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CTVH-GCO-04-EN

CVHF Compressor Assembly (Including)

- Discharge Volute Installation
- Motor Installation
- Unit Mounted Starter Installation
- Compressor Assembly
- Suction Elbow Installation
- Economizer Installation

CVHF and CDHF Unit:

Compressor Sizes 350-1280 Ton

This section describes re-assembly (including discharge volute, motor, unit mounted starter, suction cover and economizer installation) procedures for the model CVHF CenTraVac compressor assemblies. The same information applies to the compressors for the CDHF duplex units. For disassembly and re-assembly procedures for the motor, see CenTraVac Service Literature Section *CTVH-GMO-01*.The procedures covered in this section may be used for the CVHF and CDHF compressor sizes 350 thru 1280 tons. For information on the CVHE and CVHG compressors, see Centravac Literature Sections *CTVH-GCO-01& 02*.

See *CTVH-GCO-05 & 06* for the extended capacity compressor sizes 1470 and 1720.

Always check the appropriate table to obtain weights and tolerances for a particular type or size compressor.

Warning and Cautions

WARNINGs and CAUTIONs appear at appropriate sections through out this manual. Read these carefully.

WARNI NG: indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: indicates a potentially hazard us situation which, if not avoided, may result in minor or moderate injury.

CAUTION: may also be used to alert the reader to a situation that could result in equipment or property-only damage.

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IMPORTANT!: Before beginning re-assembly o the compressor, it is important to check all pieces for damage, rust, or worn parts that could result in leaks or problems with unit operation or reliability. Clean all gasket and o-ring surfaces thoroughly. All traces of previous sealants must be completely removed and the surfaces wiped with a suitable solvent such as industrial grade isopropyl alcohol to remove all traces of oil and other contaminants. When using Loctite between flanges do not touch the flanges after cleaning and before application of Loctite. The oils left from fingerprints can affect the sealing ability of the Loctite. Check flange surfaces or high spots left around bolt holes and at jack bolt locations. These high spots can cause flange separation and may result in leaks. If necessary use a flat file to remove high spots.

⚠ WARNING
Hazardous Chemicals!
Always use proper protection when handling solvents and other potentially harmful chemicals. Use rubber gloves, clothing and eye protection and avoid prolonged inhalation of vapors. Failure to do so can result in death or serious injury.

IMPORTANT!: See the chemicals MSDS (Material Safety Data Sheet) for additional precautions and warnings on use.

The procedures for using an o-ring sealant can be found in *General Service Bulletin CTV-SB-66* (latest revision).

⚠ WARNING
Heavy Objects!
Use lifting and rigging equipment that is rated to handle the maximum weights. Improper use of lifting fixtures may result in death or serious injury.

Follow all proper procedures when handling large compressor components. Use lifting and rigging equipment that is rated to handle the maximum weights of the pieces found in Table 2 in the back f this literature section. It is recommended that all lifting devices have a capacity rating no less than 100%of the weights shown. Carefully inspect lifting equipment to ensure it is in good condition and has been inspected and certified for continued use at proper intervals as appropriate.

For larger units it may be advisable to block larger components like the economizer and piping when the bolts are removed and then use slings (in the choke configuration) at each end to lift the part. See Table 2 for weights of components. Make sure the proper balance point of the load is found, to prevent it from rotating as it is lifted. See Figure 1 for proper sling use.

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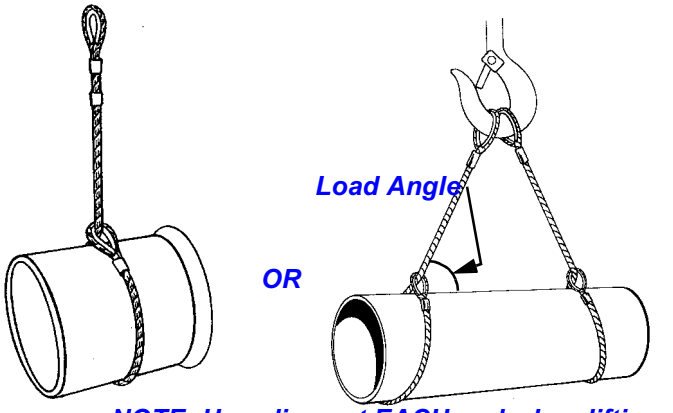
Note: The lifting capacity of a sling is reduced when the load angle is less than 90°. See Table 1 or load actor values. For angles less than 90°, multiply the load actor by the nominal sling lifting capacity to determine the allowed lift weight.

Figure 1
Typical Choke Sling Cable Arrangement



NOTE: Use slings at EACH end when lifting.

Table 1

Load Angle (°)	Factor	Load Angle (°)	Factor
90	1.000	50	0.7660
85	0.9962	45	0.7071
80	0.9848	40	0.6428
75	0.9659	35	0.5736
70	0.9397	30	0.5000
65	0.9063	25	0.4226
60	0.8660	20	0.3420
55	0.8192	15	0.2589

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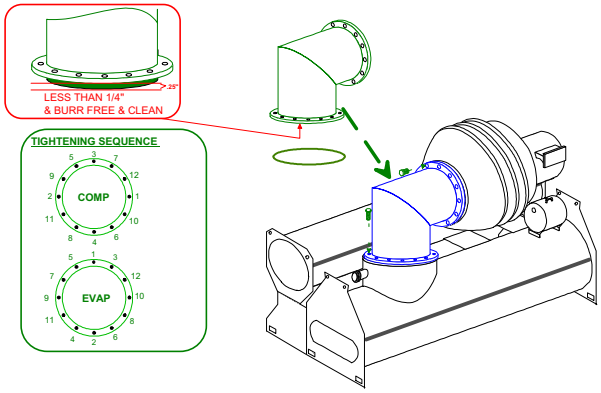
Figure 2



Before proceeding with compressor re-assembly review the procedures in General Literature Section CTVH-GCO-03EN containing information and details on CVHF compressor disassembly.

Unless otherwise specified, the bolt torques required on all flange joints with o-rings or joints where only Loctite 515 is used, can be found in Table 3 in the back of this section. The bolt torques listed in Table 3 are for Grade 5 bolts. *Use only grade 5 bolts or better.* Tighten bolts to final torque in incremental steps. Unless otherwise specified follow a crossing pattern when tightening bolts. See Figure 2 for a typical recommended bolt tightening sequence. The recommended bolt torque values in Table 3 do not apply to bolts used with flat gaskets. Bolt torques for flat gaskets will be provided in the sections covering their installation.

⚠ WARNING
Hazardous Voltage!

Before working on this or any electrical equipment, always disconnect the electric power supply. Follow proper lockout/tagout procedures to ensure the power cannot be applied during repairs. Failure to do so may result in death or serious injury.

Re-assembly

1 Discharge Volute Installation

(a) Clean the dowel pins and the dowel pin holes in the condenser discharge flange and evaporator mounting base to remove rust or other debris. Lightly coat the pins with a petroleum jelly or anti-seize compound.

(b) Clean the flanges and apply Loctite 515 and o-ring (when applicable) as recommended.

IMPORTANT!: See Service Bulletin CTV-SB-66 (latest revision) or procedures for using Loctite 515.Always check the date on the Loctite tube to ensure the sealant use time has not expired.

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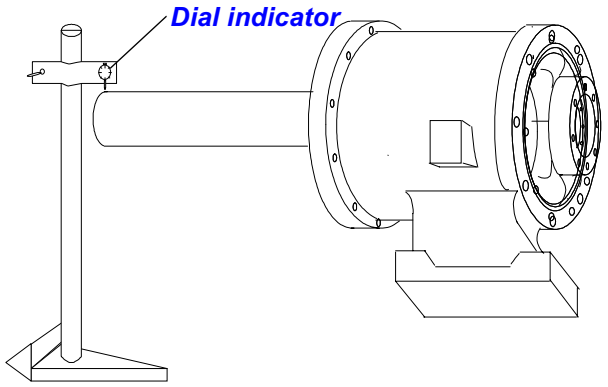
(c) Use a sling or cable in the choke configuration through the center of the volute for lifting. Be sure to protect the flange surfaces when using a cable. Place the volute on the condenser and line up the dowel holes.

(d) Tap the dowels in place as the bolts in the foot and discharge flange are tightened. Torque the bolts per Table 3 in the back of this section.

2 Motor Installation.

(a) Before installing the motor, check shaft run out (TIR) as shown in Figure 3. Using a dial indicator turn the shaft and measure the runout at the end f the shaft. The maximum allowable runout is .0012"TIR. Make sure the end of the shaft is wrapped with tape for protection during assembly.

