TRANE®

General Service Bulletin

CTV-SB-66F

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Product	**Centrifugal Liquid Chillers**
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Literature History:
CTV-SB-66D - 3/29/85 Added additional size Gasket Eliminator 515
CTV-SB-66E - Changed Trane Part Number for Chisel in Table 3
CTV-SB-66F – Added information for units built without o-rings

Subject: CenTraVac™ O-Ring and Flange Sealant

Introduction:
This service bulletin recommends the sealant and sealing methods to be used when installing new o-rings on Trane centrifugal liquid chillers using R11, R113 and R123. This bulletin also discusses recommendations for installing o-rings on Trane medium pressure centrifugal chillers using R12, R22 and R134a. The sealing of chiller components designed and assembled without the use of o-rings or gaskets is also covered in this bulletin.
Note: The information in this bulletin does not apply to sealing applications for flat rubber gasketed surfaces or other sealing methods and designs.

Discussion:
Trane recommends using Loctite Gasket Eliminator 515 on all refrigerant to atmosphere o-ring connections (except CVHE, CVHF, CVHG, CDHF and CDHG suction elbows to suction cover connection) on all centrifugal liquid chillers using R11, R113, R123, R12, R134a. The o-ring and its material properties along with the design of the casting mating surfaces are intended to provide a leak free joint without the aid of additional sealing compounds. However, providing an additional sealing mechanism with the use of Gasket Eliminator 515 extends the sealing design life of the joint and helps seal some of the minor surface imperfections in the casting and machined surfaces. These surface defects can occur due to nicks and gouges that occur due to disassembly and cleaning or due to rust and corrosion that can occur in some installations.

Minute leaks often show up at the jack-bolt holes on castings. Electronic leak detectors can often sense an intermittent refrigerant leak at the jack-bolt holes since this is a captive area where refrigerant will collect. An intermittent leak does not indicate the amount of actual leakage at that connection and additional methods should be used to verify the leak quantity. One such method is to evaluate the amount of purge time required to remove air from the unit. Another method is to plug the jack-bolt holes and use a soap solution to confirm a leak at the flange edges. Check the leak at the jack-bolt holes with a Halide leak detector and observe for a continuous leak indication. Make sure that any leak indication is properly evaluated to determine if further observations, unit testing or repairs are necessary.

Trane recommends the use of Loctite Gasket Eliminator 515 to insure all R11, R113, R123, R12, and R134a centrifugal chiller refrigerant to atmospheric o-ring and flange connections are as leak free as possible after field repairs. This discussion may not apply to reciprocating or helical rotor compressor designs.

⚠ CAUTION

Chemical Irritant!

Loctite Gasket Eliminator 515 has been shown to be a skin, eye and respiratory irritant. Always wear proper eye protection, plastic or rubber gloves, long sleeves and pants and avoid prolonged inhalation of vapors. Obtain a copy of the vendors Material Safety Data Sheet (MSDS) and follow all safe handling practices provided. Failure to follow all safety instructions could result in minor to moderate injury.

Recommended Application:
Loctite Gasket Eliminator 515 is a relatively fluid substance that will not harden in the presence of air. It will set up to form an effective seal between the o-ring and the mating surface, or between the mating surfaces, in the absence of air after the flanges or castings have been properly torqued. Loctite should not be applied to any o-ring mating surface where excessive amounts of it can extrude or seep into undesirable areas, making removal of additional components difficult. An example of this would be the suction elbow o-ring to the suction cover on CVHE, CVHF, CVHG, CDHF and CDHG units. See Figure 3. See the section for installation of the suction elbow.

To insure a leak free joint after rebuild, apply Loctite Gasket Eliminator 515 to grooved o-ring joints as follows:

Check the fit of the o-ring in the flange or casting groove to insure the correct size o-ring is being used. See the section entitled “Determining Maximum Allowable O-Ring Stretch”.

1. Inspect the o-ring groove for nicks and scratches. Minor surface scratches or nicks can be repaired by filling the imperfections with a soft soldering material, then filing or sanding the surface to a acceptable finish as described in the “Flange Surface Preparation” section.

