

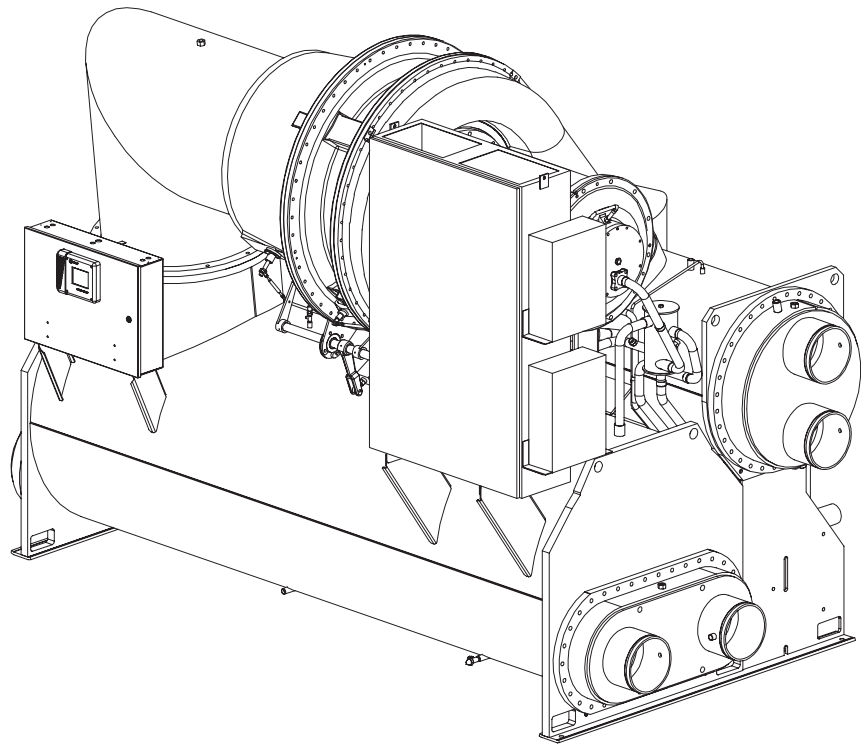


TRANE®

Service Guide

Water Cooled CenTraVac

CVHF Extended Capacity Compressor Assembly





Warnings and Cautions

Warnings and Cautions

Notice that warnings and cautions appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in personal injury or death, while cautions are designed to alert personnel to conditions that could result in equipment damage.

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

NOTICE: Warnings and Cautions appear at appropriate sections throughout this literature. Read these carefully.

⚠ WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION: Indicates a situation that may result in equipment or property-damage only accidents.



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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 1470 & 1720 Ton

This section describes re-assembly (including discharge volute, motor, unit mounted starter, suction cover and economizer installation) procedures for the model CVHF

CenTraVac with 1470 or 1720 nominal ton compressor assemblies. The same information applies to the same compressors if applied with CDHF duplex units. The procedures covered in this section may be used for the CVHF and CDHF compressor sizes 1470 and 1720 nominal tons. For information on the CVHE and CVHG compressors, see CenTraVac service literature sections CTVH-GCO-01 & 02.

See CTVH-GCO-03 & 04 for the CVHF compressor sizes 350 through 1280 ton.

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

Important: Before beginning re-assembly of 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 of 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.

Note: *The lifting capacity of a sling is reduced when the load angle is less than 90°.*

See Table 1 for load actor values. For angles less than 90°, multiply the load actor by the nominal sling lifting capacity to determine the allowed lift weight.

Table 1. Load Angle de-rate for Slings

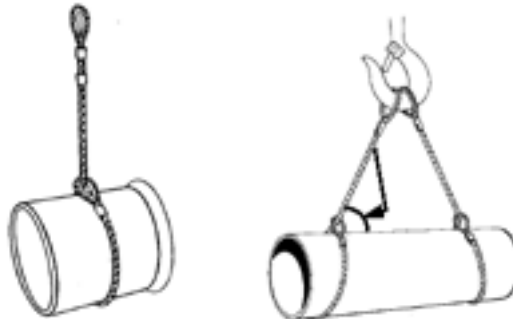
Load Angle (°)	Factor	Load Angle (°)	Factor
90	1.000	50	0.7660
85	0.9962	45	0.7071
80	0.9848	40	0.6428
75	0.9659	35	0.5736
70	0.9397	30	0.5000
65	0.9063	25	0.4226
60	0.8660	20	0.3420
55	0.8192	15	0.2589

Before proceeding with compressor re-assembly review the procedures in General Literature

Section CTVH-GCO-05EN containing information and details on CVHF extended capacity compressor disassembly.