Figure 3



(b) Place two slings or cables in the choke configuration around the motor. Place them at each end of the motor near the flanges and lift the motor slightly to get the proper balance point. See Table 4 for maximum motor weights.

(c) Apply Loctite 515 and -ring (when applicable) around the motor (shaft end) end bell.

(d) Install two guide pins in the volute r motor flange (large frame) to help guide the motor in place. See Figure 4.

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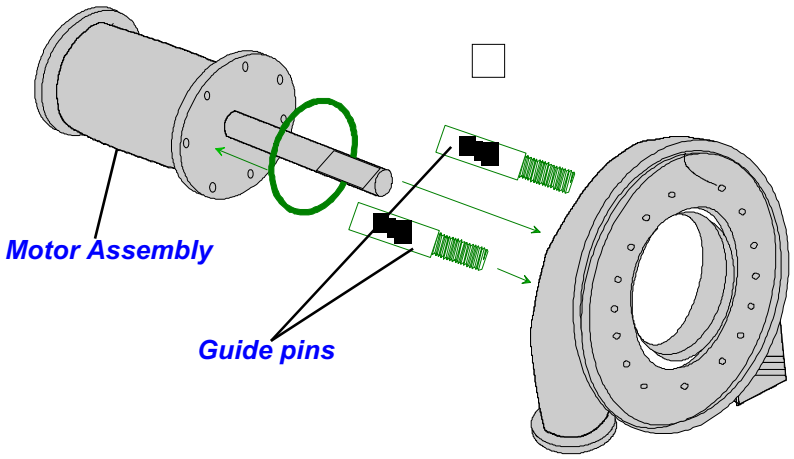
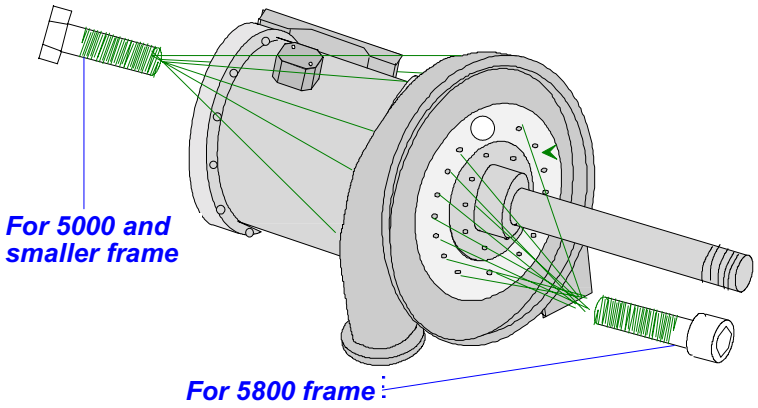
Figure 4



(e) Lift the motor in place and hand tighten the bolts holding the motor to the volute Snug the bolts and remove the guide pins. Note on some large frame motors, the bolts (allen head) that hold the motor to the volute are located on the compressor side of the volute. The proper torque for both styles of bolts is 120-165 lb- ft.

Figure 5



3 Volute Diffuser Plate Installation.

(a) Install two pins in the volute to guide the diffuser in place.

(b) Place a sling r cable in the choke configuration through the center of the diffuser.

(c) Lift the diffuser and slide it over the guide pins. Install countersunk screws and torque them to 55-75 lb-ft. Make sure the screws in the counterbore area behind impeller do not protrude more than .060"above the surface.

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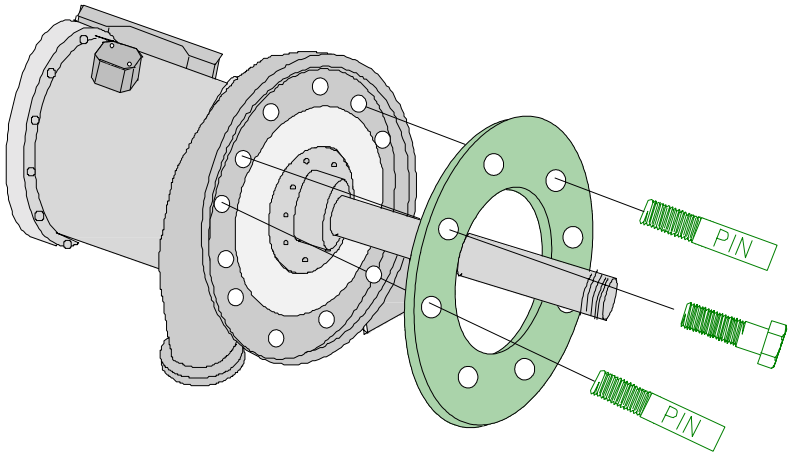
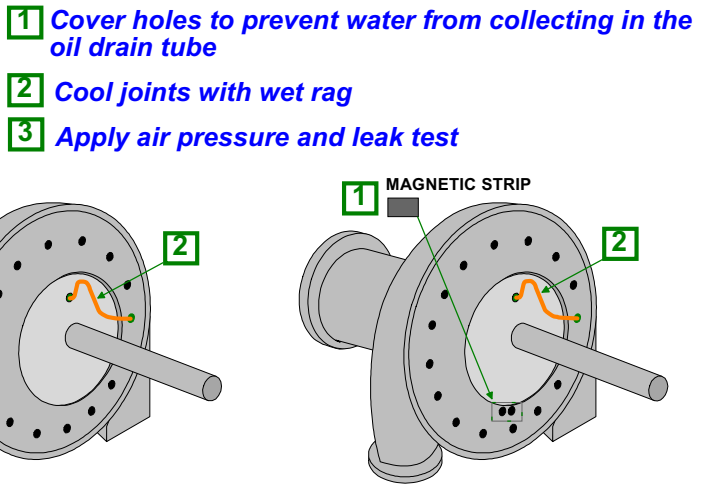
Figure 6



4 Oil Feed Tube Installation.

(a) Clean the ends of the lines thoroughly using a scotch bright pad or equivalent for metal. See Figure 7. Remove as much of the old brazing material as possible. Clean the inside of the couplings using a steel tubing brush. Use Loctite 277 Sealant on the threads.

Figure 7



(b) Wrap a wet rag around both ends f the line t prevent overheating the threaded joints.

(c) Using a regulator, allow a slight purge of dry nitrogen to flow through the volute threaded fitting and oil supply line to prevent a buildup of oxidation when brazing.

(d) Braze the lines as shown in Figure 8 using a good Sil-Fos material with 5-15%(Ag) silver.

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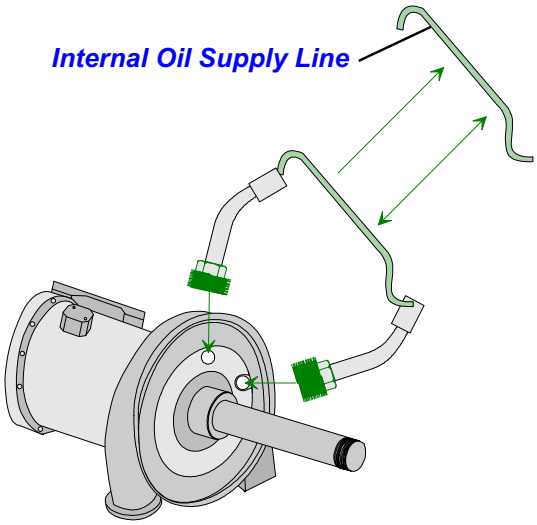
Figure 8



(e) After brazing, allow the lines to cool. Increase the nitrogen pressure and check the line and threaded fittings for a leak using a soap solution.

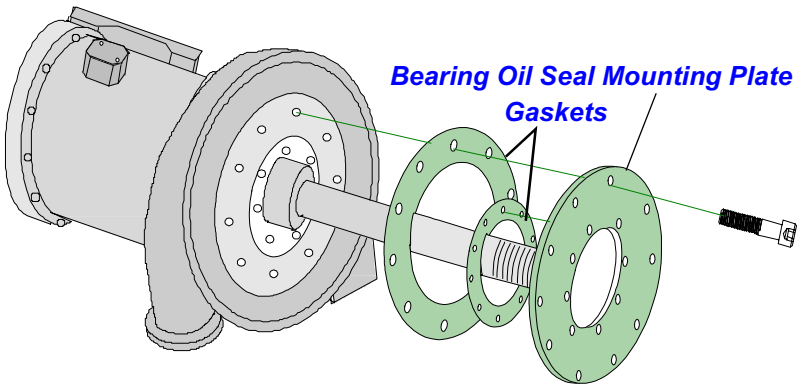
5 Bearing Cover Plate Installation

(a) Install two guide pins in both the inner and outer bolt centers to help hold the gaskets in place and to align the cover plate.

