Installation Instructions
Standard Rigid Coaxial Transmission Lines

Notice

The installation, maintenance, or removal of antenna systems requires qualified experienced personnel. ERI installation instructions are written for such personnel. Antenna and transmission line systems should be inspected once a year by qualified personnel to verify the equipment's proper installation, maintenance, and condition. ERI disclaims any liability or responsibility for the results of improper or unsafe installation practices.

Standard Transmission Line and Flange Information

Type Number	STD050	STD150	STD350	STD450	STD650B	STD675B	STD775	STD875
Line Diameter, inches	7/8	1-5/8	3-1/8	4-1/16	6-1/8	6-1/8	7-3/16	8-3/16
Characteristic Impedance, ohms	50	50	50	50	50	75	75	75
Flange Diameter, inches (mm)	2.250	3.500	5.188	6.188	8.120	8.120	9.500	11.000
	(57.2)	(88.9)	(131.8)	(157.2)	(206.2)	(206.2)	(241.3)	(279.4)
Bolt Circle Diameter, inches (mm)	1.750	2.812	4.375	5.375	7.375	7.375	8.750	10.312
	(44.5)	(71.4)	(111.1)	(136.5)	(187.3)	(187.3)	(222.3)	(261.9)
Number of Holes	3	4	6	8	12	12	14	18
Hardware Size, inches	1/4-20	5/16	3/8	3/8	3/8	3/8	3/8	3/8
Special Cut Flanged Lengths								
Outer conductor cut back for one flange, inches (mm) (“A”)	0.172	0.203	0.266	0.375	0.438	0.438	0.344	0.500
	(4.4)	(5.2)	(6.7)	(9.5)	(11.1)	(11.1)	(8.7)	(12.7)
Inner conductor cut back from flanged outer conductor to allow for inner connector, inches (mm) (“B”)	0.750 to 0.813	0.875 to 0.938	1.125 to 1.188	1.500 to 1.563	1.500 to 1.563	1.500 to 1.563	1.594 to 1.656	1.844 to 1.906
	(19.1 to 20.6)	(22.2 to 23.8)	(28.6 to 30.2)	(38.1 to 39.7)	(38.1 to 39.7)	(38.1 to 39.7)	(40.5 to 42.1)	(46.8 to 48.4)

Cut back dimensions listed are for one end of the line section only. If flanges are to be installed on both ends of the outer conductor, multiply dimensions shown by two (2). See Figure 2 for illustration of cut back dimension locations.

Cutback dimensions are for Fixed Field Flanges, and Swivel Field Flanges for installations using Unflanged Couplings refer to the current edition of ERI Installation Bulletin 17302. For applications that include Clamp on Flange Adapters, consult the most recent version of ERI Installation Bulletin II23006-CL1. For information on the installation of Soft Solder Swivel Field Flanges, read ERI Installation Bulletin II23006-SS1.

Cut back dimensions for inner conductor operating temperatures up to 120 degrees C. (248 degrees F.), maximum.

Table 1 Transmission Line and Flange Information

Read These Instructions Thoroughly Before Assembly and Vertical Installation

The inner connector insulator and protective cover provide support for each line section's inner conductor during the hoisting operation. **Note:** Do not attach hoisting sling to line section flanges.

Transmission Line Installation

Transmission line installation may begin at either end of the proposed vertical run. Installations originating at the top or antenna end of the vertical run will require proper positioning of the bottom miter elbow to allow for both expansion and contraction of the rigid line over the anticipated operational temperature range.

Installations originating at the bottom or the transmitter end of the vertical run will require careful alignment with the antenna. Additional miter elbows and field flanged sections will probably be required at the upper portion of the vertical run with additional rigid hangers at the bottom portion of the vertical run for increased support during assembly.

Note: These additional hangers used during installation must be removed prior to placing the system into operation.

