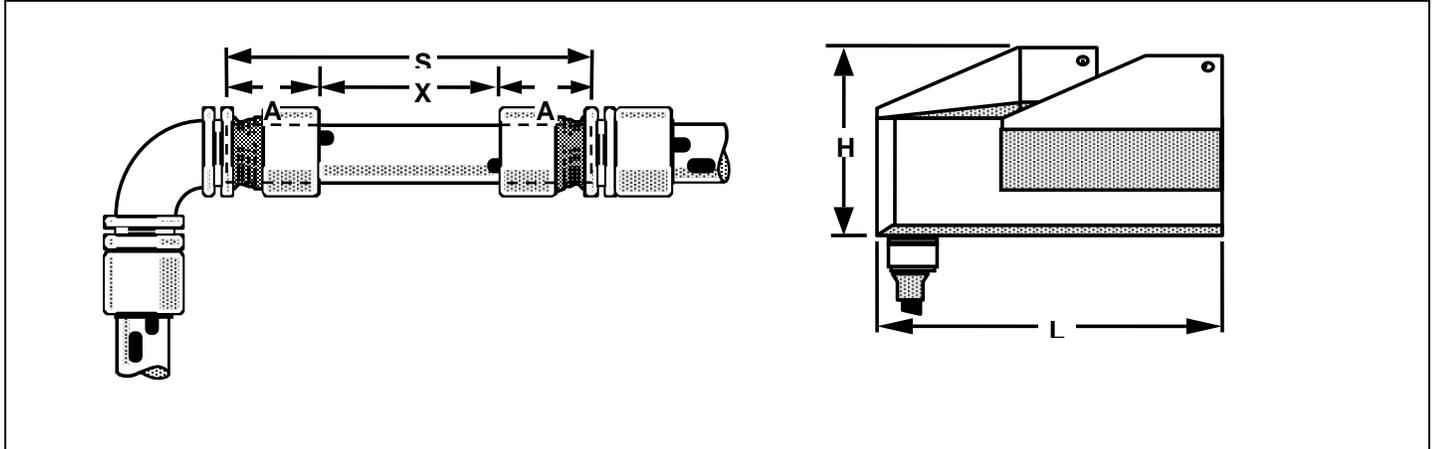
If your organization shall require a record or validation method of the assembly and installation or both please refer to **Appendix K** Lokring Assembly and Installation Checklist for a recommended format.

9.0 Reference Documents

- 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.
- A Guideline for Designing ASME B31 Pressure Piping Using Lokring™ Fittings with Elastic Strain Preload® (ESP®) Technology.
- A Guideline for Specifying Lokring™ Fittings with Elastic Strain Preload® (ESP®) Technology.
- Lokring Fitting Specifications:
 - SS40, 316L Stainless Steel Pipe Fittings ((FS-40)
 - SS40, SS3000, SS3300, 316L Stainless Steel Tube Fittings (FS-40-T)
 - LTCS-333, 4130 Alloy Steel Pipe Fittings (FS-333)
 - MAS-3000, Microalloyed Steel Pipe Fittings (FS-3000)
 - MAS-3000-RCPL, Microalloyed Steel Repair Couplings (FS-3000-RCPL)
 - BR, Brass Tube Fittings (FS-BR)
- Vibration Testing of Compression Joints, PVP2017-65043, American Society of Mechanical Engineers, New York, 2017.

APPENDIX A:
Envelope Dimensions and Space requirements

MAS-3000 Series Carbon Steel Pipe Fittings

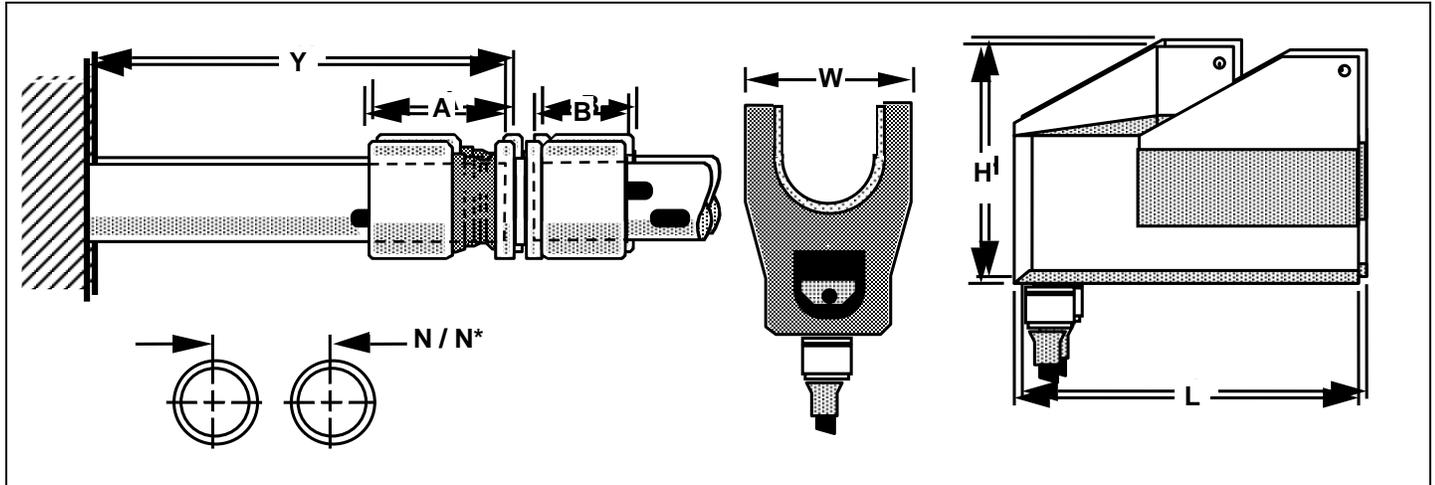


Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" NPS (P04)	0.540	IT20	3.07	0.59	1.24	5.00	3.20
3/8 NPS (P06)	0.675	IT30	3.39	0.65	1.37	6.45	3.97
3/8 NPS (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

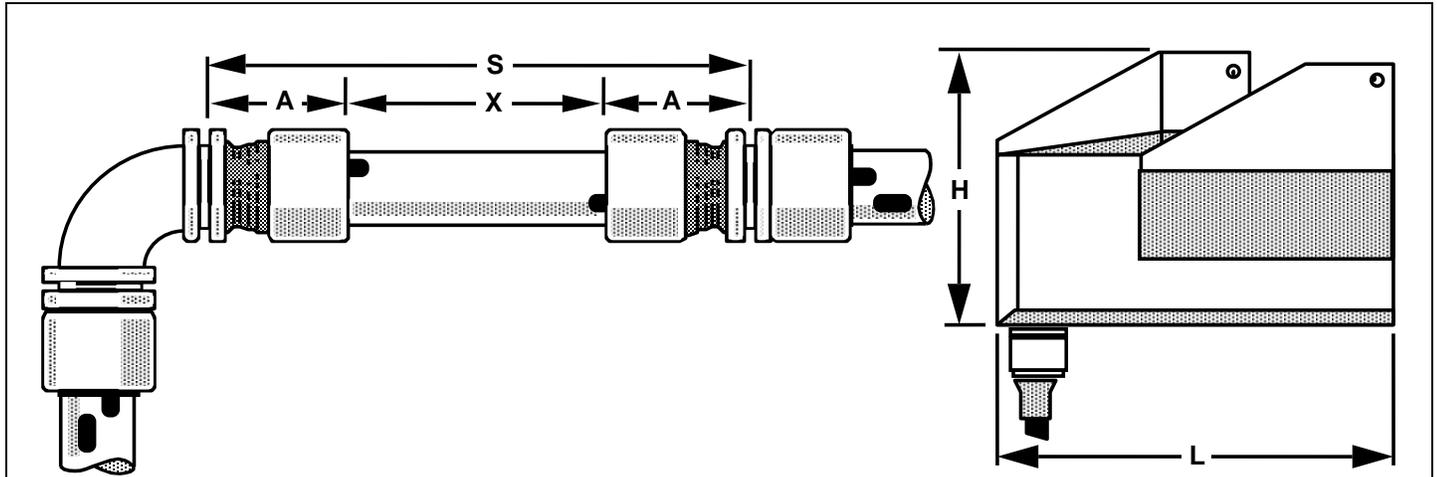


Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" NPS (P04)	0.540	IT20	2.36	1.58	1.83	1.83	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.