(b) Lightly coat both the inner and outer gaskets with a small amount of petroleum jelly to help hold them in place.

(c) Using a sling or cable in the choke configuration, slide the bearing cover plate in place while observing the gaskets to make sure they don't move out of position. See Figure 9.

Figure 9



(d) Install the outer mounting bolts. Remove the outer guide pins and torque the bolts to 20-27 lb-ft.

6 Bearing Oil Seal Installation.

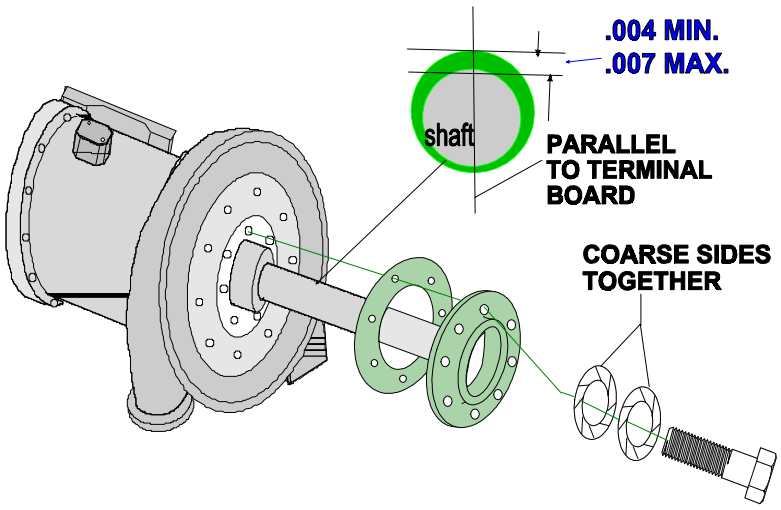
(a) Lightly coat the bearing oil seal gasket (between the bearing cover plate and oil seal) with a small amount of petroleum jelly to help hold it in place. Make sure the gasket behind the bearing cover plate is still in its proper position.

(b) Slide the bearing oil seal over the guide pins. IMPORTANT: The oil seal has a drain *hole between the teeth of the seal that must be installed at the 6 o'clock position.* Install the mounting bolts with ramp washers and hand tighten. Remove the guide pins.

NOTE: *Check the clearance between the bearing oil seal and the shaft outside diameter at the seal location. The maximum allowable* ***total*** *clearance is .0040- .0070". **IMPORTANT:** Clearances in excess of this amount will lead to oil loss.*

(c) Push up on or lightly tap the seal until the bottom of the seal touches the bottom of the shaft. Position the seal so the clearances on each side of the seal (3 and 9 o'clock) are equal. Using a feeler gauge, measure the total clearance at the 12 o'clock position and the clearances at the sides. It is recommended that a new oil seal be used if there is any question about the total clearance of the existing seal.

Figure 10



(d) With all the clearance at the top of the seal, tighten the bolts to 20-27 lb-ft. Recheck the clearance and rotate the shaft to ensure it turns freely. See Figure 10.

(e) At this point you may want to run only the motor to check for balance. This is desirable if a replacement motor is being installed or if the rotor was changed or repaired. See *General Service Bulletin CVHE-SB-18* (latest revision) for the procedures when air running motors.

7 2nd Stage Impeller Installation.

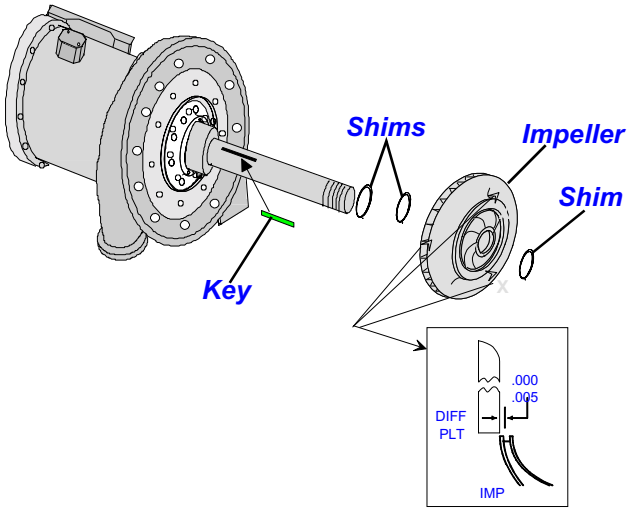
(a) Clean the impeller shims. Slide the impeller shims with the thicker steel shim against the shaft shoulder. *Note: The chamfer on the thicker steel shim should be facing the shaft shoulder.* Impeller alignment should have been checked during disassembly and any adjustments to the shim(s) thickness necessary to get proper impeller alignment can be made at this time. If the impeller or motor shaft has been replaced, then you may want to use only the steel spacer for an initial alignment to determine how many additional shims may be required.

(b) Thoroughly clean the impeller, key and shaft. Check the impeller bore for cracks. This can be done using a dye penetrant flaw detection kit. These kits are available through most weld supply or large industrial supply companies. The kits usually consist of a penetrant, developer, and cleaner and include instructions on their use. Replace the impeller if cracked. Some types of damage to the impeller bore or nose seal area on impellers can be repaired by The Trane Company.

(c) Check the impeller key and keyway in the impeller bore for damage. Check to ensure the sides of the keyway in the impeller bore are square.

(d) Coat the impeller bore and shaft with compressor oil. Install the key in the shaft. Slide the impeller on the shaft until it contacts the shims. Check the alignment of the impeller. The back inside discharge surface of the impeller should be flush to no more than a .0050" set out beyond the face of the diffuser plate. See Figure 11.

Figure 11



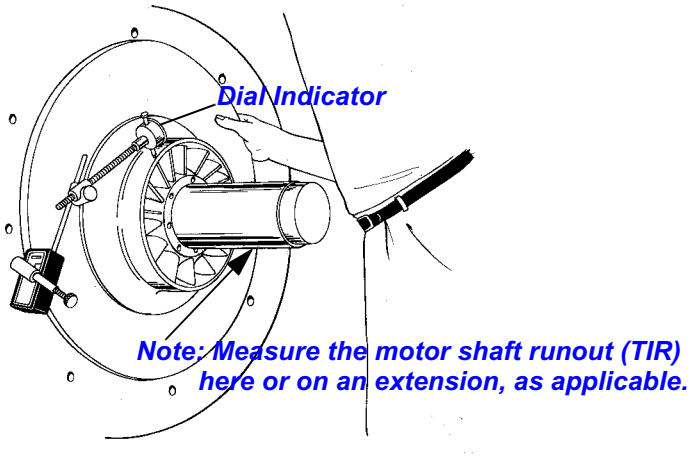
If the impeller does not slide easily on the shaft, it may be necessary to heat the impeller slightly to allow it to slide on the shaft. Before heating the impeller, inspect the impeller bore for debris or a dent (high spot) that could be causing interference. When heating the impeller, use a large (Rosebud) tip with a soft gentle flame. The impeller should be heated so that it is warm to the touch. Do not exceed 120° F. *The impeller bore (ID) to shaft* diameter (OD) total clearance should be .0000 -.0015"maximum.

(e) When required, remove the impeller and add shims to obtain the proper alignment. Slide the impeller on the shaft and recheck the alignment.

(f) Check the radial clearance between the impeller OD and the vane plate ID The minimum clearance around the entire circumference is .0220"minimum. In the unlikely event that clearance around the impeller is inadequate, it will be necessary to reposition the diffuser plate to obtain proper clearance. To reposition the diffuser plate first remove the impeller, then loosen the diffuser plate mounting bolts just enough to allow diffuser movement. Wrap a pry bar with a rag to prevent scratching the metal, then use the pry bar to shift the diffuser plate in the desired direction. Then retighten the diffuser plate bolts to 55-75 lb-ft. Re-install the impeller and recheck the clearances.

(g) Check the impeller nose run out using a dial indicator with a magnetic base. Rotate the impeller and measure the maximum runout (see Figure 12). The allowable maximum runout for fabricated (welded) impellers is .0050" and .0035" for cast style impellers.

Figure 12



(h) Install any shim(s) removed during disassembly in front of the 2nd stage impeller.

8 2nd Stage Suction Cover Installation.