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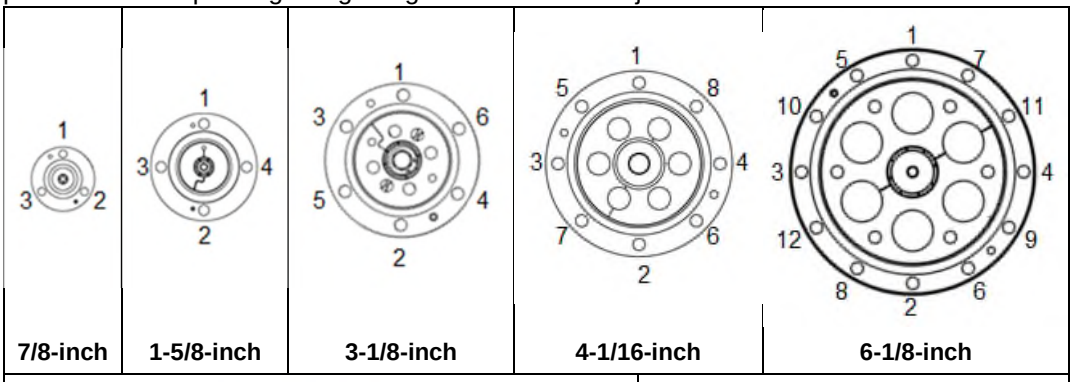
Remove protective cover from end of the line section and retain supplied O-ring gasket. One O-ring is supplied per line section and may be located under either protective end cover or in a separately supplied hardware kit.

Slightly pull inner conductor from outer conductor while inserting supplied inner connector assembly into the inner conductor using a twisting motion to ensure full engagement. Push assembly back into outer conductor and ensure that the inner connector insulator is properly seated in the flange insulator groove. **Note:** Proper installation is achieved when half of the insulator remains exposed. Apply thin coating of silicone grease to supplied O-ring gasket to temporarily secure O-ring in position during assembly.

Note: Ensure both gasket and flange groove are free of dirt to ensure pressure tight seal. Remove and discard protective cover from end of the previous line section. Align the flange pins with corresponding flange alignment holes and join mating sections. Firmly push line sections together ensuring O-ring gasket remains in place and inner connector insulator seats properly in mating flanges.

Install and alternately snug the flange mounting hardware at approximately 180-degree intervals following the Suggested Flange Bolt Tightening Sequence illustrations show below. Once all of the flange bolts are installed and are snugged to where the lock washers are compressed, tighten all the flange bolts, in the Suggested Sequence, by turning the nut up to approximately a one-quarter to a one-half turn. Do not overtighten to avoid damaging or breaking the flange bolt. When properly installed, a small uniform gap should be noted around flange circumference. Note: If any hardware becomes galled during the tightening procedure, remove damaged the damaged bolt hardware by sawing or breaking and install replacement bolt and tighten the bolt to ensure proper electrical contact between mating surfaces.



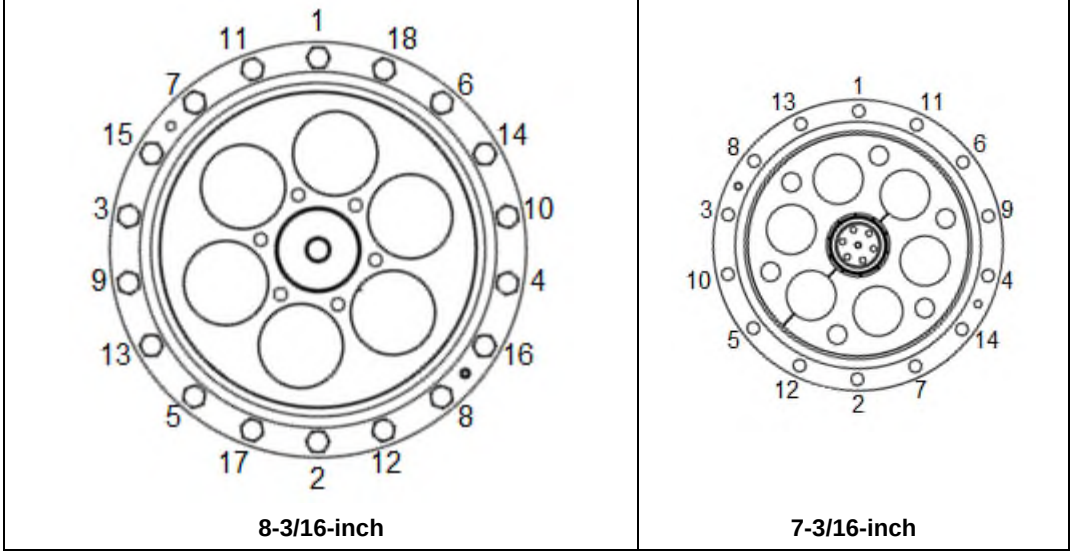
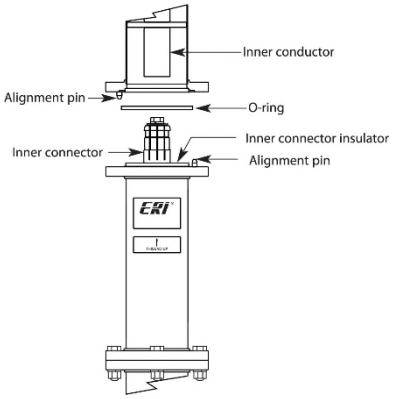