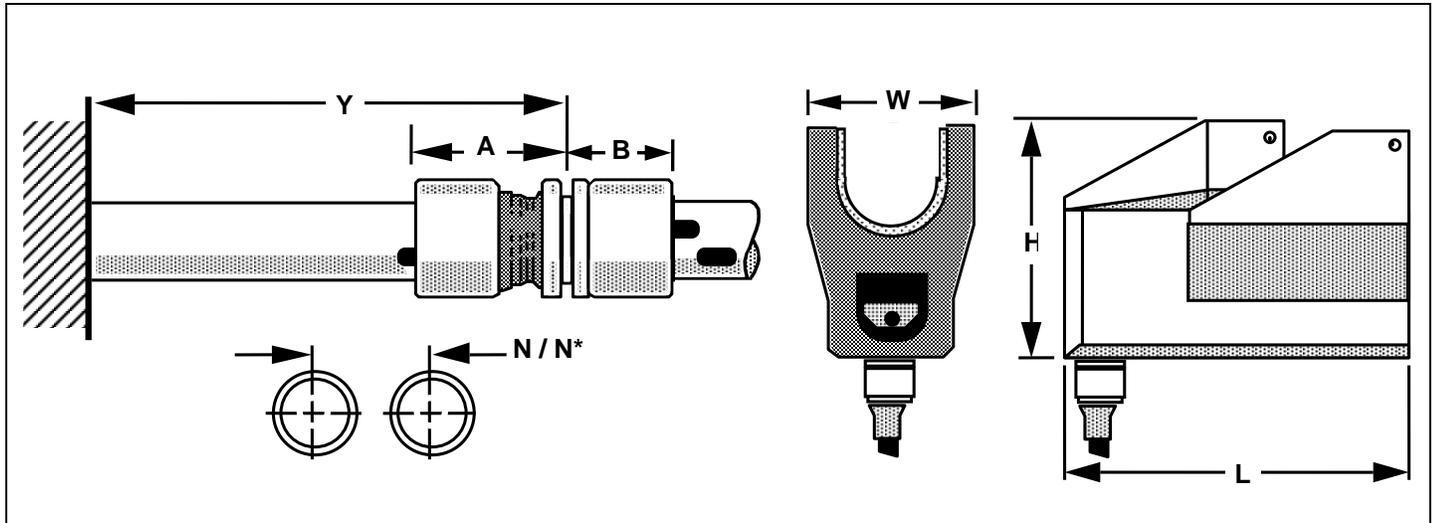
APPENDIX A:
Envelope Dimensions and Space requirements
SS40 and SS-3300 Series Stainless Steel Pipe Fittings



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.

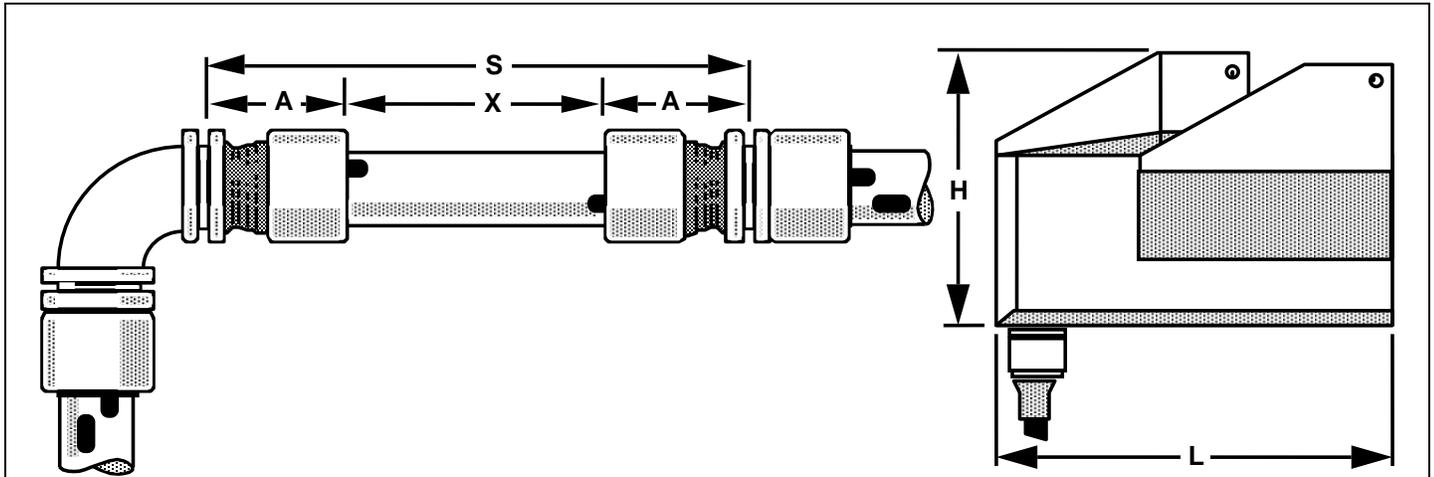
APPENDIX A:
Envelope Dimensions and Space requirements
SS40 and SS-3300 Series Stainless Steel Pipe Fittings



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



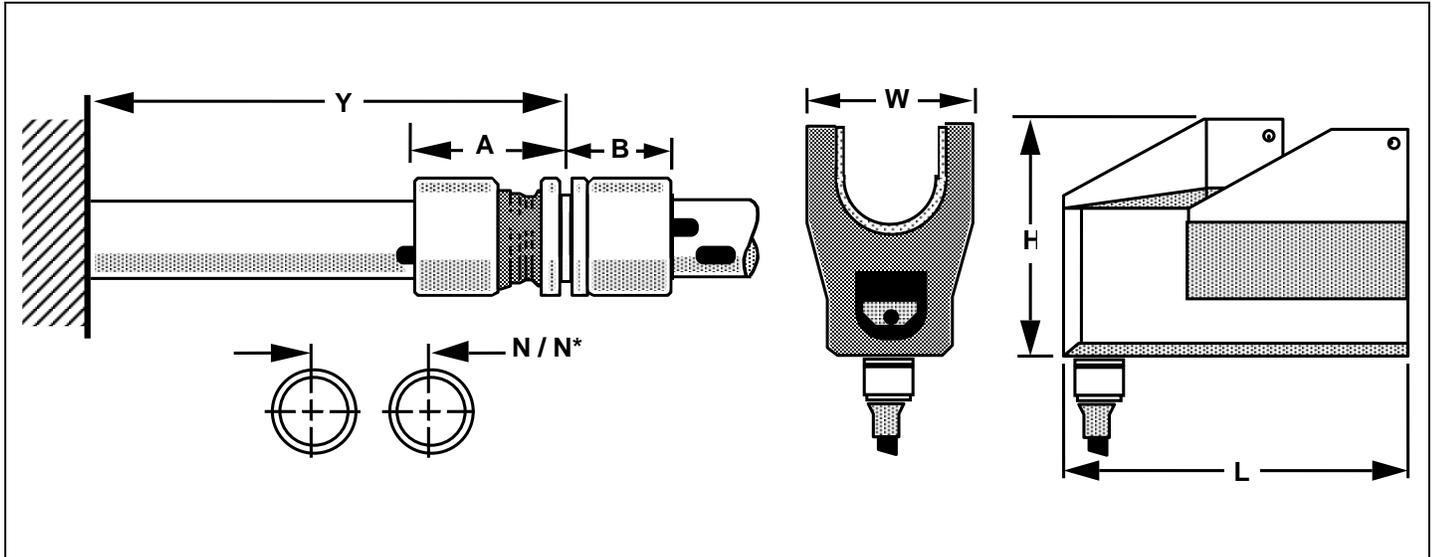
Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/4" (P04)	0.540	IT10	3.14	0.57	1.29	5.01	3.21
1/4" (P04)	0.540	IT20	3.14	0.57	1.29	5.01	3.21
3/8" (P06)	0.675	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

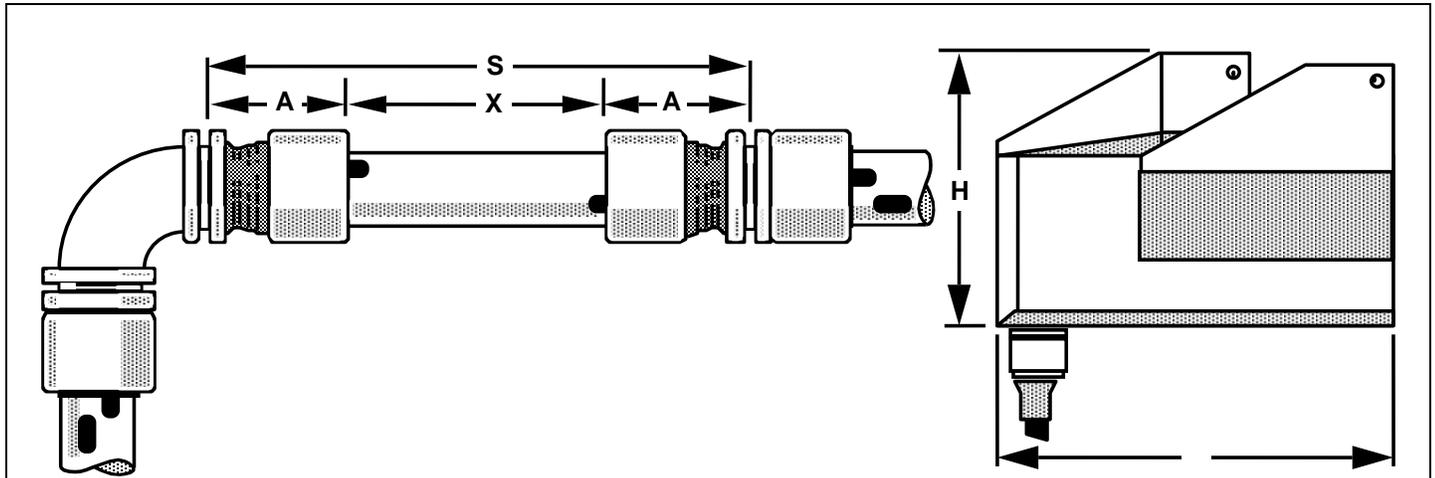
CN-200 Series Copper Nickel Pipe Fittings



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.