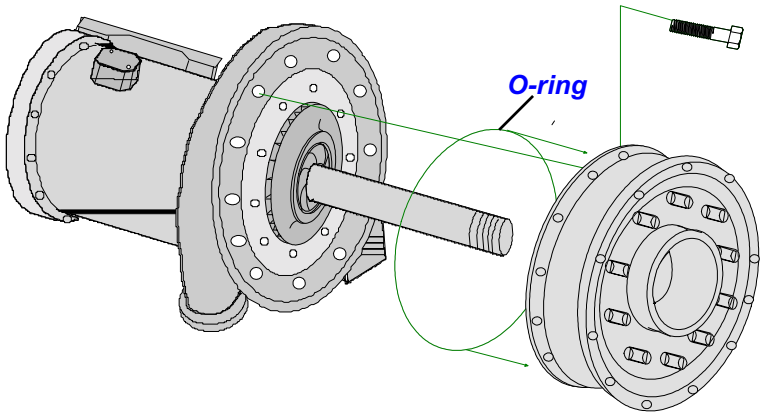
(a) Clean the cover and discharge volute.

(b) Attach the lifting fixture to the suction cover and find the proper balance point.

(c) Apply Loctite 515 and an o-ring (when applicable) per recommended procedures.

(d) Install four guide pins to help align the suction cover as shown in Figure 13. Make sure the scribe marks between the volute and the suction cover are lined up before final tightening of the bolts.

Figure 13



(e) Install bolts and torque to 120-165 lb-ft.

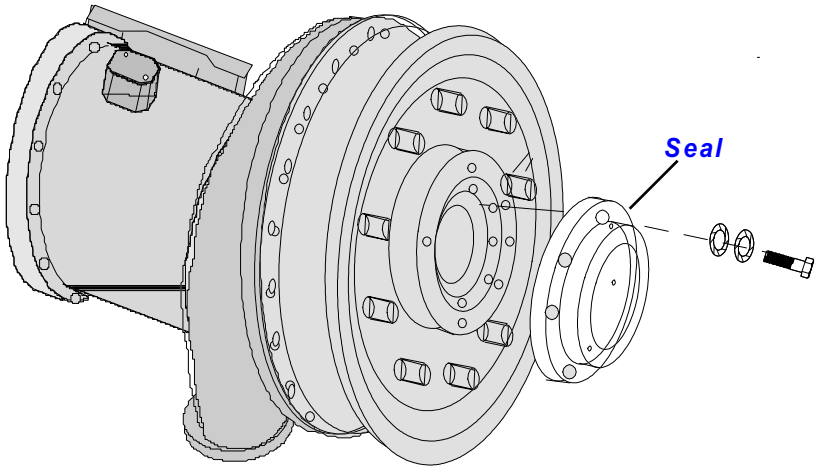
9 Impeller Nose Seal Installation.

(a) Thoroughly clean the nose seal to remove any debris or loose chips from the labyrinth teeth.

(b) Use the original bolts and new locking tab washers.

(c) Using feeler gauges, center the seal around the nose of the impeller. The proper clearance can be found in Table 5.

Figure 14



(d) With the seal set properly, tighten the seal retaining bolts to 20-27 lb-ft. Recheck seal clearance.

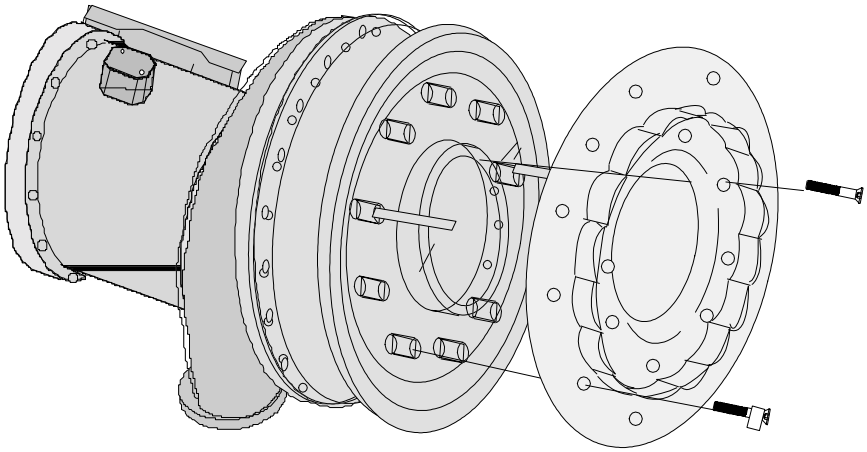
(e) Rotate the shaft to ensure it turns freely.

10 2nd Stage Vanes Assembly Installation.

(a) Install two guide pins in the suction cover to help align the shroud and vane assembly.

(b) Use a sling to lift the vane assembly in place. It is recommended that new screws be used. If reusing the original screws, coat the threads with a thread locking compound. New screws will have a nylon locking insert. It is recommended the new screws also be coated with a thread locking compound. See Figure 15.

Figure 15



(c) Tighten the allen head screws to 5-7 lb-ft. The screw heads must be flush or below the surface. Note: if installing a complete new vane/shroud assembly, you will first have to counter-sink the 8 mounting holes to accept the screw heads.

11 2nd Stage Vane Operator Assembly Installation.

(a) Clean the flanges on the suction cover and vane operator assembly.

(b) Clean any powder residue from the new gasket. The gasket should be installed dry. Slide the fork of the vane operator lever over the pin in the vane drive ring pin assembly.

(c) Tighten bolts to 33-50 lb-ft. See Figure 16. Do not over-tighten.

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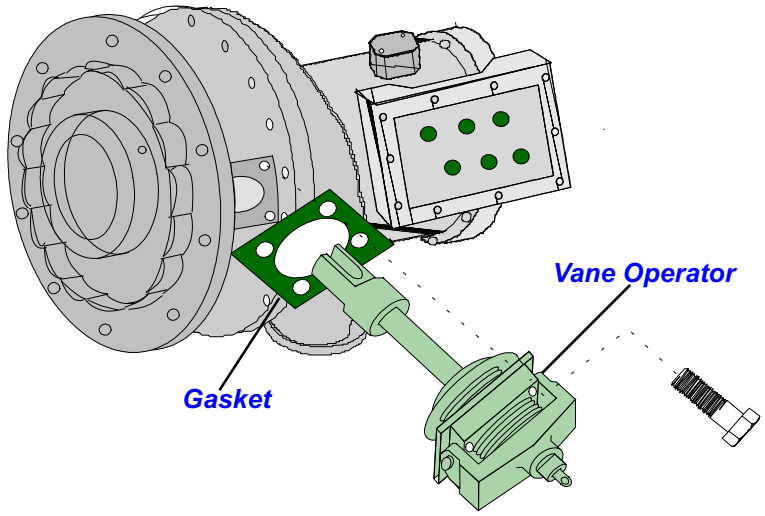
Figure 16



(d) Open and close the vane assembly to ensure it operates freely. Check to make sure the vanes close completely and open fully.

12 2nd Stage Aluminum Vane Plate Installation.

(a) Before installing the vane plate, make sure the shim in front of the impeller has been installed.

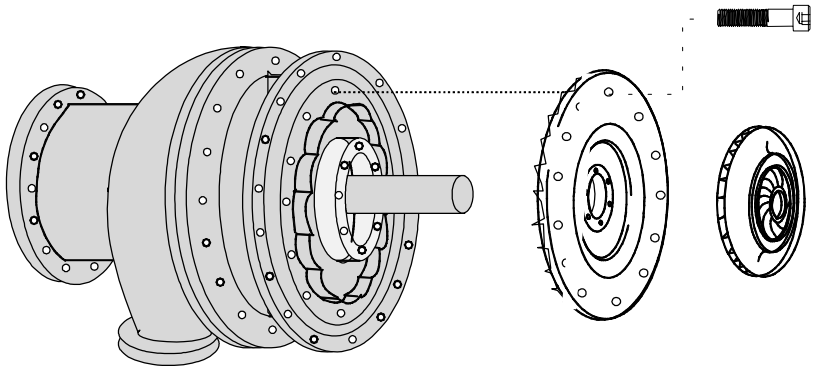
(b) Clean the aluminum plate.

(c) Insert the four guide pins to help align and hold the vane plate during installation.

(d) Lift the plate through the center using a sling in the choke configuration.

(e) It is recommended that new bolts be used. If reusing the original bolts, coat the threads with a thread locking compound. New bolts have a nylon locking insert. See Figure 17.