Table 2 Suggested Flange Bolt Tightening Sequence



During installation align flange pins with corresponding flange alignment holes and join mating sections. Firmly push line sections together ensuring the O-ring seal remains in place, inner connector slides into inner conductor and inner connector insulator seats properly in mating flanges.

Figure 1 Line Section Assembly

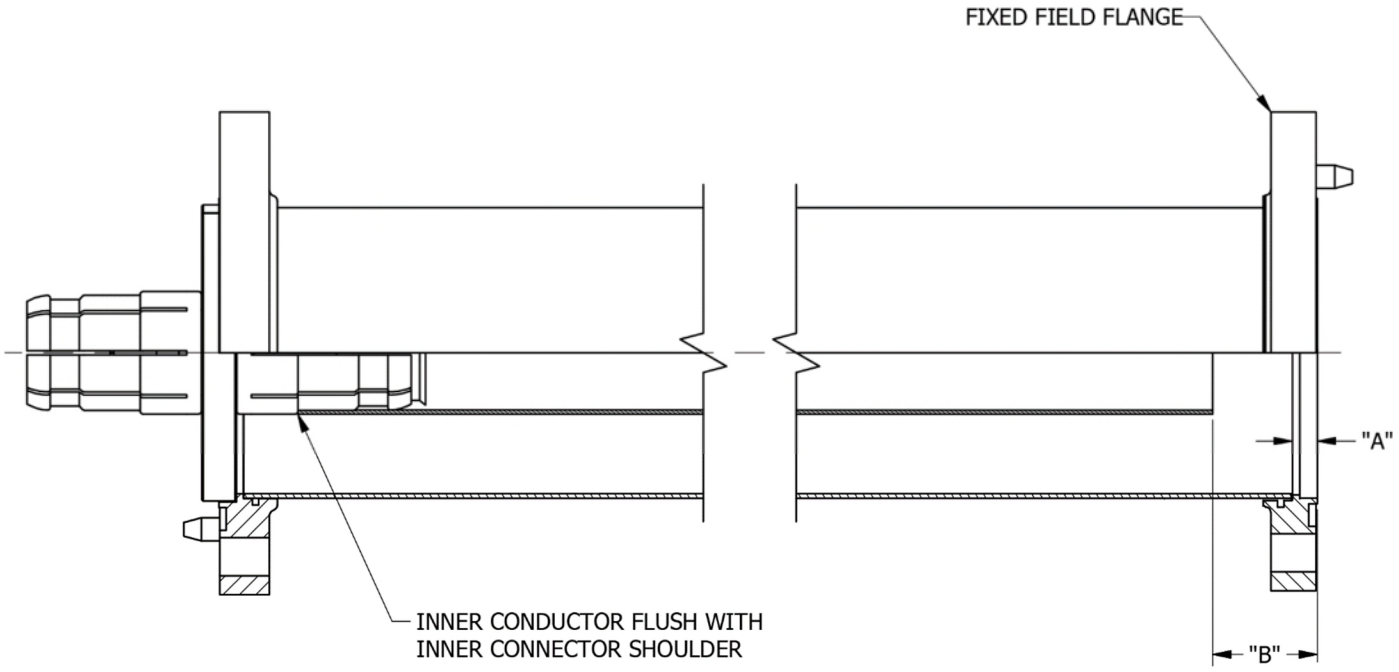


Figure 2 Outer and Inner Conductor Cut Back Dimensions for Fixed Field Flanges and Field Cut Kits. See Table 1 for additional information.

Refer to supplied installation instructions and install appropriate hangers (rigid or spring types) as line sections are being installed using the proper number and type of hangers correctly spaced. Differential line expansion is compensated by inner connectors and spring hanger assemblies. **Note:** Do not support more than one section of line on flange joint without using hangers.

Ensure all exposed horizontal runs are well protected from accumulated or falling ice and possible damage from other falling objects.

Special Cut Length Sections

A section of transmission line may be cut at any point without affecting the electrical characteristics.