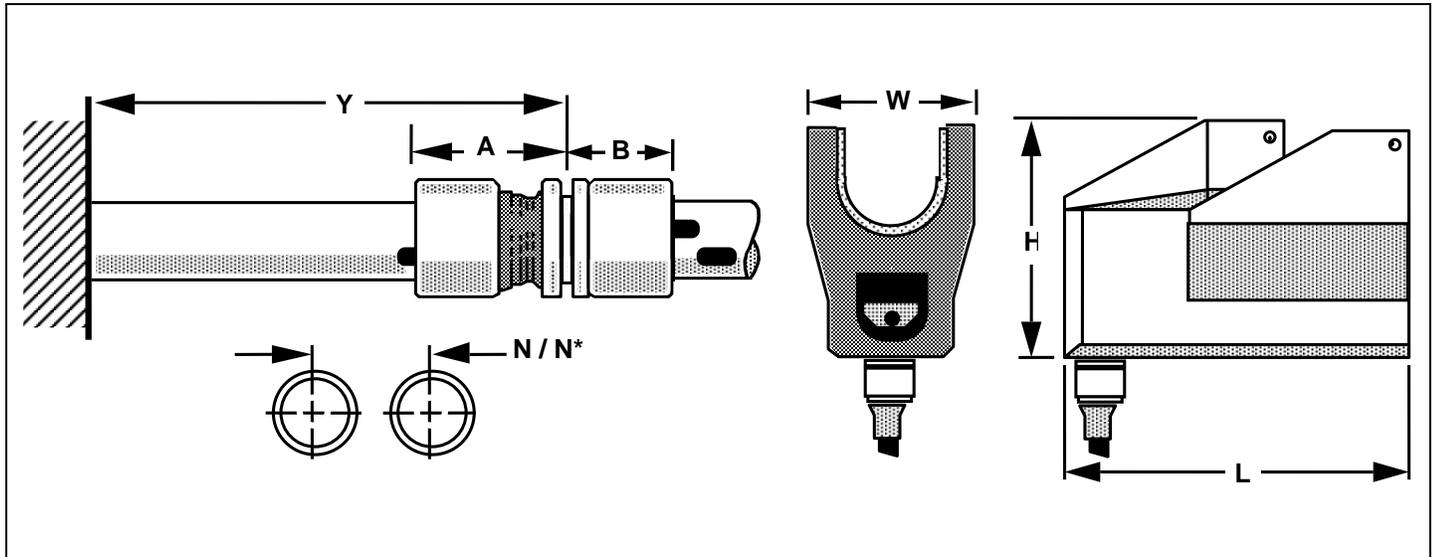
APPENDIX A:
Envelope Dimensions and Space requirements
CN-700 Series Copper Nickel Pipe and Tube Fittings



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.

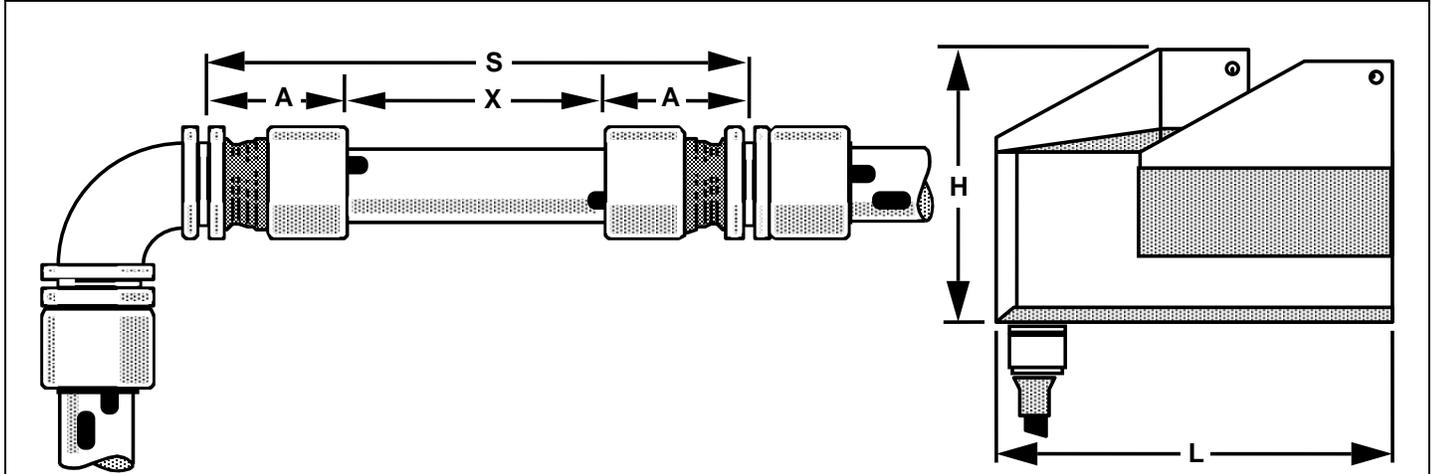
APPENDIX A:
Envelope Dimensions and Space requirements
CN-700 Series Copper Nickel Pipe and Tube Fittings



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.

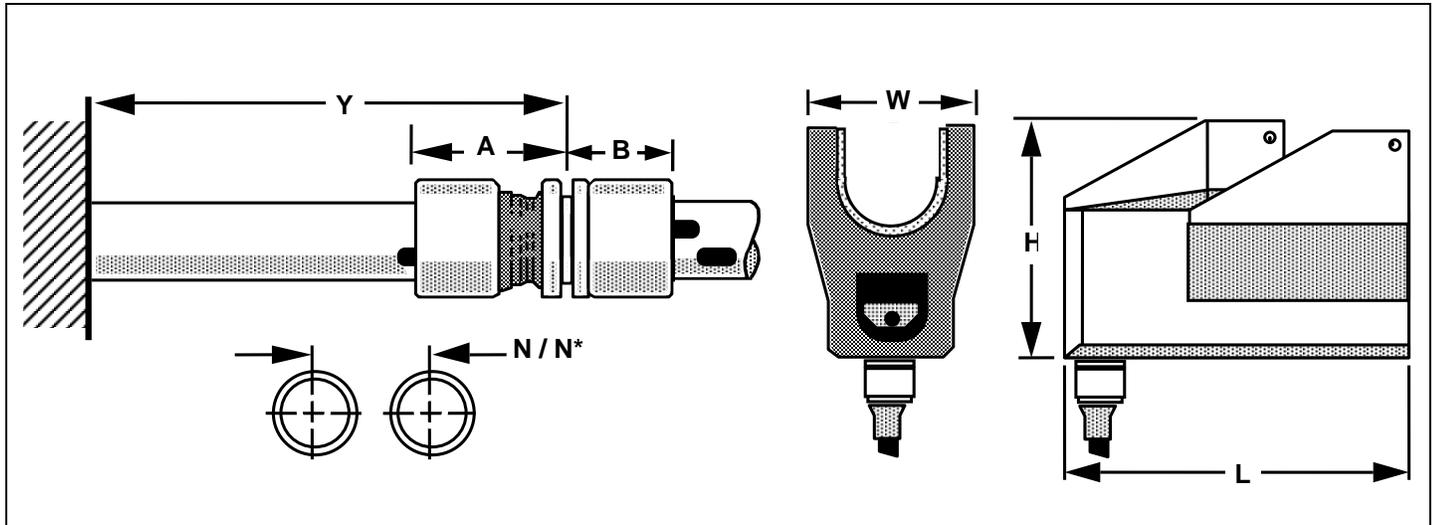
APPENDIX A:
Envelope Dimensions and Space requirements
SS40 & SS-3000, SS-3300, CN-3300 Series Tube Fittings



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



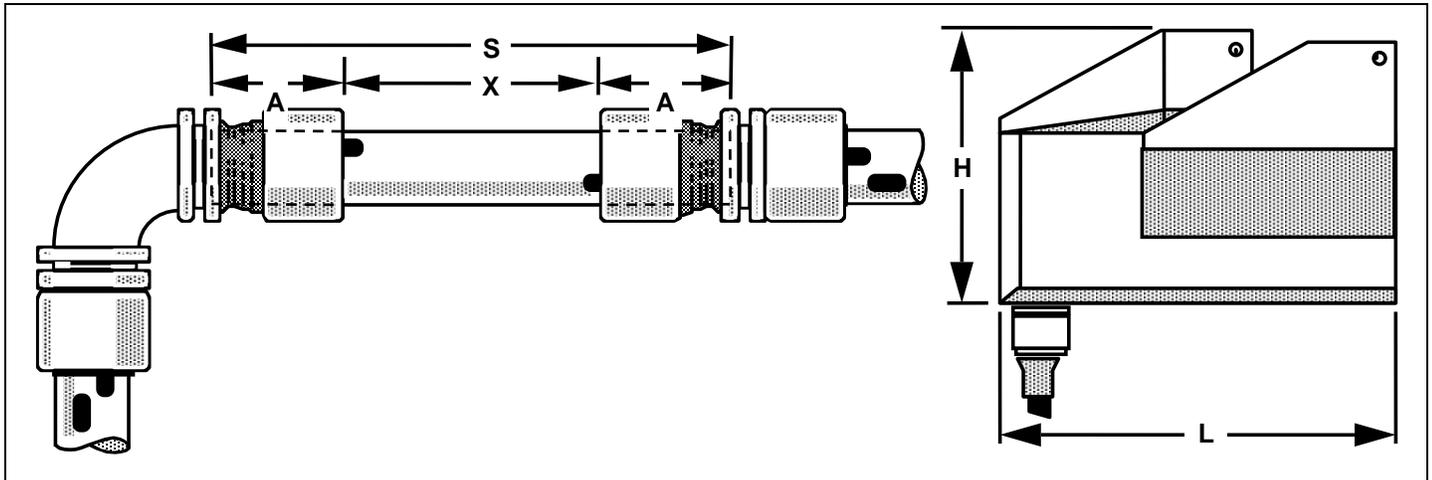
Dimensions in Inches			W	N	N*	Y	B
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Tool Width	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Insertion Depth Installed, Nominal
1/4" (T04)	0.25	IT04	1.21	0.85	1.00	1.29	0.73
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