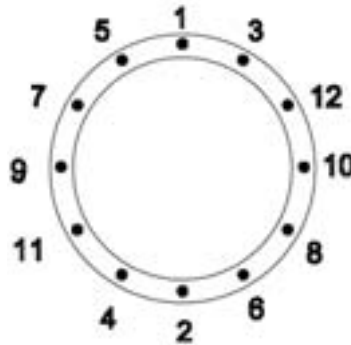
Unless otherwise specified, the bolt torques required on all flange joints with o-rings or joints where only Loctite 515 is used, can be found in Table 3 in the back of this section. The bolt torques listed in Table 3 are for grade 5 bolts. Use only grade 5 bolts or better. Tighten bolts to final torque in incremental steps. Unless otherwise specified follow a crossing pattern when tightening bolts.

Figure 1. Typical Choke Sling Cable Arrangement



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.

Figure 2. Bolt Tightening Sequence



⚠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

Discharge Volute Installation

- 1 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.

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

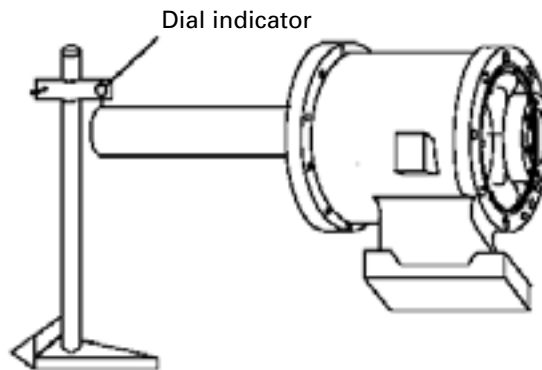
Important: See Service Bulletin CTV-SB-66 (latest revision) or procedures for using Loctite 515. Always check the date on the Loctite tube to ensure the sealant use time has not expired.

- 3 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.
- 4 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.

Motor Installation

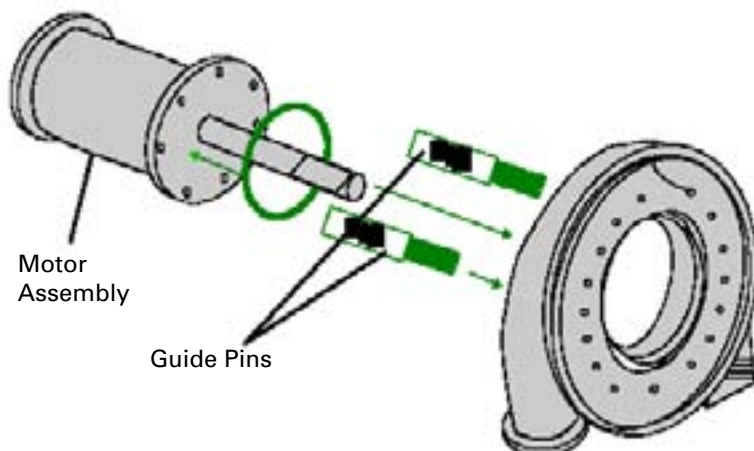
- 1 Before installing the motor, check shaft run out (TIR) as shown in Figure 3. Using a dial indicator turn the shaft and measure the runout at the end of the shaft. The maximum allowable runout is .0015" TIR. Make sure the end of the shaft is wrapped with tape for protection during assembly.
- 3 Apply Loctite 515 and o-ring (when applicable) around the motor (shaft end) end bell.
- 4 Install two guide pins in the volute or motor flange (large frame) to help guide the motor into place. See Figure 4.

Figure 3. Shaft Runout (TIR)



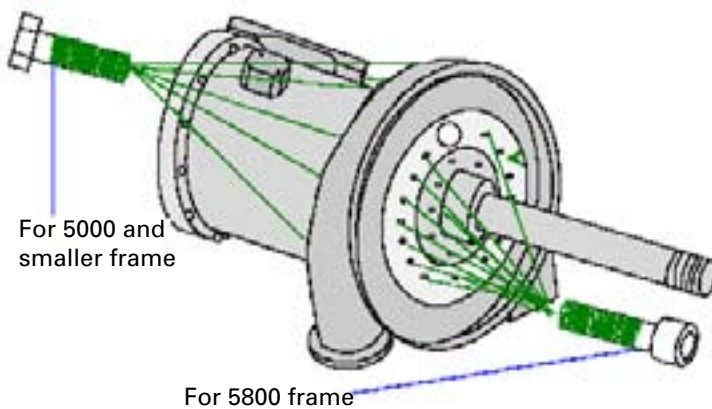
- 2 Place two slings or cables in the choke configuration around the motor. Place them at each end of the motor near the flanges and lift the motor slightly to get the proper balance point. See Table 4 for maximum motor weights.