2. Remove all high spots or burrs that may have occurred on the flange faces because of the use of the jack bolt holes. File the high spots and burrs to obtain a flat surface.

3. Check the expiration date on the tube of Loctite. Important! Do not use Loctite beyond the expiration date.

4. Apply a bead of Loctite 515 (1/8” diameter max) to the entire circumference of the bottom inside diameter (I.D.) of the o-ring groove as shown in Figure 6.

5. Place the o-ring into the groove and gently press it into sealant.
   Note: O-Rings should not be stretched more than 5 % of their inside diameter dimension once seated in the groove. See section on determining the maximum amount of allowable stretch.

6. Apply a bead of Loctite 515 (1/8” diameter max.) to the entire circumference between the o-ring and top outside diameter (O.D.) of the groove as shown in Figure 6.

7. A final smaller bead (1/16” diameter maximum) should be applied around the flange-mating surface between the o-ring groove and the bolt holes as shown in Figure 6.

8. Assemble the mating surfaces and install and properly torque all bolts. Ideally, Loctite recommends that no more than 3 minutes be allowed to elapse between the mating of the flanges and the application of the final bolt torque.

9. In standard conditions (plant room temp 21°C (70°F) or above) allow the Loctite to cure for a minimum of 8 hours before adding refrigerant to the unit.

The use of Loctite Primer N® or Loctite Primer T® accelerators will reduce the effective cure time of the Loctite 515 to as little as 15 minutes, thereby increasing the risk of the product partially curing before assembly and final bolt torque. If the Loctite partially cures during assembly it may act as a shim and prevent a proper seal. Because of this risk the use of accelerating primers is not recommended as a standard service procedure.

Determining Maximum Allowable O-Ring Stretch:
In general, o-rings used by Trane in sizes larger than 20.0" inside diameter (I.D.) are furnished in one-inch increments. The actual inside diameter of o-ring machined grooves may vary depending on the application, which may require a standard size o-ring to be stretched to fit the groove I.D. For instance an o-ring with a 60.0" I.D. will have an inside circumference of 60.0 x 3.14 (Pi) or 188.4". When used in a groove with a 60.75" I.D. (60.75 x 3.14 = 190.75" inside circumference) the o-ring will need to be stretched approximately 190.75" – 188.4" or 2.35".

O-rings may be stretched up to 5% of their inside diameter per the manufacturer's recommendations. In the example above, the 2.35" of stretch is well within the allowable tolerance for an o-ring with a 60.0" I.D.

Before installing an o-ring with Loctite hold it up to the groove and determine the amount of stretch that will be required. To do this place the o-ring in the top of the groove and work it around the groove until the bottom portion of the o-ring becomes horizontal. See Figure 5. Do not stretch the o-ring at this point. Measure the distance (Dimension "A") from the bottom of the horizontal o-ring to the bottom inside diameter of the o-ring groove. Determine the actual inside diameter of the o-ring machined groove and find the groove diameter closest to the actual measured value in Table 1. Compare the measured dimension "A" to the value shown in the table +/- 1/4" to determine if the required stretch will be less than the maximum allowable 5%. The following table shows the maximum allowable dimension "A" for all o-ring sizes from 20.0" to 60.0" inches. Any o-ring where the dimension measured is greater than the "A" dimension shown in Table 1 should not be used as the amount of stretch required will be greater than the 5% allowed by the o-ring manufacturer. Dimension "A" for any groove inside diameter can be determined by multiplying the measured groove inside diameter x .2204.

Example: Groove measured at 36.75" I.D. x .2204 = 8.1" "A" dimension.