In most cases the field fabricated special length line section are made using ERI supplied Field Cut Kits of the appropriate size length, either a Detail -41 for line sections up to 60-inches (1524 mm) in length or Detail -39 for line section requirements from 60 to 240-inches (1524 to 6096 mm). The Field Cut Kits for most ERI transmission line sizes include one (1) field cut flanged one end line section that is either 60-inches (1524 mm) or 240-inches (6096 mm) in length, with one (1) captivated inner connector, a fixed field flange kit (includes a silver solder fixed field flange, silver solder, and flux), and one flange hardware kit with O ring.

Field sections are used for field trimming to nonstandard section lengths. Full section kits are supplied with inner and outer conductor, attaching hardware, one fixed flange attached and one solder flange for attachment in field.

1. Remove inner conductor assembly from outer conductor. Use extreme care to prevent distorting, denting, or bending inner conductor.
2. Determine flange-to-flange transmission line length and deduct the outer conductor cut back, the Transmission Line and Flange Information table on page one, required to get the proper outer conductor cut length, dimension "A" in the drawing above.
3. Wrap piece of straight edged paper around outside of outer conductor as cutting guide. Scribe line along paper edge all the way around outer conductor.

Figure 3

4. Carefully cut the tubing with a hacksaw. Do not use a tube or pipe cutter, as the cut edge of the tubing will be

forced inward and become unsatisfactory electrically. Make certain that the cut is square to permit the fixed ring of the flange adapter to seat properly. A plumber's cutting box, miter box, or band clamp, if available, should be used to guide the hacksaw. Note: Fill the inside of tube with rags prior to cutting and remove after cleaning the cut edge.

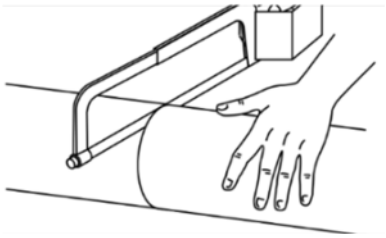


Figure 4

5. Remove burrs with a file and clean outer conductor end until bright. Do not use emery cloth or steel wool. Remove any debris from interior of outer conductor.

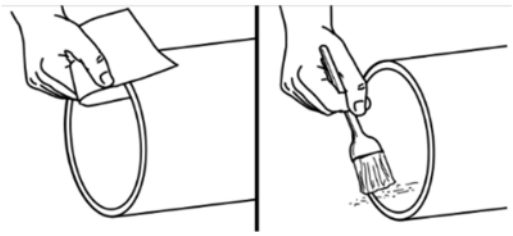


Figure 5

6. Apply silver solder lux to solder groove within flange and insert silver solder ring into groove.

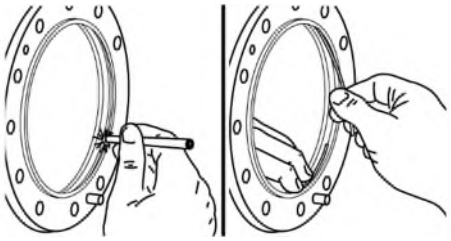


Figure 6

7. Apply silver solder flux to outer conductor outer edge and seat flange onto outer conductor.

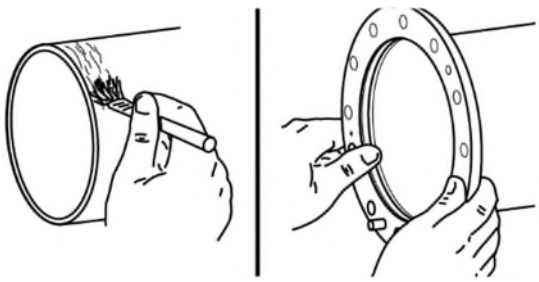


Figure 7

8. Heat the joint to a temperature of 1200° F (630° C) with a torch, using gas and air, keeping the torch tip 2-inches (51 mm) to 3-inches (76 mm) from the joint. Move the torch evenly around the joint so the solder flows uniformly. When the solder flows onto the outer surfaces of the conductor and flange, remove the heat. Remove excess flux from the assembly with hot water, then clean the assembly with garnet cloth.

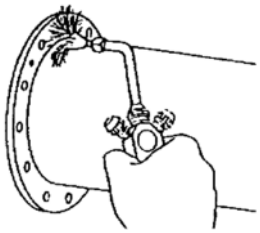


Figure 8

9. The overall length of the inner conductor must be a minimum of an inner connector width shorter than the overall length of the outer conductor (including flanges) to allow for a standard inner connector at each end of the line section.