LTCS-333 Series Carbon Steel Fittings, ITK45 & ITK60 Series Tools



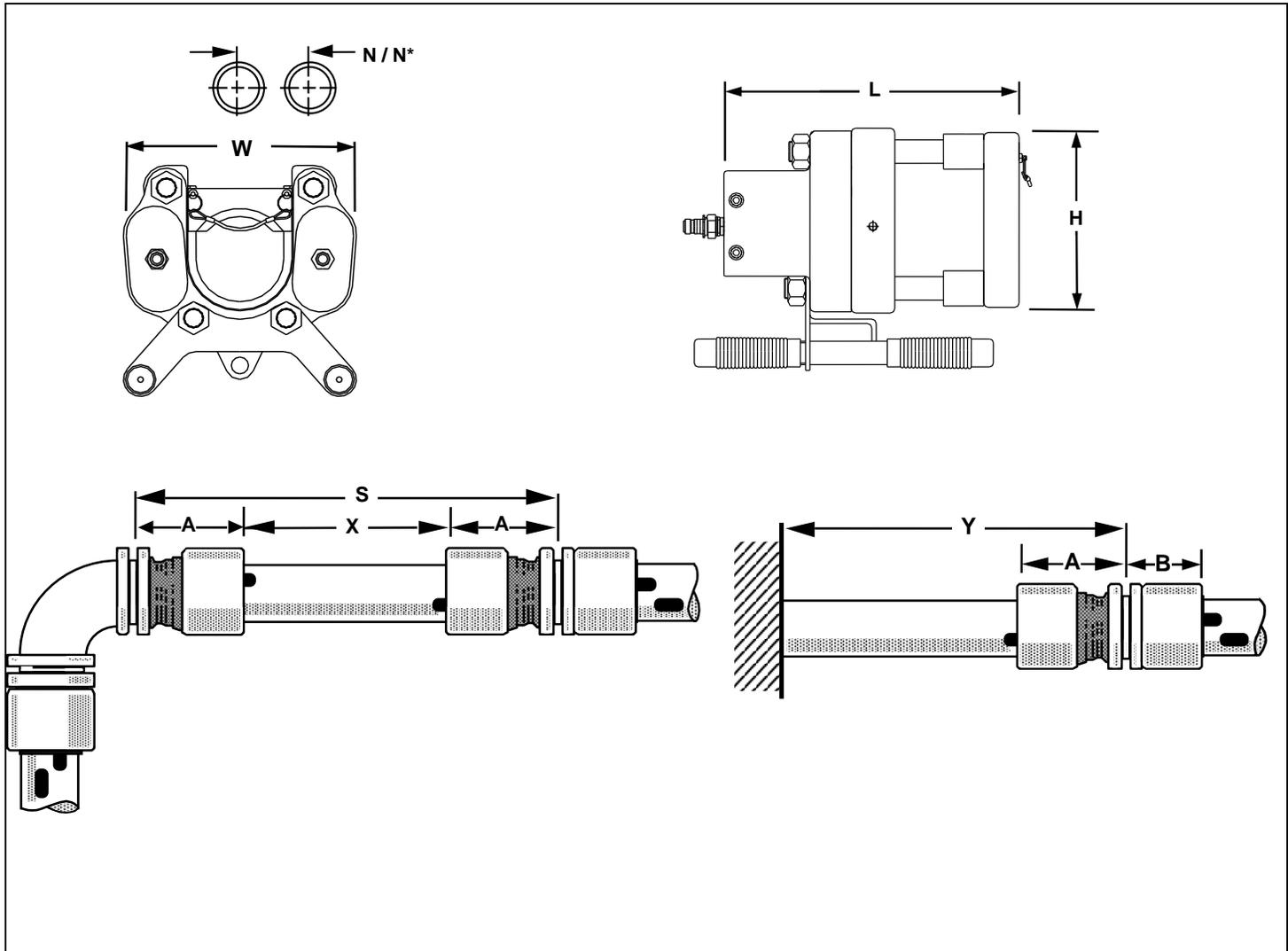
Dimensions in Inches			S	X	A	L	H
Fitting Size	Pipe Or Tube OD	LOKTOOL Size	Minimum Spool Length	Minimum Spacing Between Fittings	Pre-Installed Insertion Depth, Nominal	Tool Length	Tool Height
1/2" (P08)	0.840	IT45	3.71	0.85	1.43	6.38	4.91
3/4" (P12)	1.050	IT45	3.97	0.73	1.62	6.38	4.91
1" (P16)	1.315	IT60	4.89	0.87	2.01	8.59	5.84
1-1/2" (P24)	1.900	IT60	6.23	1.49	2.37	8.59	5.84
2" (P32)	2.375	IT60	7.28	1.08	3.10	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, LTCS-333, SS40 Series Pipe Fittings ITK100 2½ and 3 inch Tooling

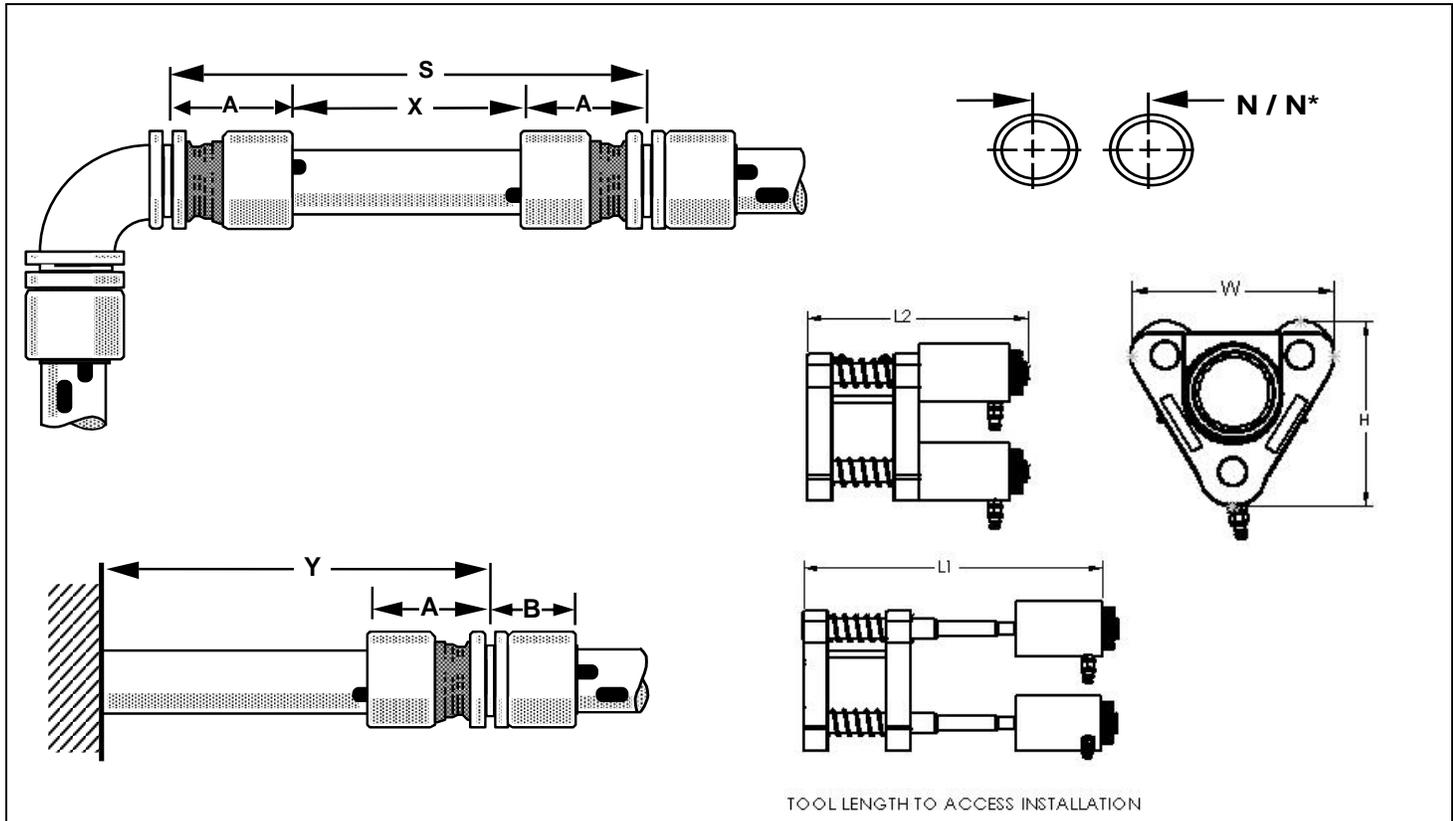


Dimensions in Inches		L	W	H	N	N*	Y	S	X	B	A
Fitting Size (NPS)	Fitting Description	Tool Length	Tool Width	Tool Height	Minimum Spacing Center to Center	Minimum Spacing Center to Center, with fittings adjacent each other	Extension from Bulkhead, Minimum	Minimum Spool Length	Minimum Spacing Between Fittings	Installed Insertion Depth, Nominal	Pre-Installed Insertion Depth, Nominal
2½" (P40)	MAS-3000	12.52	10.18	7.89	6.67	7.12	4.98	8.71	1.25	2.61	3.73
3" (P48)	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
	LTCS-333	12.52	10.18	7.89	6.98	7.47	5.54	9.83	1.25	2.99	4.29