Table 1 – Shows Maximum Allowable "A" for All O-Ring Sizes

Groove I.D.	Dim. "A"	Groove I.D.	Dim "A"	Groove I.D.	Dim. "A"
20	4.4	34	7.5	48	10.6
21	4.6	35	7.7	49	10.8
22	4.8	36	7.9	50	11.0
23	5.1	37	8.2	51	11.2
24	5.3	38	8.4	52	11.5
25	5.5	39	8.6	53	11.7
26	5.7	40	8.8	54	11.9
27	6.0	41	9.0	55	12.1
28	6.2	42	9.3	56	12.3
29	6.4	43	9.5	57	12.6
30	6.6	44	9.7	58	12.8
31	6.8	45	9.9	59	13.0
32	7.1	46	10.1	60	13.2
33	7.3	47	10.4		

Suction Elbow To Evaporator Flange:
The lower suction elbow to evaporator flange joint can be assembled using Loctite as described above.

The upper suction elbow connection to the compressor suction cover should be installed with no Loctite sealant on the o-ring and a back up Gore-Tex (GKT-2694) tape installed between the o-ring groove and the inner suction connection opening in the elbow. See Figure 4.

Installing the Gore-Tex tape:

1. Remove the adhesive backing strip from the Gore-Tex tape and install the material approximately 1/8" inboard of the o-ring groove I.D. This should be done before installation of the o-ring to avoid contaminating the surface with petroleum jelly, which could prevent the Gore-Tex from adhering to the flange surface.

2. Overlap the ends of the Gore-Tex as shown in Figure 4.

3. Lightly coat the o-ring with petroleum jelly to help it stay in the o-ring groove during installation.

Units Without Jack-Bolt Holes:
In any application using Loctite 515 as a sealant, jack-bolt holes should be present for future disassembly. If jack-bolt holes are not present refer to Figure 7 and the following procedure to tap the casings. The procedure is for CVHE units but can be modified for all other units.

Note: Model CVHE CenTraVacs built prior to November 1983 do not have jack-bolt holes. Some of these units were assembled with Loctite and will need jack-bolt holes. Casings should not be forced apart without the use of jack-bolts. Follow the procedure below. Uneven force could cause the casings to crack.

1. Remove three of the 5/8-11 bolts (120 degrees apart) that hold the casings together. The bolt clearance hole opening will be 3/4"-inch diameter.

2. Refer to Table 2 and select the proper tap for the 3/4" inch bolt hole opening. For this example, use a 7/8"-9 tap.

Table 2 – Shows Proper Tap for 3/4" Bolt Hole

Bolt Hole Opening	Tap Size	Threads Per Inch
5/16″	3/8″	16
27/64″	1/2"	13
17/32″	5/8″	11
3/4"	7/8″	9

3. Tap the holes with a 7/8″-9 tapered tap, which will allow several threads to be started easily. The remaining tapping should be done by using a 7/8″-9 bottoming tap. This will allow the maximum number of threads to be formed without damaging the 5/8″-11 threads in the adjoining casting.
   Note: When tapping, a cutting oil should be used to minimize the possibility of tap breakage or thread damage.

4. To separate the casings, insert the 5/8″-11 bolt as shown in Figure 7. Insert a 1/2″ steel ball and the 7/8″-9 bolt. By removing the remaining 5/8″-11 bolts and inserting the rigging and guide pins as necessary to remove the casing, the 5/8″-11 bolts can be tightened until they exert force on the steel balls and the 7/8″-9 bolts. This force, when uniform at all three points, will separate the casings.

5. With proper rigging the casing can be removed safely.

When Loctite 515 has been used, field clean-up of the casings can be difficult. Loctite offers gasket-removing compounds called "Chisel" and "Chisel MC Free," which are available in aerosol cans. When using "Chisel," "Chisel MC Free," or any other solvent, the manufacturer's safety recommendations should always be followed completely.

The use of Loctite on flat rubber gaskets is not recommended.

⚠ WARNING

Hazardous Chemicals!

Some gasket removal compounds (such as Loctite #790 Gasket Remover- Chisel) may contain chemicals that are known be skin, eye and respiratory tract irritants. Always wear proper eye protection, plastic or rubber gloves, long sleeves and pants and avoid prolonged inhalation of vapors. Obtain a copy of the vendors Material Safety Data Sheet (MSDS) and follow all safe handling practices provided. Failure to follow all safety instructions may result in death or serious injury.