Figure 17

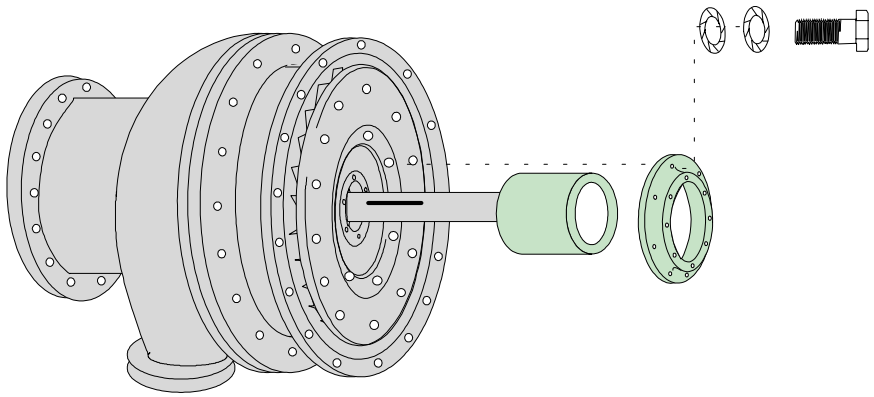


(f) Tighten the bolts to 20-27 lb-ft.

13 Interstage Spacer Installation.

(a) For units with a the large diameter (straight) shaft at the 1st stage impeller location, slide the shim and spacer on the shaft that was removed during disassembly (see Figure 18. Make sure the spacer, which was marked during disassembly, is placed back on the shaft in the proper position. This will help maintain proper balance if all the rotating components are being re-used.

Figure 18



(b) Some units have a step shaft, where the shaft diameter for the 1st stage impeller is smaller than the remainder of the shaft. Depending on unit size and design sequence, there may be a .500"aluminum spacer mounted against the 2nd stage impeller hub and then a longer aluminum spacer that steps down to the smaller shaft diameter. Some units will have a thin shim against the 2nd stage impeller, a long aluminum spacer tube, and then an end spacer that fits inside the tube. Make sure the spacer tube and end spacer (when used), which were marked during disassembly, are placed back on the shaft in the proper position. This will help maintain proper balance if all of the rotating components are being re-used.

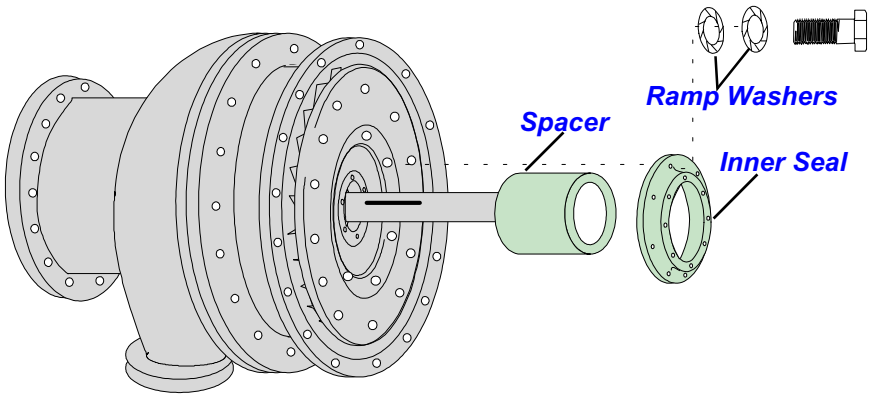
14 Interstage Spacer Seal installation.

(a) Install the seal and bolts with a ramp washer over the interstage spacer.

(b) Center the seal using feeler gauges. The allowable tolerance can be found in Table 5.

(c) Tighten the bolts to 20-27 lb-ft. See Figure 19.

Figure 19



15 1st Stage Impeller and Impeller Locknut Installation

(a) If impeller shims were originally installed, clean the impeller shims and slide them up against the interstage spacer. Impeller alignment should have been checked during disassembly and any adjustments to the shim(s) thickness necessary to get proper impeller alignment can be made at this time. If the impeller or motor shaft has been replaced, then you may want to use only a portion of the original shims for an initial alignment to determine how many additional shims may be required.

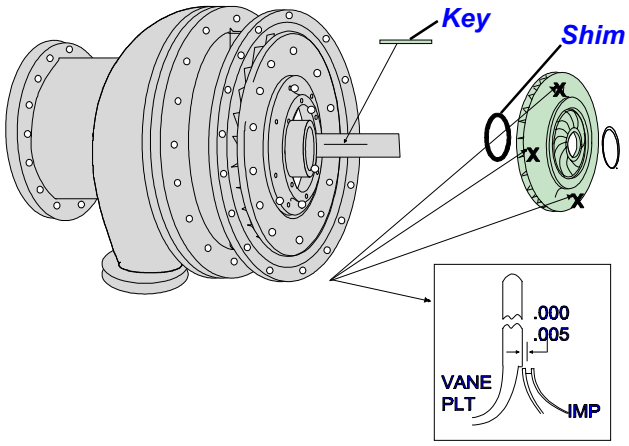
(b) Thoroughly clean the impeller, key and shaft. Check the impeller bore for cracks. This can be done using a dye penetrant flaw detection kit. (These kits are available through most weld supply or large industrial supply companies. The kits consist of a penetrant, developer and cleaner and include instructions on their use.) Replace the impeller if cracked. Some types of damage to the impeller bore or nose seal area on impellers can be repaired by The Trane Company.

(c) Check the impeller key and keyway in the impeller bore for damage. Check to ensure the sides f the keyway in the impeller bore are square.

(d) Coat the impeller bore and shaft with compressor oil. Install the key in the shaft. Slide the impeller on the shaft until it contacts the shims. Check alignment of the impeller.

The back inside discharge surface f the impeller should be flush t no more than a .0050"set out beyond the face of the vane plate. See Figure 20.The back plate on welded impellers may have some distortion due to the weld process. Locate the impeller back inside edge (lowest point) so it is flush with the vane plate.

Figure 20



If the impeller does not slide easily on the shaft, it may be necessary to heat the impeller slightly to allow it to slide n the shaft. Before heating the impeller, inspect the impeller bore for debris or a dent (high spot) that could be causing interference. When heating the impeller, use a large (Rosebud) tip with a soft gentle flame. The impeller should be heated so that it is warm to the touch. Do not exceed 120°F. The impeller bore (ID) to shaft diameter (OD) total clearance should be .0000 -.0015"maximum.

(e) When required, remove the impeller and add shims to obtain the proper alignment. Slide the impeller on the shaft and recheck alignment.

(f) Check the radial clearance between the impeller OD and the vane plate ID The minimum clearance around the entire circumference is .0220"minimum. In the unlikely event that clearance around the impeller is inadequate, it will be necessary to reposition the diffuser plate to obtain proper clearance. To reposition the diffuser plate first remove the impeller, then loosen interstage seal mounting bolts, then loosen the diffuser plate mounting bolts just enough to allow diffuser movement. Wrap a pry bar with a rag to prevent scratching the metal, then use the pry bar to shift the diffuser plate in the desired direction. Then retighten the diffuser plate bolts to 55-75 lb-ft. Re-set the interstage seal clearances as was described in step 14 and tighten the seal retaining bolts to 20-27 lb-ft. Reinstall the impeller and recheck the clearances.

(g) Before installing the spacer, conical (spring) washer, and lockwasher on the shaft, (Figure 29) thread the locknut on by hand to ensure there are no burrs or damaged threads etc. The locknut thread fit should be snug but may be turned by hand without use of a spanner wrench. Install the spacer, spring (conical shaped) washer, lockwasher, and impeller locknut on the shaft and tighten by hand until all clearance has been taken up in the assembly. Make sure the spring washer is installed so the concave side is towards the impeller as shown in Figure 29.

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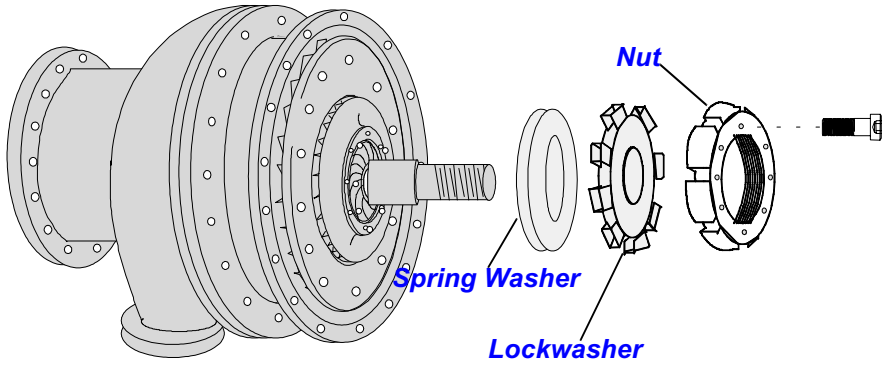
Figure 21



(h) Rotate the shaft so that the 1st stage impeller key is at the 12 o'clock position.