10. From the measured flange to flange length of the outer conductor find the cut back for the inner conductor in Table 1 Transmission Line and Flange Information on page 1, and calculate the proper inner conductor cut length, dimension "B" in the drawing on page Figure 2. Use a tape measure to mark the location where the inner conductor is to be cut. **Note:** If the cut is less than 2-inches (51 mm) from an inner conductor support, trim the opposite end of inner conductor instead. Both ends of the inner conductor should be a minimum of 2-inches (51 mm) from an inner conductor support to allow for installation of the inner connector.

11. Wrap a piece of straight-edged paper around the inner conductor as a cutting guide. Scribe a line along the paper edge all the way around the inner conductor.

12. Cut the inner conductor at the marked position using a and hacksaw, A plumber's cutting box, miter box, or band clamp, if available. Make sure the cut is square.

13. Remove burrs with a file and clean thoroughly inner conductor end. Remove any debris from the interior of the inner conductor.

14. Reinstall the intermediate and flange insulators if they were removed from the inner conductor for trimming.

15. If the captivate inner connector is not installed. Fully insert the inner connector into one end of the inner conductor as shown. Use a small wrench to tighten the bolt. Do not over tighten the bolt. *The inner connector fingers should not bulge the inner conductor tube.* If the inner conductor tube is held in one hand and the

exposed inner connector is held in the other hand, it should be extremely difficult, if not impossible, to pull them apart.

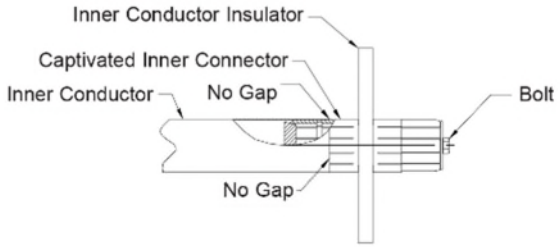


Figure 9

16. Insert conductor and connector assembly into outer conductor assembly until connector insulator is fully seated in flange and install complete assembly.

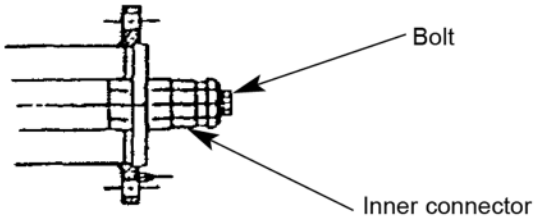


Figure 10

Unflanged Lines

Unflanged lines for indoor unpressurized installations are joined by straight couplings comprised of an inner connector, a copper sleeve, and corresponding clamps. Allowances must be made for inner connector and insulator installations in determining final line section lengths.

For installation information of systems using Unflanged Couplings refer to the current edition of ERI Installation Bulletin 17302. When the system includes Clamp on Flange Adapters consult the most recent version of ERI Installation Bulletin II23006-CL1. For information on the installation of Soft Solder Swivel Field Flanges obtain a copy of ERI Installation Bulletin II23006-SS1. All of these publications, and others, are available on the ERI web site, www.eriinc.com and are located under Home/Resources/Installation Instructions.

Attaching the Gas Barrier

A gas barrier is used to isolate the transmission line so that it can be pressurized with a source of dry air or other gas. Pressurization is needed in outdoor air-dielectric transmission lines because temperature variations cause moisture from outside air to enter the line, condense and seriously impair efficiency. Moisture will accumulate and result in possible failure of the system. The system must be pressurized at the time of installation and remain pressurized at all times to avoid this type of system failure.

ERI gas barriers include One, Two, or Four ports depending on transmission line size. Gas barriers that include two or four ports have them located on either side of the gas barrier insulator to allow for separating pressurization sources; for example, placing a barrier between the transmission line and a pressurized radome enclosed antenna allows for separate pressurization. This is useful in isolating a problem in one of these components when troubleshooting the system. If no gas barrier is installed at the top of the transmission line, both the line and the antenna can be pressurized from one source. If the antenna is not enclosed by a pressurized radome or is an unpressurized antenna that does not have a gas tight seal at its input, a gas barrier should be used to seal off the top end of the transmission line for pressurization. If no gas barrier is installed at the top of the transmission line, both the line and the antenna can be pressurized from one source.