CenTraVac Flanges Assembled Without O-Rings:

Beginning in late 1999 Trane began eliminating the use of some o-rings and gaskets in motors and compressors on CVHE/F/G, CDHF/G, and CVGF units. Loctite 515 Gasket Eliminator® is used alone to seal flanges designed and constructed without o-rings or gaskets. In the early stages of the program only the inspection covers and end shields of the CenTraVac motors were affected, later results of the program will include other various motor and compressor flange assemblies. Various CVGF motor and compressor joints are also assembled using this new technology and may be without o-rings or gaskets. This section will provide the proper service procedure to be used when servicing a motor or compressor flange assembly that does not have an o-ring groove, an o-ring, or a gasket.

Note: Components designed and assembled without o-rings use a new flange design that eliminates the o-ring groove. The procedures described in this section do not apply to components that were originally assembled with o-rings. Units originally constructed with o-rings should be properly repaired using o-rings in conjunction with Loctite 515 sealant. Refer to the preceding sections of this bulletin for information regarding the servicing and repair of CenTraVac flanges and joints constructed with o-rings.

Figure 1: Typical original flange design with o-ring groove.

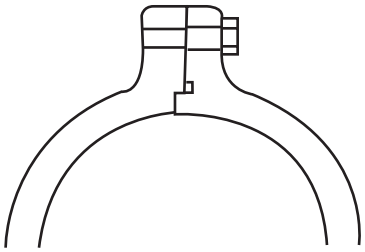
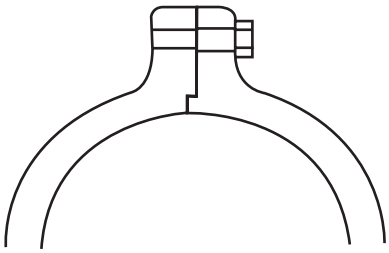


Figure 2: Typical new flange design with o-ring groove removed.



Flange Separation:

Unit flanges constructed without the use of o-rings or gaskets will have adequate jack-bolt holes to allow the separation of the sealed flanges. Insert the appropriate size bolts into the jack-bolt holes, and install the rigging and guide pins that are necessary to safely remove the part. Remove the remaining bolts and apply a uniform tightening force to all jack-bolts and the flanges will separate.

Flange Surface Preparation:

Surface preparation prior to the reassembly of a joint constructed without o-rings will first require the removal of the old Loctite 515.

Cured Loctite 515 may be removed with a scraper, such as a putty knife or gasket removal tool, if care is taken to not seriously scratch or gouge the flange. Wire or abrasive bristle brushes, either hand or powered, may also be used but care must be taken to ensure that you do not polish the flange. Do not use solid grinding wheels or disks or powered sanding tools because of the excessive damage they may cause to the flange surface.

Remove all high spots or burrs that may have occurred on the flange faces because of the use of the jack bolt holes. File the high spots and burrs to obtain a flat surface.
Loctite 515 is not effective on polished or “glass-smooth” surfaces. If a flange surface does get extremely smooth (mirror-like), use some 80 to 120 grit sandpaper on a hand-sanding block to rough up the surface and complete the removal of the cured Loctite.

If using a gasket removal chemical such as Loctite Chisel® or Chisel MC Free®, read and follow all of the manufacturers’ directions carefully. Review the product MSDS sheet and be aware of and follow any safety requirements for eye, face, and hand protection, space ventilation, respirator use, waste disposal, etc.

⚠ WARNING

Hazardous Chemicals!

Some gasket removal compounds (such as Loctite #790 Gasket Remover- Chisel) may contain chemicals that are known be skin, eye and respiratory tract irritants. Always wear proper eye protection, plastic or rubber gloves, long sleeves and pants and avoid prolonged inhalation of vapors. Obtain a copy of the vendors Material Safety Data Sheet (MSDS) and follow all safe handling practices provided. Failure to follow all safety instructions may result in death or serious injury.

During Loctite removal, use cloth or plastic to cover any openings in the parts or the chiller. Avoid the uncontrolled use of compressed air or nitrogen to blow sealant debris from the part, as it may push the debris into inaccessible areas. Take all possible actions to keep the internal chiller parts clean and free of debris.