Figure 4.



- 5 Lift the motor in place and hand tighten the bolts holding the motor to the volute. Snug the bolts and remove the guide pins. When the motor is properly inserted the motor terminal board will be vertical. Note that on larger 5800 and 5800L frame motors the bolts (allen head screws) 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. See Figure 5.

Figure 5.

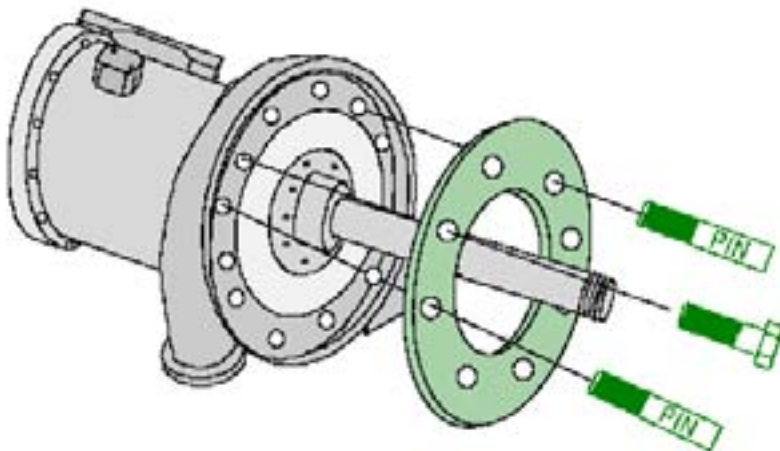


Volute Diffuser Plate Installation

- 1 Install two pins in the volute to guide the diffuser in place.
- 2 Use the proper lifting clevis or place a sling or cable in the choke configuration through the center of the diffuser. Be aware of the high weight of the diffuser of an extended capacity compressor.

- 3 Lift the diffuser and slide it over the guide pins. Install the 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.

Figure 6.



Oil Feed Tube Installation.

1 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.

- 2 Wrap a wet rag around both ends of the line to prevent overheating the threaded joints.
- 3 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.

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

Figure 7.

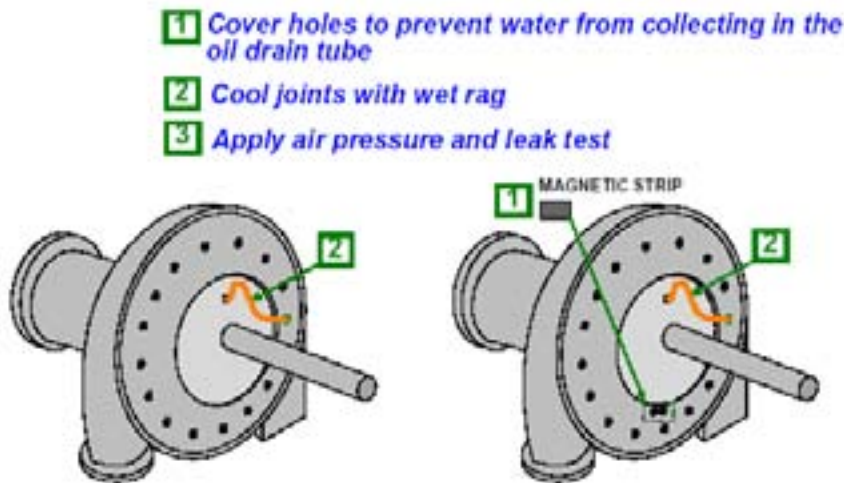
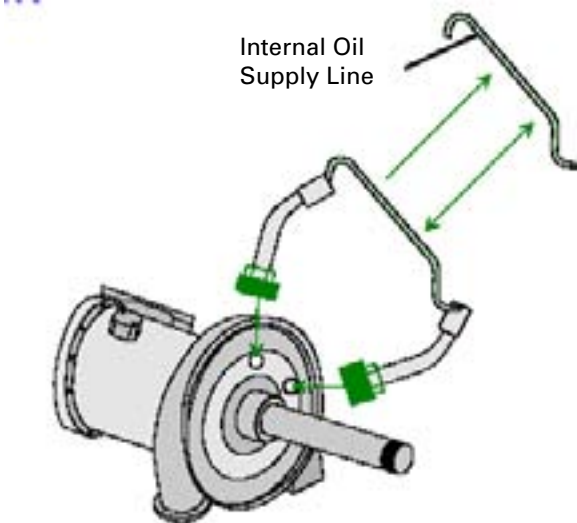
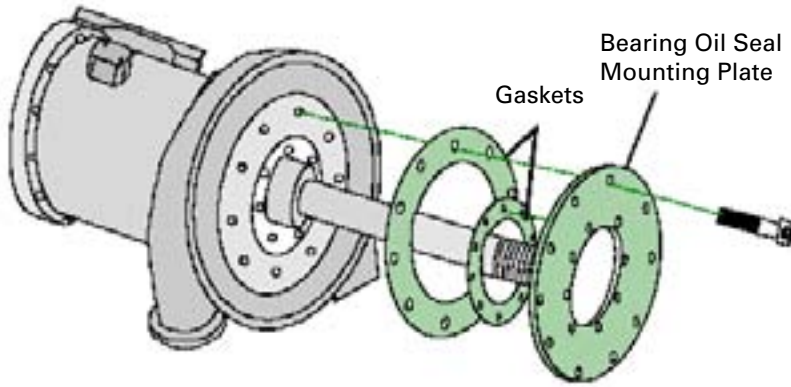