(i) Some compressors have a balance/locknut with weights. If all original compressor components (motor/rotor, impellers, spacers etc.) are being re-used, then the original weights may be left on the balance nut. Once the locknut has been hand tightened, place a mark on the locknut and the impeller hub. Tighten the locknut the required rotation as described below.

Small Locknut:

Once hand tightened, the small locknut (less than 2.500") should be rotated another 360-390 degrees using a spanner wrench and brass hammer or special socket and impact wrench. Use the marks described above to determine the rotation of the nut compared to the impeller. Once reaching 360 degrees of rotation, look for the next locking tab on the lockwasher that will fit into a notch in the locknut. Do not over-tighten the locknut as it is possible to cause shaft bending and run out, which could result in vibration problems.

Large Locknut:

Once hand tightened, the large locknut (greater than 4.000") should be rotated 170-180 degrees. Use the marks to determine the rotation of the nut compared to the impeller. Once reaching 170 degrees of rotation, look for the next locking tab n the lockwasher that will fit into a notch in the locknut. Do not over-tighten the locknut as it is possible to cause shaft bending and run out, which could result in vibration problems.

When reusing a locknut with it's original balance weights, make sure the match marks made during disassembly are aligned in their original position after the nut is tightened properly. See the Disassembly section.

IMPORTANT!: If the rotating components have been reused and the balance weights do not line up as originally marked, the balance weights should be removed.

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IMPORTANT!: If the rotating components have been replaced or were not marked during disassembly or do not line up as originally marked, the balance weights should be removed.

⚠ CAUTION

Once the locknut has been properly tightened, bend over a tab on the locking washer. It is recommended that a new lockwasher be used during re-assembly.

⚠ CAUTION

Compressor Damage!

Once a locking tab has been bent over on a lockwasher it may become weak and break off f the same tab is re-used. This could cause the impeller locknut to loosen and come off during operation, causing major damage to the compressor and motor.

(j) Check the impeller nose run out using a dial indicator with a magnetic base. Rotate the impeller and measure the maximum runout. The allowable maximum runout for fabricated (welded) impellers is .0050"and .0035"for cast style impellers.

(k) For shafts with the extension beyond the locknut or units with balance nuts, check the shaft runout after the locknut is tightened. Checking shaft runout on units without the balance nut or shaft extension will be difficult since the standard locknut does not have a smooth machined surface where the indicator can be used. Rotate the shaft and measure the maximum shaft runout. The allowable maximum shaft runout is .0012"

16 1st Stage Suction Cover Installation. (See Figure 22)

(a) Clean the cover and mating surface.

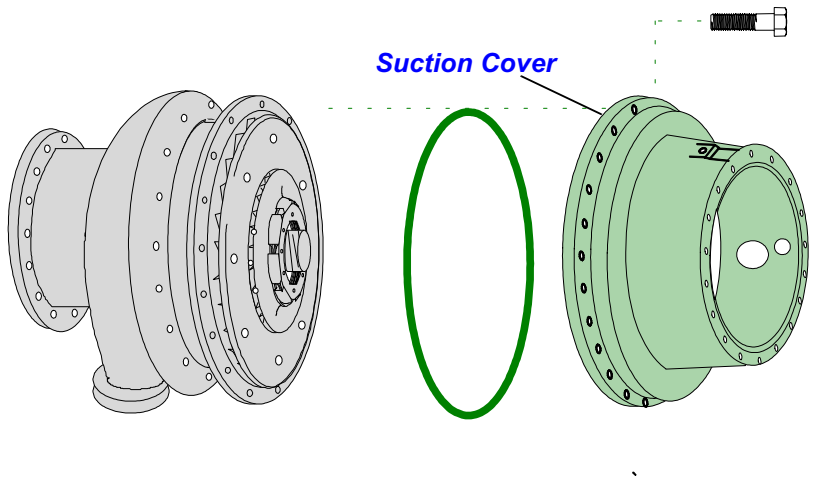
(b) Attach the lifting fixture to the suction cover and find the proper balance point.

(c) Apply Loctite 515 and an o-ring (when applicable) per recommended procedures.

(d) Install four guide pins to help align the suction cover. Make sure the scribe marks between the 2nd stage cover and 1st stage cover are lined up before final tightening of bolts.

(e) Install bolts and torque to 120-165 lb-ft.

Figure 22



17 Impeller Nose Seal Installation.(seeFigure 23)

(a) Thoroughly clean the nose seal to remove any debris or loose chips from the labyrinth teeth.

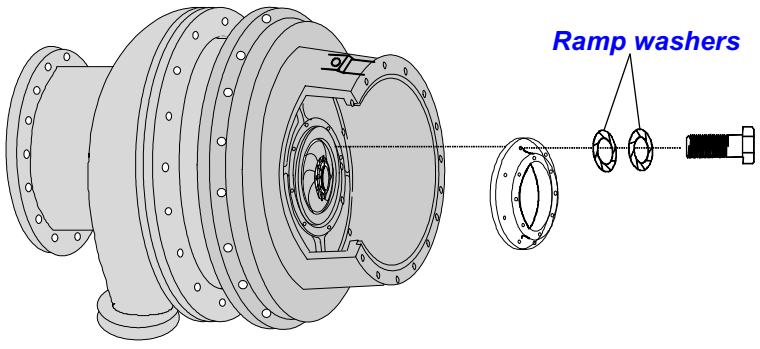
(b) Use the original bolts and new locking tab washers.

(c) Using feeler gauges, center the seal around the nose of the impeller. The proper clearance can be found in Table 5.

(d) With the seal set properly, tighten the bolts to 20-27 lb-ft. Recheck the seal clearance.

(e) Rotate the shaft to ensure it rotates freely.

Figure 23



18 1st Stage Vane Assembly Installation.

(a) Thoroughly clean the vane assembly and check to ensure that the vanes move freely. Oil the vane bearings before installing.

(b) Use the special lifting tool described in the disassembly section to lift the vane assembly. Once the vanes are positioned in the housing, secure the vane assembly using a piece of L-angle and two bolts with washers. See Figure 24.

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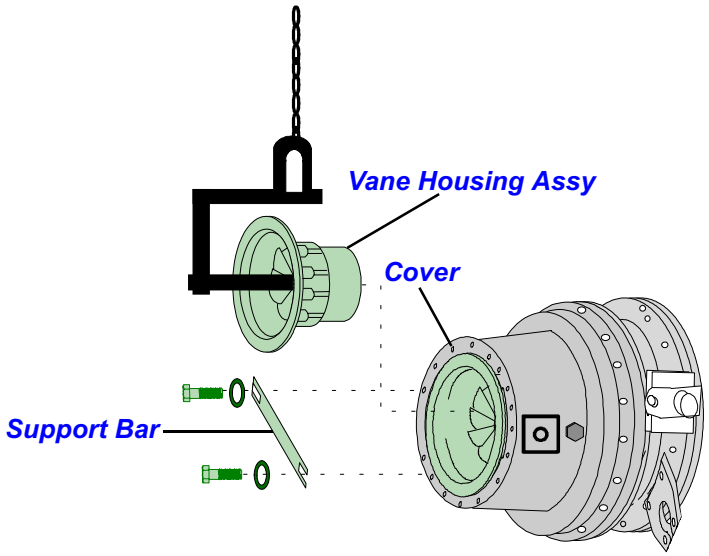
Figure 24



(c) Use three allen head setscrews to secure the inlet vane in the housing. Tighten the setscrews. See Figure 25.

(d) Install the 1st stage vane operator tang assembly using the marks placed on the operator lever and suction cover (with vanes closed) during disassembly to position the tang assembly (see Figure 25). It may be advisable to consider rebuilding of the operator using new o-rings, nylon bushings, and lip seal if applicable to eliminate a leak potential. The 1/8" NPT pipe plug should be removed and compressor oil poured into the area between the two internal o-rings to lubricate them. Replace the plug (see Figure 26).