After the flange surfaces are free of any cured Loctite and the surface finish is acceptable, wipe the flanges clean with industrial quality Isopropyl Alcohol applied with a clean towel or rag. Do not contaminate the flange surface by using a dirty or oily rag. Do not use a rag that deposits fibers on the surface. Do not use Isopropyl Alcohol wipes that contain lanolin or other oils. Avoid touching the cleaned flange surface with bare hands as body oils can affect the adhesion of the sealant.

Sealant Application:
With both mating flanges fully cleaned and ready, select one of the flanges and apply 2 continuous beads of Loctite 515 in a crossing pattern as shown in Figure 8. The approximate thickness of each bead of sealant is given in Table 3. The thickness of the bead that is applied can be adjusted by trimming the tip of the applicator tube and by varying the pressure that is applied to the sealant container. Practice on a different surface may be desirable before applying Loctite to the actual flanges.

Ensure that all process holes and jack-bolt holes have sufficient Loctite 515 applied directly around them. A process hole is a hole that was used during the factory machining process, it may be unused or open on the final assembled product.

Table 3: Loctite 515 bead size when no o-ring is applied

Flange Face Width (inches)	Sealant Bead Size (inches)
1 1 ¼	3/32
1 ½ 1 ¾ 2 2 ¼	1/8
2 ½ 2 ¾ 3 3 ¼ 3 ½	5/32
3 ¾ 4	3/16

After the sealant is applied, quickly assemble the flanges and properly torque all fasteners.

Loctite 515 is an anaerobic sealant and very little curing will occur until the sealant is pressed between the flanges and air can no longer contact it. However, Loctite 515 will begin to cure very quickly once the flanges are assembled. Because of it's fast cure rate it is recommended that the time between Loctite application, flange assembly, and final bolt torque be kept as short as possible. Ideally, Loctite recommends that no more than 3 minutes be allowed to elapse between mating of the flanges and applying the final bolt torque.

Typical effective cure times for Loctite 515 will range from 1 to 12 hours depending on surrounding temperatures and flange gaps. For our typical applications and in a plant room with a surrounding temperature of 21°C (70°F) or higher we recommend that a minimum of 6 to 8 hours be allowed before pressure testing, evacuation, or charging of the unit. For plant room temperatures below 21°C (70°F) a minimum time of 12 hours is recommended before pressure testing, evacuation, or charging of the unit.

Application of Loctite 515 at ambient temperatures below 8°C (46°F) is not recommended.

⚠ CAUTION

Chemical Irritant!

Loctite Gasket Eliminator 515 has been shown to be a skin, eye and respiratory irritant. Always wear proper eye protection, plastic or rubber gloves, long sleeves and pants and avoid prolonged inhalation of vapors. Obtain a copy of the vendors Material Safety Data Sheet (MSDS) and follow all safe handling practices provided. Failure to follow all safety instructions could result in minor to moderate injury.

The use of Loctite Primer N® or Loctite Primer T® accelerators will reduce the effective cure time of the Loctite 515 to as little as 15 minutes, thereby increasing the risk of the product partially curing before assembly and final bolt torque. If the Loctite partially cures during assembly it may act as a shim and prevent a proper seal. Because of this risk the use of accelerating primers is not recommended as a standard service procedure.

Parts Ordering Information:
Loctite Gasket Eliminator 515 and Gore-Tex tape are available from Trane as follows.

Table 4 – Shows Gasket Eliminator 515 and Trane Information

Description	Trane Part Number
Gasket Eliminator 515 (50 ml tube) (Carton 10 pieces)	SEL00489
Gasket Eliminator 515 (300 ml caulking tube)	SEL00376
Gore-Tex (.03 + K x .12W x 150 inches)	GKT02694

Note: Loctite 515 Gasket Eliminator® should ideally be stored in a cool, dry location in unopened containers at a temperature that is between 8° to 28°C (46° to 82°F). Do not use previously opened sealant. Loctite 515 Gasket Eliminator® has a limited shelf life, SEL00376 300ml caulking tubes have a "use by" date marked on each individual tube. Smaller SEL00489 50ml tubes have the "use by" date marked on the bulk carton the tubes are shipped in, so be sure to note this date when removing tubes from the carton for individual sale or use.