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 A:
Envelope Dimensions and Space requirements
MAS-3000, LTCS-333, Series Pipe Fittings ITK140 4 inch Tooling



TOOL LENGTH TO ACCESS INSTALLATION

Dimensions in Inches		L1	L2	W	H	N	N*	Y	S	X	B	A
Fitting Size (NPS)	Fitting Description	Tool Length Required to Access Installation	Tool Length During Install	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
3" (P48)	MAS-3000, LTCS-333	24.00	15.00	11.70	10.66	9.00	9.50	24.00	16.58	8.00	2.99	4.29
	SS40	24.00	15.00	11.70	10.66	9.00	9.50	24.00	17.42	8.00	3.41	4.71
4" (P64)	MAS-3000, LTCS-333	24.00	15.00	11.70	10.66	9.00	9.50	24.00	18.88	8.00	3.93	5.44

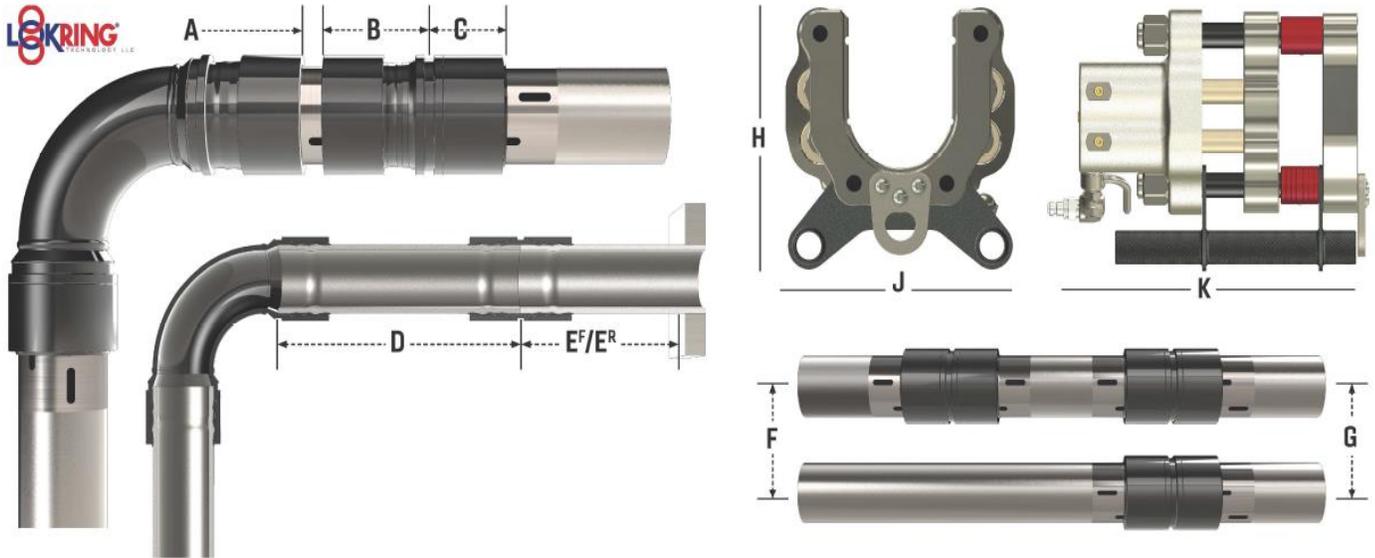
Note: Spool lengths are for reverse operation, except w here noted. Spool lengths may be decreased slightly if one fitting end can be pulled up prior to positioning the second end and the reverse position of the tool is used for the installation.

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

APPENDIX A:

Envelope Dimensions and Space requirements

MAS-3000, LTCS-333, Series Pipe Fittings ITK400 4 inch Tooling



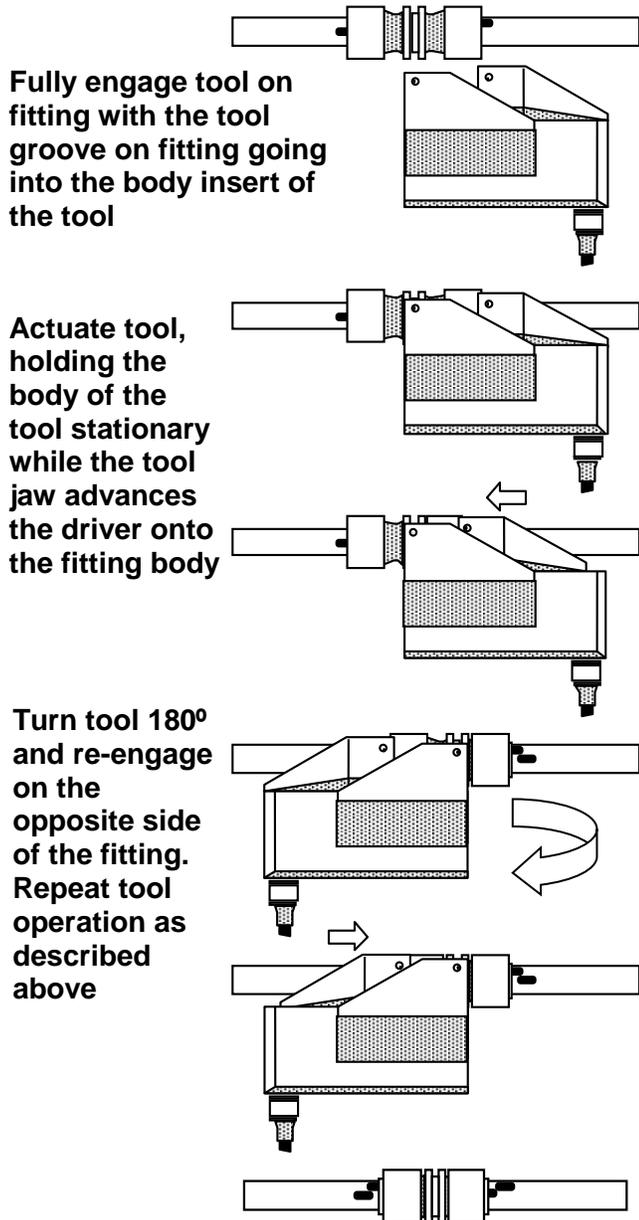
Dimensions in inches / Dimensions in millimeters

Tool	Pipe Size, NPS (Lokring Size)	Lokring Fitting Material	Space Between Uninstalled Fittings (Minimum)		Pipe Insertion Depth (Nominal)		Length of Installed Lokring End (Nominal)		Spool Length Between Fittings (Minimum)		Extension from Bulkhead for Forward Installation (Minimum)		Extension from Bulkhead for Reverse Installation (Minimum)		Space Between an Adjacent Pipe (Minimum)		Space Between an Adjacent Fitting (Minimum)		Clearance Required for Tool, Height (Minimum)	Clearance Required for Tool, Width (Minimum)	Clearance Required for Tool, Depth (Minimum)	Weight of Tool
			A	B	C	D	E ^F	E ^R	F	G	H	J	K									
IT100	2.5 (P40)	MAS	5/8	16	4 7/16	113	3 5/16	84	8 11/16	221	13 5/8	347	5 9/16	142	6 3/4	172	7 1/8	181	10 3/8 264	10 1/4 261	10 1/2 268	60 lb 27 kg
		SS	5/8	16	4 3/4	121	3 7/16	87	9 13/16	250	12 3/4	324	5 13/16	148	7 1/16	180	7 7/16	189				
	3 (P48)	MAS	5/8	16	4 3/4	121	3 7/16	87	10 15/16	278	13 1/16	332	7 1/4	185	7	178	7 1/2	191				
		4130	5/8	16	4 3/4	121	3 7/16	87	10 1/16	256	12 3/4	324	5 13/16	148	7	178	7 7/16	189				
IT400	4 (P64)	MAS	5/8	16	5 1/2	140	3 15/16	100	11 5/16	288	13 1/16	332	6 3/4	172	8	204	8 1/2	216	11 1/2 293	11 1/4 286	14 432	95 lb 43 kg
		4130	5/8	16	5 1/2	140	3 15/16	100	13 1/16	286	13 1/16	332	6 3/4	172	8	204	8 5/16	212				