Figure 8.



Bearing Oil Seal Mounting Plate Installation

- 1 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.
- 2 Lightly coat both the inner and outer gaskets with a small amount of petroleum jelly to help hold them in place.
- 3 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.
- 4 Install the outer mounting bolts. Remove the outer guide pins and torque the bolts to 20-27 lb.-ft.

Figure 9.


Bearing Oil Seal Installation

- 1 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.

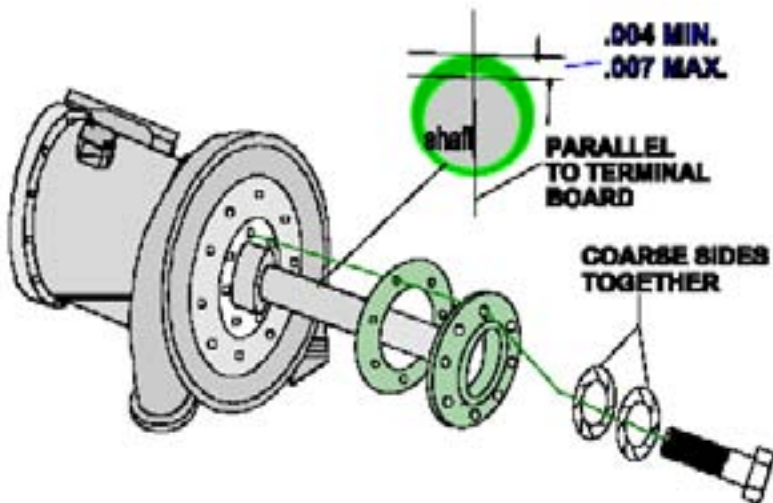
- 2 Slide the bearing oil seal over the guide pins.

Important: The oil seal may have 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.

- 3 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.
- 4 With all the clearance at the top of the seal, tighten the bolts to 20-27 lb.-ft. Recheck the clearance while hand rotating the shaft to ensure it turns freely. See Figure 10.
- 5 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.

Figure 10.


2nd Stage Impeller Installation

- 1 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.*

- 2 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 Trane.
- 3 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.
- 4 Coat the impeller bore and shaft with compressor oil. Install the key in the shaft.
- 5 The impellers on the extended capacity compressor are heavier than the impellers used on the smaller compressors. Great care must be taken when lifting them onto the compressor shaft. It is recommended that a soft nylon