Review the Loctite 515 Gasket Eliminator® MSDS sheet and be aware of and follow any safety requirements for eye, face, and hand protection, space ventilation, respirator use, waste disposal, etc.

Figure 3: Suction Elbow Flange to Compressor Gortex Application

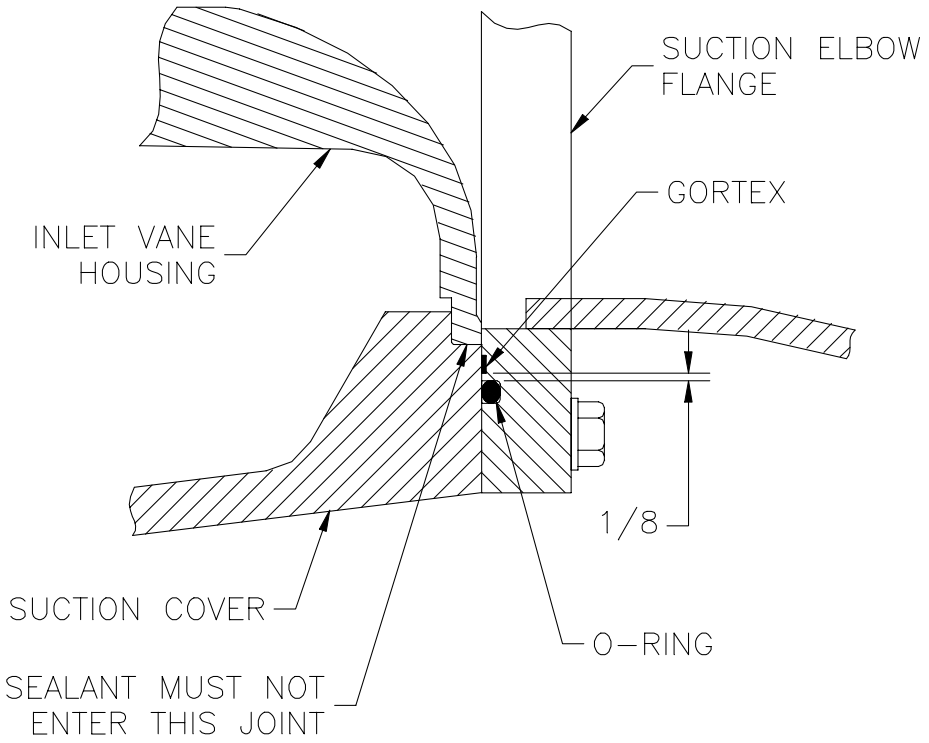


Figure 4: Suction Elbow Flange to Suction Cover Gortex Application

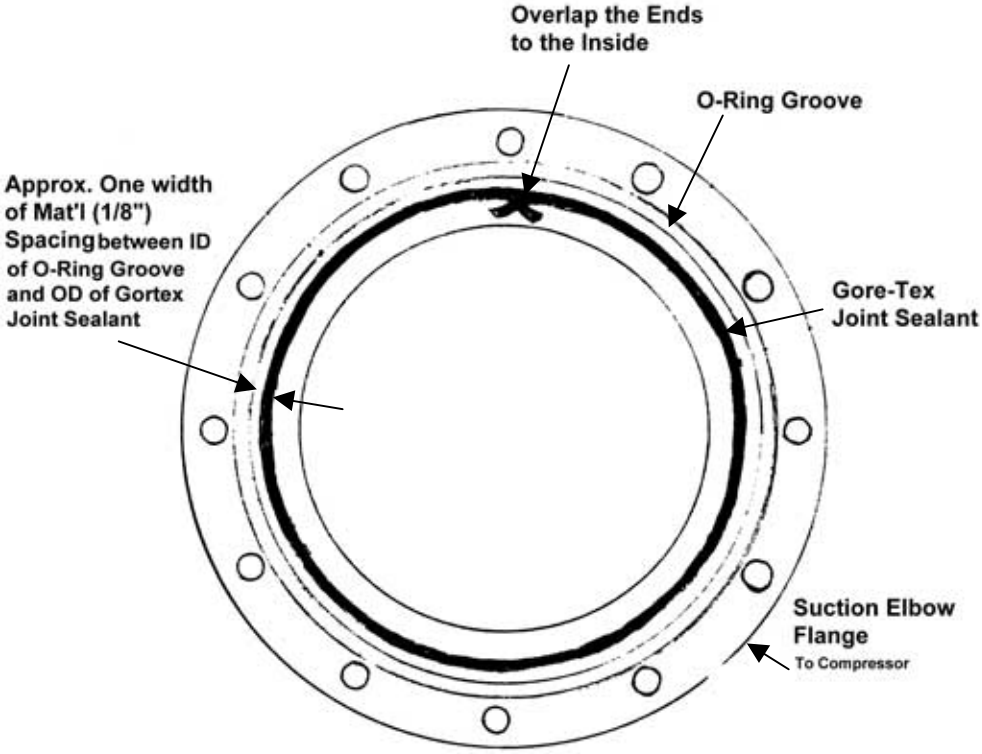


Figure 5: Example of O-Ring Stretched

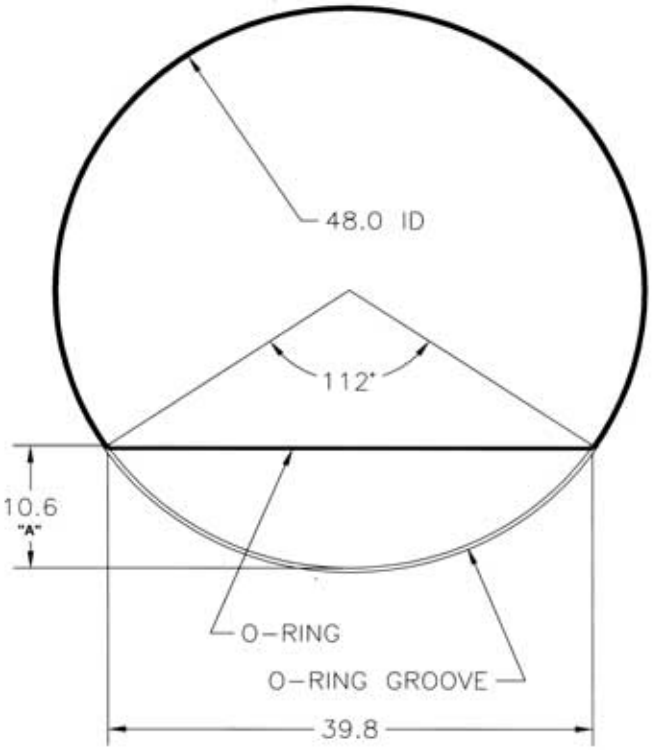