Figure 25

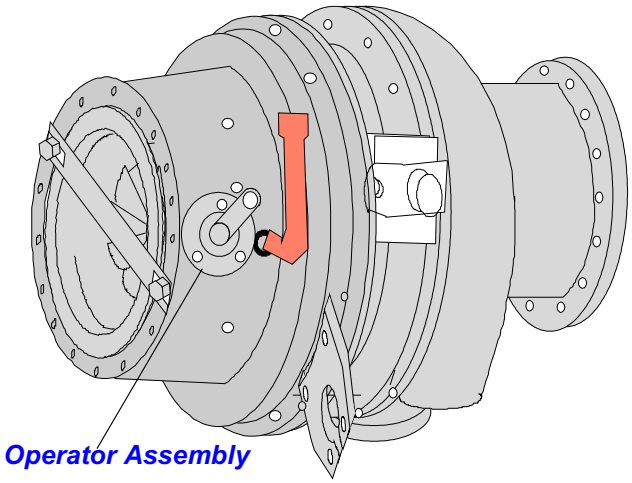
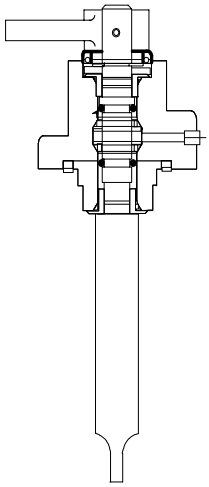


Figure 26



(e) Torque the tang operator mounting bolts to 14 lb-ft.

(f) *(f)*Remove the L-angle and bolts holding the vane assembly in the suction cover.

19 Air Run of Compressor For Balance.

(a) Run the compressor on air with the suction elbow off.

(b) Measure the vibration levels as indicated in *CVHE-SB-18* (latest revision) and, when required, trim balance the compressor to ensure proper balance.

20 Suction Elbow Installation.

(a) Clean the sealing surfaces on the suction elbow, evaporator, and suction cover flanges. The suction elbow must be properly insulated to prevent moisture from condensing. Insulation that was improperly applied or damaged may allow moisture to collect between the flanges and in the bolt holes. It may be necessary to use a bottoming tap to clean up the bolt holes before installing the elbow.

(b) Apply Loctite 515 and o-ring (when applicable) per recommended procedures. The lower flange at the evaporator requires Loctite. The upper suction elbow connection at the compressor suction cover should be installed with *no* sealant on the o-ring and a back-up Gore-Tex tape installed between the o-ring groove and the inner suction connection opening in the elbow. After installing the Gore-Tex tape, apply a small amount of petroleum jelly to the -ring to help hold it in place while installing the suction elbow. See *General Service Bulletin CTV-SB-66* (latest revision).

(c) Using a sling lift the suction elbow into position. Install bolts by hand making sure the flanges at the suction cover are square with the cover. ***NOTE:*** *All bolts should be coated with an anti-seize compound to help prevent rust.* Snug up the bolts slightly.

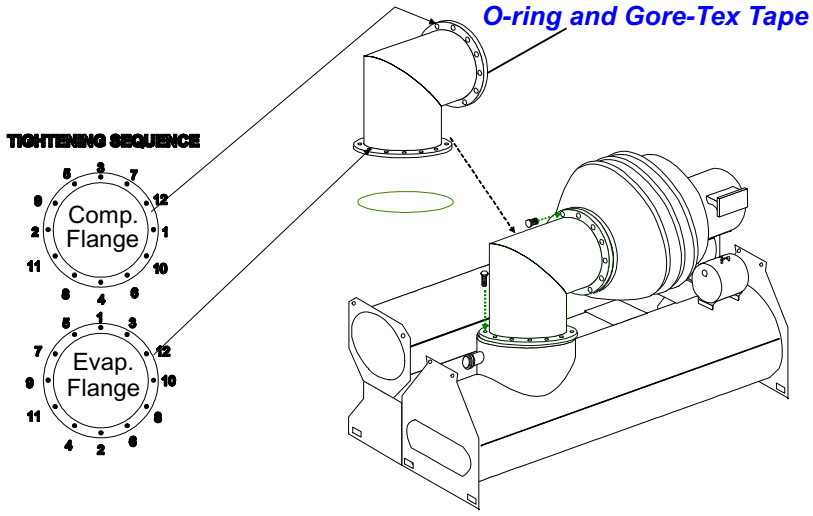
(d) Torque the bolts in the elbow to 120-165 lb-ft following the pattern shown in Figure 27. Ensure the elbow flange pulls up square to the suction cover and does not place a strain on the cover.

⚠ CAUTION

Compressor Damage!

Verify proper elbow flange fit. Failure to maintain proper suction elbow fit up can cause vibration problems or seal-to-impeller interference and possible damage to the impellers and compressor.

Figure 27



(e) The compressor should be run on air with the suction elbow installed. Refer to *General Service Bulletin CVHE-SB-18* (latest revision).

(f) See Step 23 when the unit-mounted starter is used.

21 Economizer Installation.

(a) Clean the flanges on the economizer, evaporator, and the condenser outlet pipe. The bolts holes on the evaporator flange may need to be cleaned up using a bottoming tap to remove rust. Some of the early vintage CVHF units may have used a four bolt flange at the evaporator for the larger size units. This was changed on later designs to eight bolts to ensure a better seal. It may be advisable to drill and tap the four additional holes in the evaporator flanges of early-production chillers to prevent leaks. The replacement gasket will have the four additional holes.

(b) Using a sling on either end of the economizer, move the economizer into position. See Figure 28.

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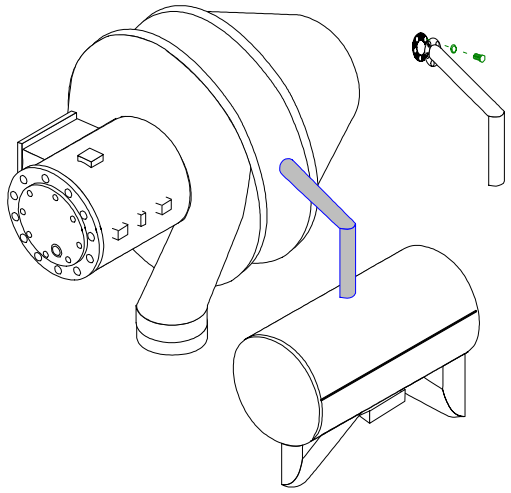
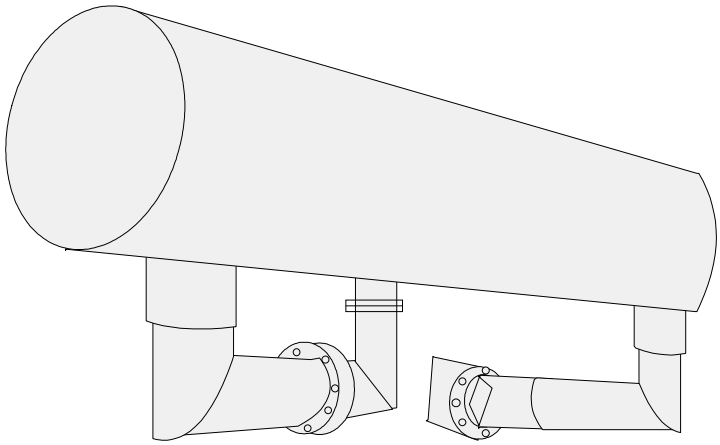
Figure 28



(c) Coat the threads of the bolts for the evaporator flange with an anti-seize compound.

(d) Evenly tighten the bolts to 14 -16 lb-ft. See Figure 29. Do not overtighten or cause the gasket to extrude from between the flanges.

Figure 29



22 Inlet Vane Linkage Installation.

(a) Attach the linkage assembly brackets to the compressor casings. The outline of the mounting brackets should have been scribed on the casings to align the brackets in their original position.

IMPORTANT! Maintaining the proper vane schedule between stages is important. Mis-adjustment of the vanes can cause gas flow turbulence at certain compressor load points resulting in noise and vibration. This problem is usually an indication that the final stage vane assembly has lagged behind the 1st stage vane position.

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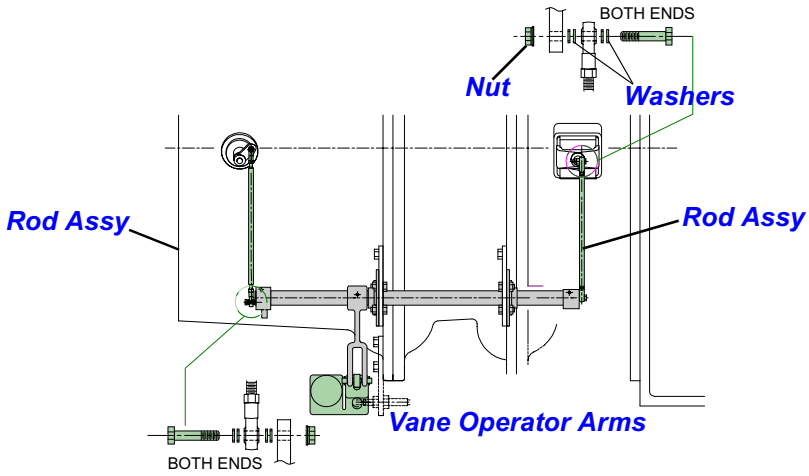
Adjustment of the vane assembly brackets on the compressor casings or length of linkage rods may resolve this condition.