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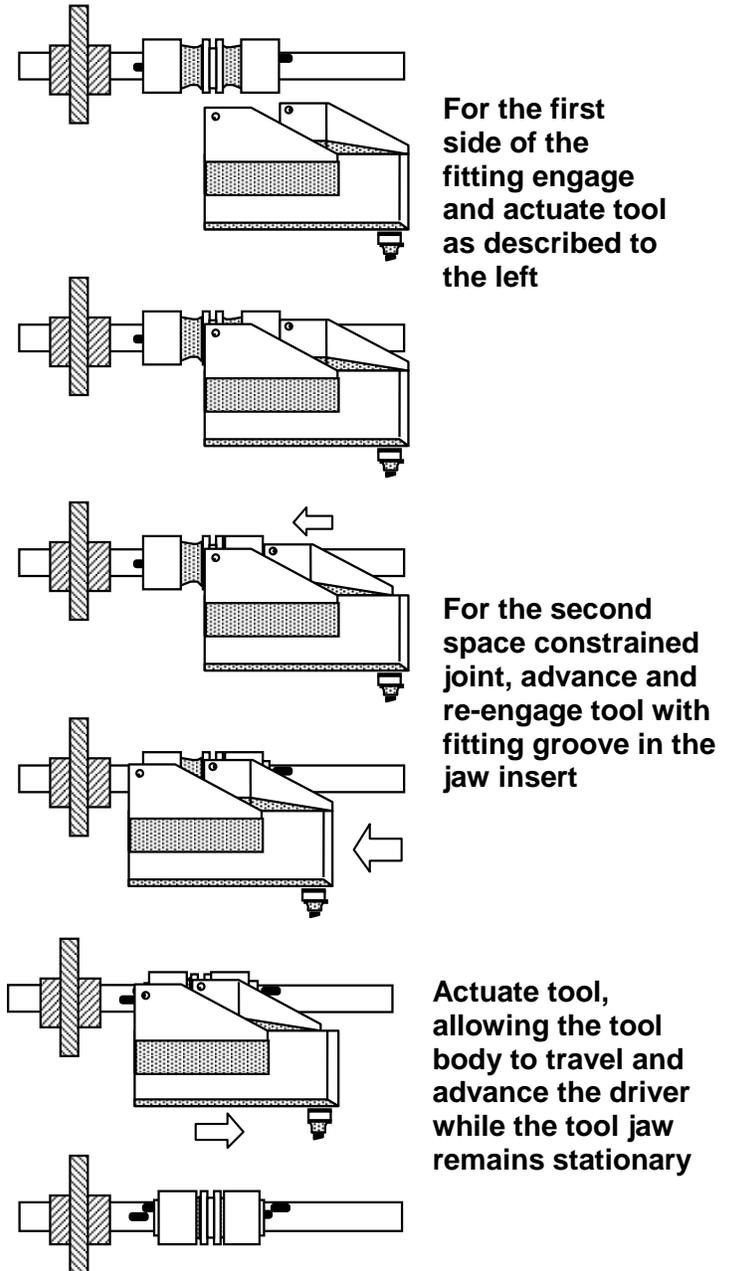
Appendix B Lokring Tool Placement Options Lokring™ Reverse Tool Installation Technique

Normal Tool Use



Reverse Tool Use

(Where space constrained by bulkhead or adjacent fitting)



NOTICE: 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.

Note: 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 authorized Lokring distributor for details on this capability.

Appendix C: Loktool Installation Tool Selection Guide

Microalloyed Steel Pipe Fittings, MAS-3000-XXX-PYY¹

Pipe Size (Designator)	Multi-Tool Kit, MTK ²	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4 (P04)	See Note 2	IT20	BI20-MAS/SS4-P04/M14-FR	JI20-MAS/SS4-P04/M14-FR	MPG-MAS-P04
3/8 (P06)	See Note 2	IT30	BI30-MAS/SS4-P06/M15/M16-FR	JI30-MAS/SSX-P06/M15/M16-FR	MPG-MAS-P06
		IT45	BI45-MAS/SS4-P06/M15/M16-FR	JI45-MAS/SS4-P06/M15/M16-FR	
		IT50	BI50-MAS/SS4-P06/M15/M16-FR	JI50-MAS/SS4-P06/M15/M16-FR	
1/2 (P08)	MTK45-MAS/SS4-P08/P12/P16-FR	IT45	BI45-MAS/SSX-P08-FR	JI45-MAS/SS4-P08-FR	MPG-MAS-P08
		IT50	BI50-MAS/SSX-P08-FR	JI50-MAS/SSX-P08-FR	
3/4 (P12)	MTK45-MAS/SS4-P08/P12/P16-FR	IT45	BI45-MAS/SS4-P12/JP12-FR	JI45-MAS/SS4-P12/JP12-FR	MPG-MAS-P12
		IT50	BI50-MAS/SSX-P12-FR	JI50-MAS/SSX-P12-FR	
1 (P16)	MTK45-MAS/SS4-P08/P12/P16-FR	IT45	BI45-MAS/SS4-P16/JP16-FR	JI45-MAS/SS4-P16/JP16-FR	MPG-MAS-P16
		IT50	BI50-MAS/SS4-P16-FR	JI50-MAS/SS4-P16-FR	
	MTK60-MAS/SS4-P16/P20/P24/P32-FR	IT60	BI60-MAS/SS4-P16/JP16-FR	JI60-MAS/SS4-P16/JP16-FR	
1 1/4 (P20)	MTK60-MAS/SS4-P16/P20/P24/P32-FR	IT50	BI50-MAS/SS4-P20-FR	JI50-MAS/SS4-P20-FR	MPG-MAS-P20
		IT60	BI60-MAS/SS4-P20/JP20-FR	JI60-MAS/SS4-P20/JP20-FR	
1 1/2 (P24)	MTK60-MAS/SS4-P16/P20/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/P20/P24/P32-FR	IT60	BI60-MAS/SS4/CN7-P32/M57-FR	No jaw inserts required	MPG-MAS-P32
2 1/2 (P40)	ITK100-MAS/SS4/333-P48-FR	IT100	BI100-MAS-P40/M76.1-FR (upper insert)	BI100-MAS-P40/M76.1-FR (upper insert)	MPG-MAS/333-P40
3 (P48)	ITK100-MAS/SS4/333-P48-FR	IT100	BI/JI100-MAS/SS4/333-P48-FR	BI/JI100-MAS/SS4/333-P48-FR	MPG-MAS/SS4/333-P48
4 (P64)	ITK400-MAS/SS4/333-P64	IT400	JI400-MAS/333-P64-FR	JI400-MAS/333-P64-FR	MPG-MAS/333-P64

Note 1: XXX = CPL (coupling), EL90 (90° elbow), EL45 (45° elbow), TEE (tee), etc.
YY = Size, as included in the designator (e.g. P04, P06, P08, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable

Appendix C: Loktool Installation Tool Selection Guide

316L Stainless Steel Pipe Fittings, SS40 and SS-3300-XXX-PXX¹

Pipe Size (Designator)	Multi-Tool Kit, MTK ²	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4 (P04)	See Note 2	IT20	BI20-MAS/SS4-P04/M14-FR	JI20-MAS/SS4-P04/M14-FR	MPG-SS4-P04
3/8 (P06)	See Note 2	IT30	BI30-MAS/SS4-P06/M15/M16-FR	JI30-MAS/SS4-P06/M15/M16-FR	MPG-SS4-P06
		IT45	BI45-MAS-SS4-P06/M15/M16-FR	JI45-MAS/SS4-P06/M15/M16-FR	
		IT50	BI50-MAS/SS4-P06/M15/M16-FR	JI50-MAS/SS4-P06/M15/M16-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-FR	JI50-MAS/SS4-P16-FR	
		IT60	BI60-MAS/SS40-P16-FR	JI60-MAS/SS40-P16-FR	
1 1/4 (P20)	See Note 2	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/M57-FR	NO JAW INSERT REQUIRED	MPG-SS4-P32
3 (P48)	ITK100	IT100	BI/JI100-MAS/SS4/333-P48-FR	BI/JI100-MAS/SS4/333-P48-FR	MPG-MAS/SS4/333-P48

Note 1: XXX = **CPL** (coupling), **EL90** (90° elbow), **EL45** (45° elbow), **TEE** (tee), etc.
YY = Size, as included in the designator (e.g. **P04**, **P06**, **P08**, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable

Appendix C: Loktool Installation Tool Selection Guide

Copper Nickel Pipe Fittings, CN-200-XXX-PXX¹

Pipe Size (Designator)	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4 (P04)	IT10	BI10-CN3/7-P04/T08-FR	J110-CN3/7-P04/T08-FR	MPG-CN-200-P04
	IT20	BI20-CN3/7-P04/T08/M12-FR	J120-CN3/7-P04/T08/M12-FR	
3/8 (P06)	IT20	BI20-CN3/7-P06/M16-FR	J120-CN3/7-P06/M16-FR	MPG-CN-200-P06
1/2 (P08)	IT20	BI20-CN3/7-P08/M20-FR	J120-CN3/7-P08/M20-FR	MPG-CN-200-P08
3/4 (P12)	IT30	BI30-CN3/7-P12-FR	J130-CN3/7-P12-FR	MPG-CN-200-P12
	IT45	BI45-CN3/7-P12/M25-FR	J145-CN3/7-P12/M25-FR	
1 (P16)	IT45	BI45-CN3/7-P16/M30-FR	J145-CN3/7-P16/M30-FR	MPG-CN-200-P16
	IT50	BI50-CN3/7-P16-FR	J150-CN3/7-P16-FR	
1 1/4 (P20)	IT45	BI45-CN3/7-P20/M38-FR	J145-CN3/7-P20/M38-FR	MPG-CN-200-P20
	IT50	BI50-CN3/7-P20-FR	J150-CN3/7-P20-FR	
1 1/2 (P24)	IT50	BI50-CN3-P24-FR	J150-CN3-P24-FR	MPG-CN-200-P24
	IT60	BI60-CN3-P24/M44.5-FR	J160-CN3-P24/M44.5-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° elbow), **EL45** (45° elbow), **TEE** (tee), etc.
YY = Size, as included in the designator (e.g. **P04**, **P06**, **P08**, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable

Appendix C: Loktool Installation Tool Selection Guide

Copper Nickel Type 70/30 Pipe and Tube Fittings CN-700-XXX-PXX / CN-700-XXX-TXX¹

Pipe Size (Designator)	Tool 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/M12-FR	JI20-CN3/7-P04/T08/M12-FR	
3/8 (P06)	IT20	BI20-CN3/7-P06/M16-FR	JI20-CN3/7-P06/M16-FR	MPG-CN-200-P06
1/2 (P08)	IT20	BI20-CN3/7-P08/M20-FR	JI20-CN3/7-P08/M20-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/M25-FR	JI45-CN3/7-P12/M25-FR	
1 (P16)	IT45	BI45-CN3/7-P16/M30-FR	JI45-CN3/7-P16/M30-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/M38-FR	JI45-CN3/7-P20/M38-FR	MPG-CN-200-P20
	IT50	BI50-CN3/7-P20-FR	JI50-CN3/7-P20-FR	
1 1/2 (P24)	IT60	BI60-MAS/SS4/CN7-P24-FR	JI60-MAS/SS4/CN7-P24-FR	MPG-CN7-P24
2 (P32)	IT60	BI60-MAS/SS4/CN7-P32/M57-FR	NO JAW INSERT REQUIRED	MPG-CN7-P32
Tube Size (Designator)	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/2 (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	

Note 1: XXX = **CPL** (coupling), **EL90** (90° elbow), **EL45** (45° elbow), **TEE** (tee), etc.

YY = Size, as included in the designator (e.g. **P04**, **P06**, **P08**, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable

Appendix C: Loktool Installation Tool Selection Guide

316L Stainless Steel and Copper Nickel Tube Fittings SS40 and SS-3000 and SS-3300-XXX-TXX and CN-3300-XXX-TXX¹

Tube Size (Designator)	Multi-Tool Kit, MTK ²	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/4 (T04) (Copper Nickel)	See Note 2	IT04	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-SS4-T04
		IT10	BI10-SS4/CN4-T04/M06-RO	JI10-SS4/CN4-T04/M06-FR	
1/4 (T04)	See Note 2	IT04	NO BODY INSERT REQUIRED	NO JAW INSERT REQUIRED	MPG-SS4-T04
		IT10	BI10-SS4/CN4-T04/M06-RO	JI10-SS4/CN4-T04/M06-FR	
3/8 (T06)	MTK20-SS4-T06/T08	IT10	BI10-SS4-T06-FR	JI10-SS4-T06-FR	MPG-SS4-T06
		IT20	BI20-SS4-T06-FR	JI20-SS4-T06-FR	
1/2 (T08)	MTK20-SS4-T06/T08	IT10	BI10-SS4-T08/M12/M10-FR	JI10-SS4-T08/M12/M10-FR	MPG-SS4-T08
		IT20	BI10-SS4-T08/M12/M10-FR	JI10-SS4-T08/M12/M10-FR	
5/8 (T10)	See Note 2	IT20	BI20-SS4-T10-FR	JI20-SS4-T10-FR	MPG-SS4-T10
3/4 (T12)	MTK20-SS3-T12/T14/T16	IT20	BI20-SSX-T12-FR	JI20-SSX-T12-FR	MPG-SS4-T12
7/8 (T14)	MTK20-SS3-T12/T14/T16	IT20	BI20-SS3-T14-FR	JI20-SS3-T14-FR	MPG-SS4-T14
1 (T16)	MTK20-SS3-T12/T14/T16	IT20	BI20-SS3-T16	JI20-SS3-T16	MPG-SS4-T16
1 1/4 (T20)	MTK45-SS3-T20/T24	IT45	BI45-SS3-T20-FR	JI45-SS3-T20-FR	MPG-SS4-T20
1 1/2 (T24)	MTK45-SS3-T20/T24	IT45	BI45-SS3-T20-FR	JI45-SS3-T20-FR	MPG-SS4-T24
		IT50	BI50-SS3-T24	JI50-SS3-T24	
		IT60	BI60-SS3-T24	JI60-SS3-T24-FR	
2 (T32)	ITK60-SS4-T32-FR	IT50	BI50-SSX-T32	JI50-SSX-T32-FO	MPG-SS4-T32
		IT60	BI60-SS4-T32-FR	JI60-SS4-T32-FR	
2 1/2 (T40)	See Note 2	IT60	BI60-SS4-T40	NO JAW INSERT REQUIRED	MPG-SS4-T40

Note 1: XXX = **CPL** (coupling), **EL90** (90° elbow), **EL45** (45° elbow), **TEE** (tee), etc.
YY = Size, as included in the designator (e.g. **P04**, **P06**, **P08**, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable
FO = Forward only
RO = Reverse only

Appendix C: Loktool Installation Tool Selection Guide

4130 Alloy Steel (LTCS-333) Pipe Fittings LTCS-333-XXX-PXX¹

Pipe Size (Designator)	Multi-Tool Kit, MTK ²	Tool Head	Body Insert	Jaw Insert	Multi-Purpose Gauge
1/2 (P08)	MTK45-333-P08/P12-FR	IT45	BI45-333-P08-FR	JI45-333-P08-FR	MPG-333-P08
3/4 (P12)	MTK45-333-P08/P12-FR	IT45	BI45-333-P12-FR	JI45-333-P12-FR	MPG-333-P12
1 (P16)	MTK60-333-P16/P24/P32-FR	IT60	BI60-333-P16-FR	JI60-333-P16-FR	MPG-333-P16
1 1/2 (P24)	MTK60-333-P16/P24/P32-FR	IT60	BI60-333-P24-FR	JI60-333-P24-FR	MPG-333-P24
2 (P32)	MTK60-333-P16/P24/P32-FR	IT60	BI60-333-P32-FR	NO JAW INSERT REQUIRED	MPG-333-P32
3 (P48)	ITK100-MAS/333/SS4-P48-FR	IT100	BI/JI100-MAS/SS4/333-P48-FR	BI/JI100-MAS/SS4/333-P48-FR	MPG-MAS/SS4/333-P48
4 (P64)	ITK400-MAS/SS4/333-P64	IT400	JI400-MAS/333-P64-FR	JI400-MAS/333-P64-FR	MPG-MAS/333-P64

Note 1: XXX = **CPL** (coupling), **EL90** (90° elbow), **EL45** (45° elbow), **TEE** (tee), etc.
YY = Size, as included in the designator (e.g. **P04**, **P06**, **P08**, etc.).

Note 2: Contact your authorized Lokring distributor for additional tool kits.

KEY: MTK = Multipurpose tool kit
ITK = Individual tool kit
FR = Forward and reverse operation capable

Appendix C: Loktool Installation Tool Selection Guide

Pumps and Hoses

Description	Actuated	Pumps and Hoses
Electric Pump	Foot Pedal	PUMP-OTC-QTRHRSE-ELEC
Pneumatic Pump	Foot Pedal	PUMP-TURBO-AIR-QD
Manual Pump	Manual	PUMP-P-19-QD or Pump-P-392-QD
Manual Pump	Manual	Portable Loktool
15 ft (4.5 m) Hydraulic Hose Assembly	N/A	HH15-QD

Appendix D: Safety and Maintenance Instructions for Loktool Installation Tools

Loktool System General Safety Instructions

CAUTION

Operation of the tool without inserts installed correctly could cause damage to the tool and will likely result in an improperly installed Lokring fitting.

CAUTION

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

CAUTION

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 or tool or both may be damaged during fitting installation and may leak or separate in use.

NOTICE: *Never attempt to disassemble Loktool heads. Call your authorized Lokring representative immediately if any problems with the tools are encountered.*

NOTICE: *Loose quick-connects will act as a partial or complete line restriction causing little or no oil flow and resulting in equipment damage or failure.*

NOTICE: *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.*

1. Loktool system components (head, quick-connects, hoses, pumps) are fully rated for 10 000 psig (689 bar) operating pressure. Do not substitute non-approved components without prior authorization of Lokring.
2. Make sure quick-connects are fully secured, and that threaded locking ring on the hose quick-connect is fully advanced to ensure against accidental separation of installation tool from hose during operation or transportation.
3. Cycle tool several times without fitting to assure that quick connects are fully secured, and no air is trapped in the system.
4. On the IT30, IT45, IT50, and IT60 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 or tool or both.
6. 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 quick-connect to avoid moving objects, abrasion, or sharp objects.
7. Keep hydraulic equipment and hoses away from flames and heat. For optimum performance, do not expose equipment to temperatures of 150 °F (65 °C) or higher.
8. Do not use Loktool components that show signs of damage, abuse, or excessive wear.