Figure 6: Loctite 515 Application

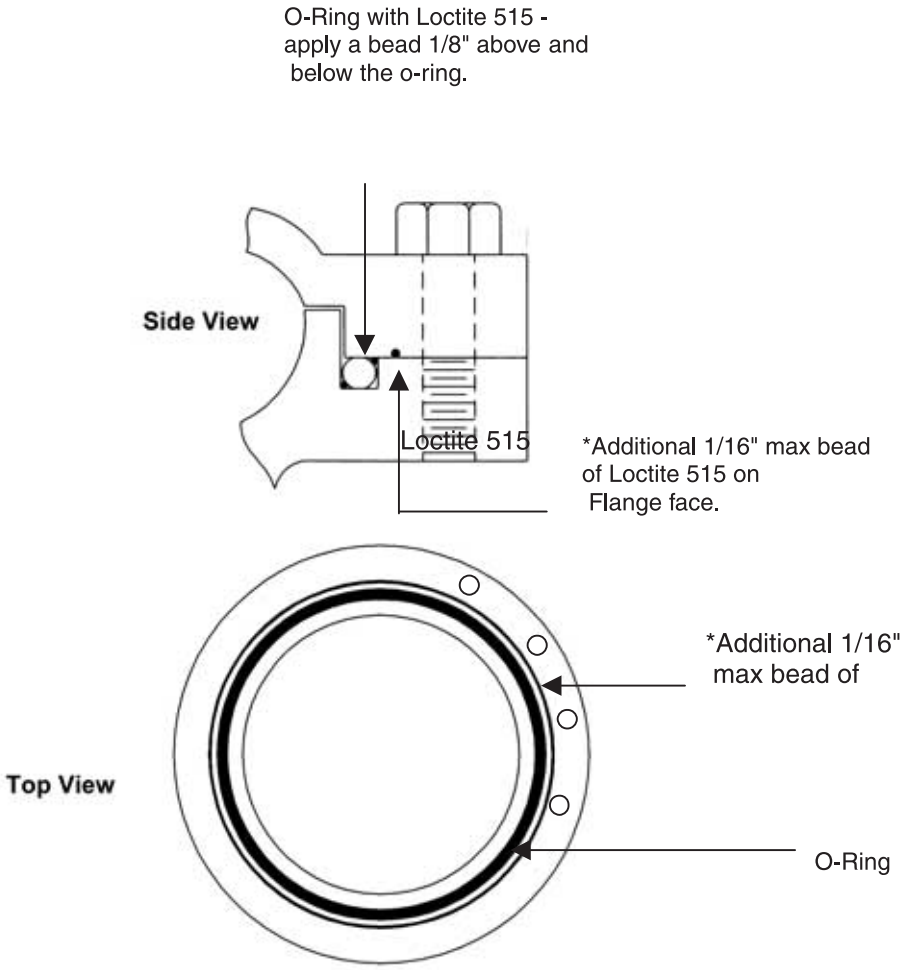


Figure 7: Bolt Connection Modified for Jack-Bolt Hole

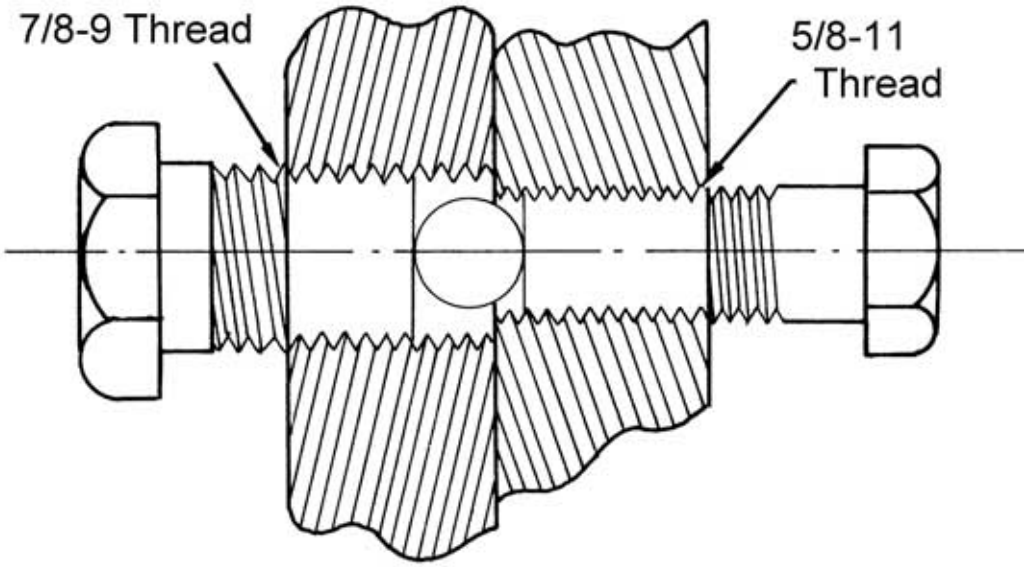


Figure 8: Loctite 515 Application, without O-Ring