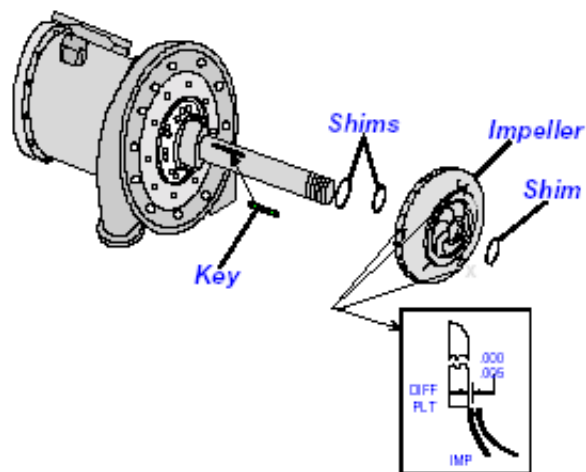
riggers sling be passed through the impeller and secured in a choke configuration for lifting the impeller. Do not use chain or cable or damage to the impeller may occur.

- 6 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.

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.

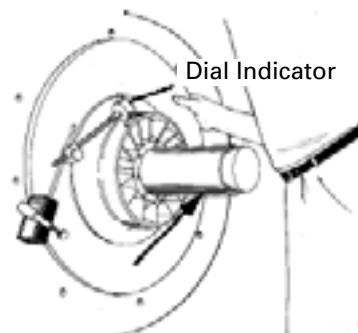
- 7 'When required, remove the impeller and add shims to obtain the proper alignment. Slide the impeller on the shaft and recheck the alignment.
- 8 Check the radial clearance between the impeller O.D. and the vane plate I.D. The minimum clearance around the entire circumference is .0220" minimum. In 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.

Figure 11.



- 9 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 the extended capacity 2nd stage impeller is .0040".

Figure 12.



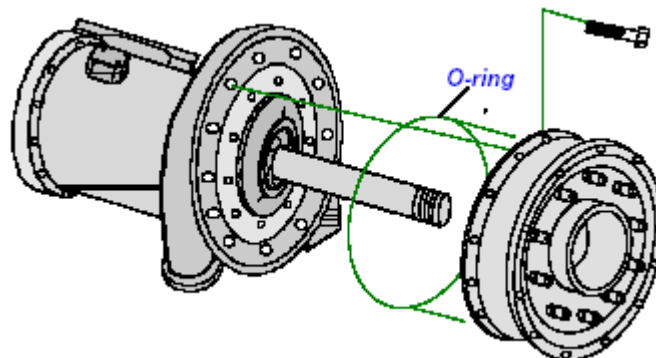
Note: Measure the motor shaft runout (TIR) here or on an extension, as applicable.

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

2nd Stage Suction Casing Installation

- 1 Clean the casing and discharge volute.
- 2 Attach the correct lifting fixture to the suction casing and find the proper balance point.

Figure 13.



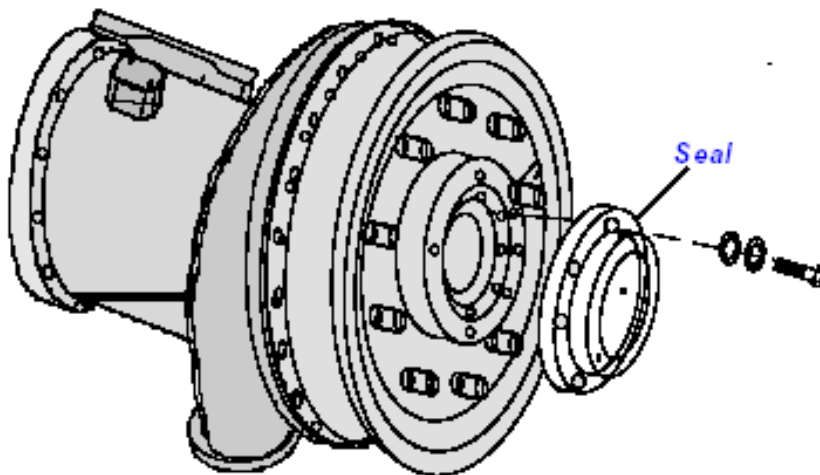
- 3 Apply Loctite 515 and an o-ring (when applicable) per recommended procedures.
- 4 Install a minimum of six guide pins to help align the suction cover as shown in Figure 13.
- 5 Using the proper lifting fixture, place the 2nd stage suction casing over the guide pins and slide it snugly into place up against the discharge volute. **For safety, leave the lifting fixture and rigging connected to the casing.**
- 6 Make sure the scribe marks between the volute and the 2nd stage suction casing are lined up, then install 46 of the 5/8"-11 bolts.
- 7 Remove the guide pins and install the remaining bolts. Tighten the bolts to a final torque of 120-165 lb.-ft. using the proper alternating pattern.