(b) Reconnect the drive rods to the vane operator arms. See Figure 30.

Figure 30



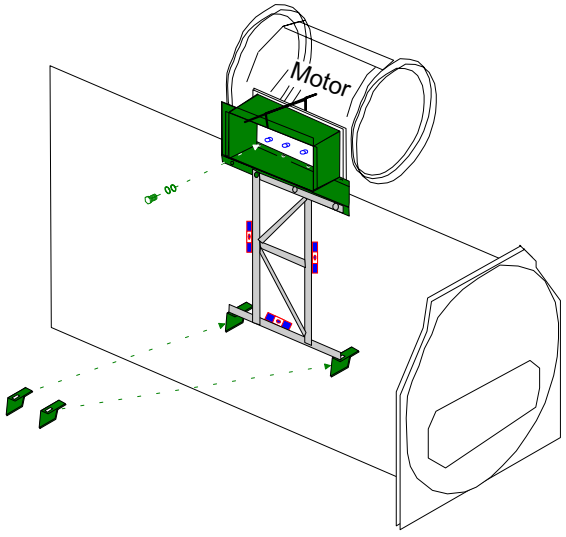
(c) Open and close the vanes to ensure they operate freely.

23 Unit Mounted Starter Installation.

(a) Clean off the flange on the motor housing and transition piece between the starter and motor housing.

(b) Use a new gasket between the transition piece that bolts to the motor terminal board casting flange. See Figure 31.

Figure 31



(c) Lift the unit mounted starter into position using the eye bolts in top of starter.

(d) Bolt the starter to the motor housing flange and the lower evaporator mounting brackets.

(e) Re-attach the motor leads to the motor terminal studs. The leads and motor studs should have been marked during disassembly. Torque clamp connectors to 27 lb-ft.

24 Motor Cooling Lines.

(a) Clean the motor cooling line flanges and motor housing.

(b) Install the motor cooling orifice between the flange and motor housing with a gasket on either side of the orifice. The motor cooling orifice is a flat piece of steel with a stamped hole in the center of a specific diameter matching the motor size and horsepower.

(c) Install the drain lines using new gaskets.

(d) Tighten the bolts.

25 Oil Supply Line Orifice.

(a) The oil supply line for the ball bearing end has an orifice at the motor housing.

The orifice is threaded into the motor end bell. The orifice limits the amount of oil that is supplied to the ball bearing. Installing the oil supply line without the proper orifice may lead to excessive oil flow through the bearing cavity and possible oil loss.

Table 2
CVHF/CDHF Compressor/Component Weights

Unit Type	Unit/Comp Size	Economizer (std, less free cooling)	Suction Elbow	1st Stage Inlet Vane	1st Stage Suction Cover	Impellers All Stages	2nd Stage Alum Vane Plate	2nd Stage Casing	2nd Stage Inlet Vanes and Plate	Steel Volute Diffuser Plate	Discharge Volute	Complete Compressor Including Motor
CVHF	350-485	700 lb. (318 kg.)	494 lb. (224 kg.)	295 lb. (134 kg.)	1400 lb. (635 kg.)	64 lb. (29 kg.)	190 lb. (86 kg.)	1400 lb. (635 kg.)	82 lb. (37 kg.)	289 lb (131 kg.)	1336 lb. (606 kg.)	7610 lb. (3452 kg.)
CVHF	555-640	700 lb. (318 kg.)	494 lb. (224 kg.)	311 lb. (141 kg.)	1740 lb. (789 kg.)	64 lb. (29 kg.)	190 lb. (86 kg.)	1840 lb. (835 kg.)	88 lb. (40 kg.)	356 lb. (161 kg.)	1418 lb. (643 kg.)	8230 lb. (3733 kg.)
CVHF	650-910	836 lb. (379 kg.)	688 lb. (312 kg.)	408 lb. (185 kg.)	1690 lb. (767 kg.)	70 lb. (32 kg.)	190 lb. (86 kg.)	1990 lb. (903 kg.)	88 lb. (40 kg.)	309 lb. (140 kg.)	1430 lb. (649 kg.)	9200 lb. (4173 kg.)
CVHF	1060-1280	836 lb. (379 kg.)	688 lb. (312 kg.)	425 lb. (193 kg.)	1718 lb. (779 kg.)	70 lb. (32 kg.)	190 lb. (86 kg.)	2010 lb. (912 kg.)	94 lb. (43 kg.)	309 lb. (140 kg.)	1820 lb. (826 kg.)	9800 lb. (4445 kg.)
CVHF (ext cap)	1470-1720	836 lb. (379 kg.)	1000 lb. (454 kg.)	750 lb. (340 kg.)	2133 lb. (968 kg.)	100 lb. (45 kg.)	290 lb. (132 kg.)	2210 lb. (1002 kg.)	300 lb. (136 kg.)	712 lb. (323 kg.)	2250 lb. (1021 kg.)	13120 lb. (5951 kg.)
CDHF	1500	836 lb. (379 kg.)	688 lb. (312 kg.)	See Compressor Size CVHF 650-910								
CDHF	2000	836 lbs (379 kg.)	688 lb. (312 kg.)	See Compressor Size CVHF 650-910								
CDHF	2100	836 lbs (379 kg.)	688 lb. (312 kg.)	See Compressor Size CVHF 1060-1280								
CDHF	2500	836 lbs (379 kg.)	688 lb. (312 kg.)	See Compressor Size CVHF 1060-1280								

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Table 3
Bolt Torques (Metal to Metal Flanges) Grade 5 Bolt

Size	Thread TPI/Class	Torque (lb.-ft.)*	
		Minimum	Maximum
¼"	UNC 20	5	7
5/16"	UNC 18	11	15
3/8"	UNC 16	20	27
½"	UNC 13	55	75
5/8"	UNC 11	120.	165
3/4"	UNC 10	200	280
1"	UNC 8	400	550

Table 4
Centravac Motor Weights

Unit Type	Unit/ Compressor Size (60Hz)	Low Voltage (208-600 Volts)	High Voltage (2300-6600 Volts)
CVHF	350-485	2637 lb. (1196 kg.)	2806 lb. (1273 kg.)
CVHF	555-640	2833 lb. (1285 kg.)	2936 lb. (1332 kg.)
CVHF	650-910	3887 lb. (1763 kg.)	3923 lb. (1779 kg.)
CVHF	1060-1280	4439 lb. (2013 kg.)	4713 lb. (2138 kg.)
CDHF	**1500**	**3887 lb. (1763 kg.)**	**3923 lb. (1779 kg.)**
CDHF	2000	3887 lb. (1763 kg.)	3923 lb. (1779 kg.)
CDHF	2100	4439 lb. (2013 kg.)	4713 lb. (2138 kg.)
CDHF	2500	4439 lb. (2013 kg.)	4713 lb. (2138 kg.)

Note: Weights shown are for the largest motor available in the compressor size.

Table 5
CVHF/CDHF Impeller Clearances

Unit Model and Size	1st and 2nd Stage Impeller Nose Seal
CVHF and CDHF (all)	0.0100"-0.0180"

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Compressor/Motor Record Sheet

Job Name:	*Disassembly:*	*CVHE:*
Technician:	*Assembly:*	*CVHF:*
Date:	*City:*	*CVHG:*
Unit Model:	*Serial #:*	

(in.)	*1st Stage Impeller Seal Clearance*
(in.)	*1st Stage Impeller Nose Runout*
(in.)	*1st Stage Impeller OD. to Diffuser Clearance*
(in.)	*Shaft Runout (TIR)*
(in.)	*1st Stage Spacer Seal Clearance*
(in.)	*2nd Stage Impeller Seal Clearance*
(in.)	*2nd Stage Impeller Nose Runout*
(in.)	*2nd Stage Impeller OD. To Diffuser Clearance*
(in.)	*2nd Stage Spacer Seal Clearance*
(in.) 12:00	*Oil Seal Clearance (Record 4 Places)*
(in.) 6:00	
(in.) 3:00	
(in.) 9:00	

Air-Run (Elbow Off)	*(in./sec. H)*	*(in./sec. V)*	*(in./sec. A)*
Air-Run (Elbow On)	*(in./sec. H)*	*(in./sec. V)*	*(in./sec. A)*
Freon-Run	*(in./sec. H)*	*(in./sec. V)*	*(in./sec. A)*

Comments:

Figure 32
Cross sectional cut-away view of a 2-stage CVHF compressor/motor assembly