A gas barrier is installed at the bottom end to the transmission line where the line is connected to a pressurization network within the transmitter equipment building. The gas tubing from either a dehydrator or other gas pressure source is connected to one of the gas barrier ports with a 1/8-inch female NPT connector.

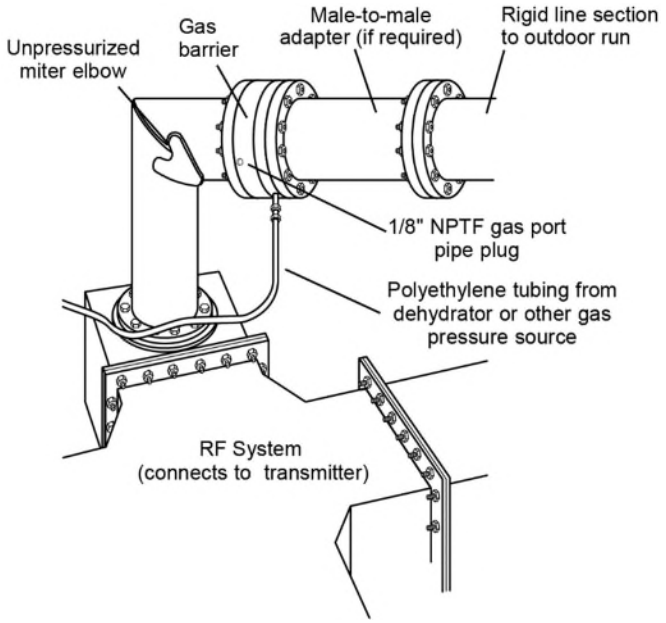


Figure 11 Typical Gas Barrier Installation

Pressurization

The transmission line must be purged of any moist air that has entered during installation. Purging is done by connecting the pressurization unit to a gas port at one end of the line and opening a gas port at the other end. The pressurization unit is allowed to run long enough for at least three (3) air volume changes to take place. The open end of the line is then closed, and the system is allowed to reach the full pressure required. The pressure rating of the system should be the same as the lowest component pressure rating in the system.

Maximum pressurization values, normally less than 10 psig (70 kPa), are determined by the lowest rated system component and should not be exceeded. The transmission line is rated at 10 psig (70 kPa) maximum. Consult applicable pressurization specifications all of the system components (usually much lower) to determine maximum system pressurization limit (generally 3 to 5 psig (21 to 35 kPa)) with the antenna, ½ psig (4 kPa) for rectangular wave guide).

After the installation is complete, pressurize the line and check all flange connections for leakage. Use a commercial leak detector or liquid detergent over joints and check for evidence of bubbles. Unbroken soap film over an entire joint for several minutes indicates absence of noticeable leaks.

Pressurization can be accomplished by manual or automatic means depending upon the quantity of line in use at the station and whether or not the site is attended. A dry air hand pump is satisfactory for attended sites using relatively small quantities of line. Automatic electric dehydrators are recommended for unattended sites or where large quantities of line are utilized. A compressed dry air or nitrogen cylinder can also be used. A regulating tank in the pressurization system can be utilized to provide very low-pressure outputs.

The transmission line and the antenna should be purged prior to placing the system in service, and at any other time that moist air could have entered the system. Purging may be accomplished by pressurizing the transmission line from the transmitter end to approximately 5 to 10 psig (35 to 70 kPa), or the pressure rating of the lowest rated component in the system. Water vapor will rise above the nitrogen or dry air in the system so purging should be done at the highest point in the system. Bleed the system at a bleeder valve at the top of the antenna, if one is included in the antenna, or by temporarily loosening transmission line flange bolts at the highest accessible point in the system.

Allow at least one full tank of dry nitrogen to be used for this purging. If a dry air compressor is used, allow it to purge the system slowly for a minimum of one hour. In the event that there has definitely been water in the transmission line and/or antenna, the use of several tanks of dry nitrogen is recommended. At minimum, the purging process should allow at least three (3) exchanges of the full volume of the system.

After the purging process tighten all bolts and connections in the system and pressurize the system. Be certain that pressure level is maintained below the lowest rated component in the system.

Note: Line assemblies are not hermetically sealed and may exhibit a low leakage rate; consequently, line installations not using an automatic air supply must be periodically inspected. Dry air or nitrogen is normally used for pressurizing. When pressurization equipment is connected to the gas port on a gas barrier, or whenever pipe fittings are reassembled, threads must be covered with Teflon tape to ensure a leak-proof connection.