Note: Though Loctite does not cure immediately, it can cure quickly. Do not allow excessive time to elapse between the initial Loctite application and the final bolt torque. Though the high number of bolts in this application make it difficult, assemble and torque the flanges as quickly as is possible. Refer to service bulletin CTV-SB-66 (latest revision).

Impeller Nose Seal Installation

- 1 Thoroughly clean the nose seal to remove any debris or loose chips from the labyrinth teeth.
- 2 Use the original bolts and new locking tab washers.
- 3 Using feeler gauges, center the seal around the nose of the impeller. The proper clearance can be found in Table 5.

Figure 14.



- 4 With the seal set properly, tighten the seal retaining bolts to 20-27 lb.-ft. Recheck seal clearance.
- 5 Rotate the shaft to ensure it turns freely.

2nd Stage Inlet Guide Vane Assembly Installation.

In the two-part design of the extended capacity compressor, the inlet guide vane assembly should be installed in the compressor first.

- 1 Install a minimum of two 3/8" -16 x 6 inch guide pins in the compressor casing.
- 2 The proper lifting tool may be utilized.

Note: The extended capacity compressor 2nd stage inlet guide vane assembly is substantially heavier than the vane assemblies used in smaller CVHF compressors. Always use proper and safe rigging practices and do not attempt to manually lift the vane assembly. Refer to Table 2 for the 2nd stage IGV weight.

compressor disassembly should be utilized.

- 4 Ensure that the sector or drive gear assembly on the back side of the vane assembly will correctly align with the port for the vane shaft operator assembly.
- 5 After removing the rigging device, push the vane assembly into position and secure it in place with at least two mounting screws. It is recommended that the screws be coated with a thread locking compound. Remove the guide pins and insert the remaining mounting screws. Torque the mounting screws to 20-27 lb-ft. The screw heads must be flush or below the surface.

Figure 15.



- 3 Carefully hoist the vanes into position and onto the pins. The alignment marks applied during

2nd Stage Vane Operator Assembly Installation

- 1 Ensure the vanes are in a fully closed position.
- 2 Apply Loctite 515 (1/8" bead) to the interstage casing flange and around the bolt holes which the vane operator will mount on.
- 3 Insert the vane operator assembly into the interstage casing, being careful to ensure that the housing and the lever are positioned in the same locations as noted when the vane operator assembly was removed. The gear on the end of the vane shaft assembly must mesh with the rack on the driver ring. Loosely fasten the vane operator shaft assembly to the casing, then push the assembly in firm to ensure the gear is seated against the rack. Torque the vane operator assembly mounting bolts to 20 to 27 lb. ft.
- 4 Move the vane operator lever back and forth to ensure free and full motion. Return the vanes to the closed position.

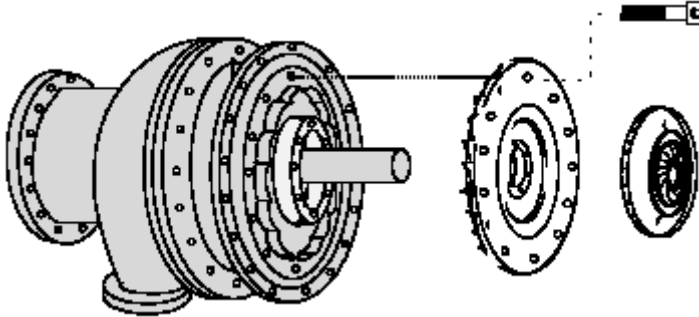
Install 2nd Stage Inlet Guide Vane Shroud

- 1 Install 2 alignment pins into the compressor casing and carefully hoist the outer shroud into position and onto the pins.
- 2 Ensure the shroud is correctly seated into the counter-bore of the compressor casing and secure the shroud in place with two mounting screws.
- 3 Remove the alignment pins and install the remaining screws. It is recommended that new screws be used. It is recommended that screws be coated with a thread locking compound. Torque the screws to 5-7 lb.-ft.

- 4 The screw heads must be flush or below the surface.