Appendix D: Safety and Maintenance Instructions for Loktool Installation Tools (cont.)

9. Clean Loktool head and lubricate bearing surfaces daily after use. Although the Loktool installation tooling does not contact wetted surfaces, it is best to ensure that contamination cannot be sourced to the tool. Clean accordingly.
10. Do not attempt to install Lokring fittings with broken or damaged inserts nor with inserts of the wrong size.
11. If there is any sign of hydraulic fluid leakage, consult your authorized Lokring representative for assistance.

Appendix D: Safety and Maintenance Instructions for Loktool Installation Tools (cont.)

Loktool Head Maintenance and 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 daily 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.

NOTICE: *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 quick-connect 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 567 PST Thread Sealant

Loctite 567 PST thread sealant is a white creamy paste which has excellent solvent resistance and is compatible with a wide range of process fluids and gasses. It has a maximum operating temperature range of 400 °F (204 °C).

1. Loctite 567 PST thread sealant is recommended for concentrations of 10 % or less:

- Acetic Acid
- Battery Acid
- Carboic 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 567 PST thread sealant 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
- 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 to 95 %
- Sulfuric Acid, 95 to 100 %
- Chlorine Wet
- Oxygen
- Ozone
- Sulfur Trioxide Gas
- Ozone Wet

Note: For a more information on Loctite sealants visit the Loctite website at www.loctite.com

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 the proposed application before use. Use this data as a guide only.

Appendix F: Installation Procedure for the Lokring Microalloyed Steel Repair Couplings (MAS-3000-RCPL)

Description

The Lokring microalloyed steel repair couplings, designated as MAS-3000-RCPL-PXX, use the exact same Loktool equipment (Loktool head, inserts, MPG) as the standard microalloyed steel (MAS) coupling. However, it differs in two important ways from the standard microalloyed steel (MAS) coupling:

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

The "thru-bore" design permits the Lokring microalloyed steel repair coupling to slide entirely over the pipe OD, 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 microalloyed steel coupling (which has a center stop).

If for any reason microalloyed 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.

Option 1: Install First Pipe End

Verify that the first pipe end is properly prepared; gauged and marked (please see LP-105 Installation Procedure, Sections 4 and 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 Microalloyed 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 install 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, if 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

Appendix F: Installation Procedure for the Lokring Microalloyed Steel Repair Couplings (MAS-3000-RCPL) (cont.)

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 install the 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 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 stainless steel/corrosion resistant steel (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.

MIL-STD-777 CATEGORY and GROUP

SERVICE

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:

MIL-STD-777 CATEGORY and GROUP

SERVICE

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 wash down) 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/OD tube end?

3. What grit sanding cloth is used to prep the pipe or OD tube Sealing Zone for Lokring fittings? _____
4. In what direction should you sand the pipe/OD tube ends? _____
Why do you not sand pipe along the axis of the pipe/OD tube? _____
5. After initial sanding, how do you know if a scratch on the pipe/OD 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/OD 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/OD tube are:
 - 1) _____
 - 2) _____

APPENDIX H:

LOKRING Fitting Installation Training Certification Test (cont.)

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

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/OD 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/OD 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? _____

APPENDIX H:

LOKRING Fitting Installation Training Certification Test (cont.)

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/OD tube extending 1 and 1/2 pipe/OD tube diameters from the end of the pipe/OD tube.

2. How do you check for proper squareness of the cut pipe/OD 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 OD tube Sealing Zone for Lokring fittings?

120# grit aluminum oxide cloth

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

Always sand around the circumference of the pipe/OD tube

Why do you not sand the pipe/OD tube along the axis of the pipe/OD 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/OD tube surface in the Sealing Zone is unacceptable?

If your thumbnail "catches" while running it circumferentially around the pipe/OD tube, the user should prepare the surface according to the pipe preparation procedure.

APPENDIX H:**LOKRING Fitting Installation Training Certificate Test Answers (cont.)****6. What three options/alternatives do you have if you have a deep scratch in the Sealing Zone?**

- 1) Cut the pipe/OD 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/OD tube to fail the Multipurpose Gauge Tool test, cut the pipe/OD tube back again and repeat all end pipe/OD tube qualifications.
- 3) If sanding is not effective in removing the bad pipe/OD tube conditions, or is too time consuming, an anaerobic pipe/OD tube thread sealant such as Loctite® PST #567 may be applied to the pipe/OD tube surface within the Sealing Zone in lieu of further sanding.

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

7. How do you check for pipe/OD 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/OD tube at two points 90° apart from each other. If the pipe/OD 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/OD tube outside diameter with a caliper or other suitable device and compare with the minimum specification values for that specific pipe/OD tube diameter.

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

- 1) Install Mark
- 2) Inspect mark

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers (cont.)

9. When the pipe/OD 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/OD 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/OD tube ends before making up the fitting?

Verify pipe/OD 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 OD tube to OD tube.

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers (cont.)

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, making sure the locking sleeve slides completely forward.**
- 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)

APPENDIX H:

LOKRING Fitting Installation Training Certificate Test Answers (cont.)

- 15. Can you use stainless steel fittings on carbon steel pipe?** YES
Can you use a carbon steel fitting on stainless steel pipe/OD tube? NO
Can you use a copper nickel fitting on carbon steel or stainless steel pipe? NO

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 areas in which installation errors may 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/OD tube is completely exposed
- 3***) The repair fitting's **INSPECT** mark is not visible at all on one end of the pipe/OD tube.

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

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

***Solution: Pipe/OD 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 (207 bar) and 775° F (413° C)
- b. 250 psi (17 bar) and 425° F (218° C)
- c. 1000 psi (69 bar) and 200° F (93° C)
- c. 250 psi (17 bar) and 1000° F (538° C)

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

- a. 3300 psi (227 bar) and 500° F (260° C)
- b. 3300 psi (227 bar) and 425° F (218° C)
- c. 3300 psi (227 bar) and 200° F (93° C)
- c. 3300 psi (227 bar) and 775° F (413° C)

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

APPENDIX I:**Alternate LOKRING Fitting Installation Training Certificate Test (cont.)****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.

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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 OD Tube Fittings: stainless steel OD 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 OD 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.

a. Check to see if the trailing edge of the fitting body protrudes from underneath the end of the drive ring.

b. 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.

c. 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)

APPENDIX I:

Alternate LOKRING Fitting Installation Training Certificate Test Answers (cont.)

- 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**
a. 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

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

Name:

Company:

Date Trained:

Date Expires:

Certification Number:

Authorized Signature: _____



Five Simple Steps to a Lokring End Connection

1. Cut and prepare pipe ends.
2. Check pipe ends for square cut, check pipe OD 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 thread sealant is required in automotive paint applications and is strongly

Appendix K: Suggested Format for QA/QC Record of Assembly and Installation of Lokring Fittings

		<p>LOKRING Assembly and Installation check list.</p>	
Reason for use;			
Requested By;		Approved by; (Inspection)	
MWO; PJN;		Area/Location	
Joint No/s;		PSSR No;	
Service;		Line Size;	
Line No;		Line Spec;	
Isometric Drawing No;		Unique Fitter/Installer No;	

Item No.	Procedure Method	Acceptable		Fitter/Installer Initials
		Yes	No	
1	Ensure pipe has been cut square and to correct length			
2	Ensure pipe is clean and free from rust, chips, burrs and metal filings			
3	Sand/Prep pipe from end of pipe to 1.5 X OD of pipe			
4	Use MPG (Multi-Purpose Gauge) to ensure correct pipe size, then mark pipe though "INSTALL" and "INSPECT" slots			
5	Select, assemble and inspect required LOKRING Tool (LOKTOOL)			
6	Slide fitting onto marked pipe. Position ends on "INSTALL" mark. ("INSPECT" mark should be fully covered)			
7	Ensure correct size inserts are mounted on LOKTOOL, fully engage fitting into LOKTOOL and start cycle of LOKTOOL			
8	After cycling LOKTOOL, Disassemble tool and inspect to points in line item 9			
9	"INSPECT" marks are partially covered. Fitting body extends from drive-ring. Drive ring is fully engaged with body tool flange			

<p style="text-align: center;">Signature below confirms final acceptance;</p> <p style="text-align: center;">Installed/Fitter</p> <p>Name: _____</p> <p>Signed: _____</p> <p>Date: _____</p>	<p style="text-align: center;">Signature below confirms the Installer/Fitter's Qualification in carrying out the above procedure</p> <p style="text-align: center;">Supervisor</p> <p>Name: _____</p> <p>Signed: _____</p> <p>Date: _____</p>
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NOTES	
1	Installation to be carried out by qualified personel only.
2	If in doubt refer to, LP-105 Installation Procedure for LOKRING Carbon Steel, Stainless Steel (CRES), and Copper Nickel Pipe and Tube Fittings

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Loctite, PST, 567—TM Henkel Corporation

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