2nd Stage Aluminum Vane Plate Installation

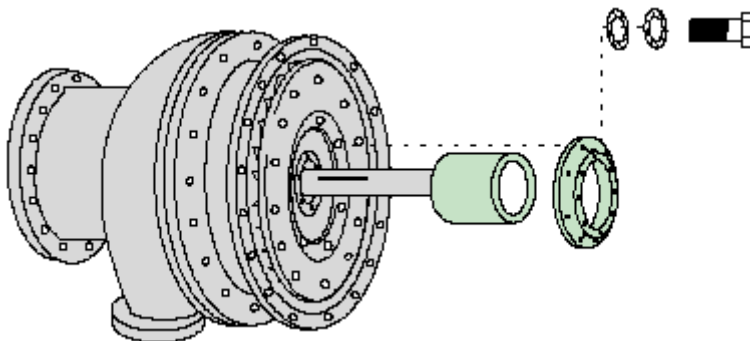
- 1 Before installing the vane plate, make sure the shim in front of the impeller has been installed.
- 2 Clean the aluminum plate.
- 3 Insert a minimum of four guide pins to help align and hold the vane plate during installation. The weight of the CVHF extended capacity 2nd stage vane plate is high, so care is needed. Refer to Table 2 for weight of the 2nd stage vane plate.
- 4 Using the proper lifting clevis, tool, or strap, lift the plate into position over the guide pins and slide it on as far as possible towards the casing. Remove the clevis and slide the vane plate fully into position.
- 5 Install four retaining screws to secure the vane plate to the casing. Remove the four guide pins and install the remaining retaining screws. 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 16.
- 6 Tighten the bolts to 20-27 lb.-ft.

Figure 16.


Interstage Spacer Installation

- 1 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 17. 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.

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.

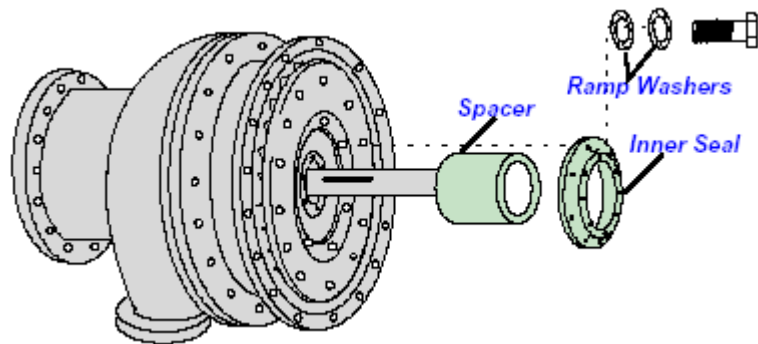
Figure 17.


- 2 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

Interstage Spacer Seal installation

- 1 Install the seal and bolts with a ramp washer over the interstage spacer.
- 2 Center the seal using feeler gauges. The allowable tolerance can be found in Table 5.
- 3 Tighten the bolts to 20-27 lb.-ft. See Figure 18.

Figure 18.



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 Trane.

1st Stage Impeller and Impeller Locknut Installation

- 1 Clean the impeller shims. Slide the impeller shims with the thicker steel shim against the shaft shoulder.

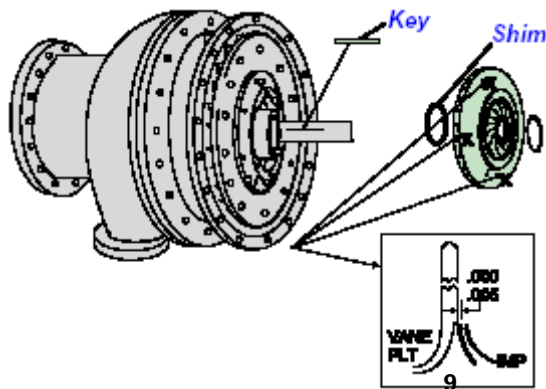
Note: *The chamfer on the thicker steel shim should be facing the shaft shoulder. Impeller alignment should have been checked during disassembly and any adjustments to the shim(s) thickness necessary to get proper impeller alignment can be made at this time. If the impeller or motor shaft has been replaced,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

- 2 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

- 3 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.
- 4 Coat the impeller bore and shaft with compressor oil. Install the key in the shaft.
- 5 The impellers on the extended capacity compressor are heavier than the impellers used on the smaller compressors. Great care must be taken when lifting them onto the compressor shaft. It is recommended that a soft nylon riggers sling be passed through the impeller and secured in a choke configuration for lifting the impeller. Do not use chain or cable or damage to the impeller may occur.

- 6 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 19.

Figure 19.



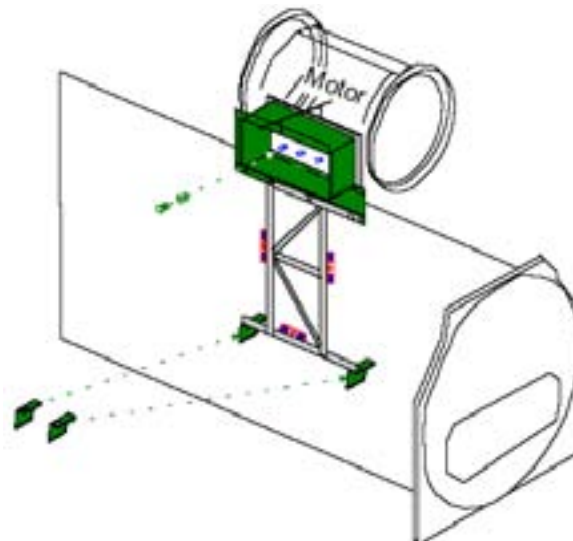
If the impeller does not slide easily on the shaft, it may be necessary to heat the impeller slightly to allow it to slide on the shaft. Before heating the impeller, inspect the impeller bore for debris or a dent (high spot) that could be causing interference. When heating the impeller, use a large (Rosebud) 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 (I.D.) to shaft diameter (O.D.) total clearance should be .0000 -.0015" maximum.

- 7 When required, remove the impeller and add shims to obtain the proper alignment. Slide the impeller on the shaft and recheck the alignment.
- 8 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 vane plate first remove the impeller, then loosen the vane plate 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 vane plate in the desired direction. Then retighten the vane plate bolts to 20-27 lb.-ft. Re-install the impeller and recheck the clearances.

Figure 20.



- 10 Before installing the conical (spring) washer and lockwasher onto the shaft, thread the locknut on by hand to ensure there are no burrs or damaged threads. The locknut thread fit should be snug, but the locknut should still be able to turn without the use of a spanner wrench.
- 11 Remove the locknut from the shaft and install the spring washer. Make sure the spring washer is installed with its concave side towards the impeller, as shown in Figure 20. Install the lockwasher onto the shaft. It is recommended that a new lockwasher be used for assembly.
- 12 Install the impeller locknut onto the shaft and tighten it by hand until all clearance has been taken up in the assembly.
- 13 Rotate the shaft so that the 1st stage impeller key is at the 12 o'clock position.
- 14 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 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.

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.*

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.*

- 15 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

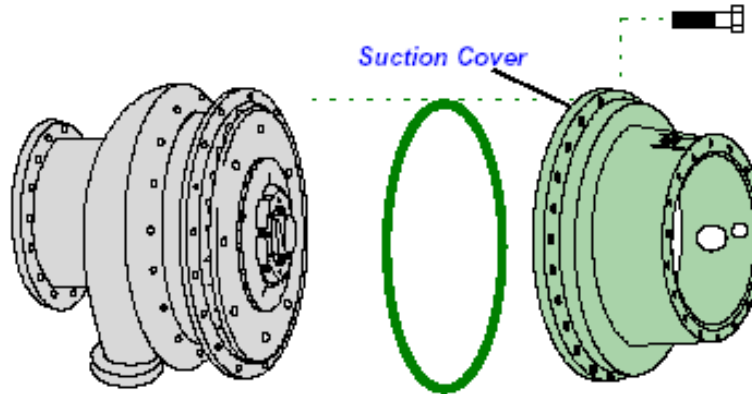
Compressor Damage!

Once a locking tab has been bent over on a lockwasher it may become weak and break off if 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.

- 16 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 extended capacity 1st stage impellers is .0050"
- 17 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".

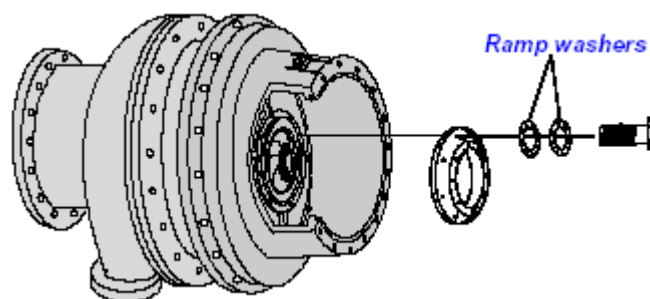
1st Stage Suction Cover Installation.

- 1 Clean the suction cover and mating surfaces.
- 2 Attach the correct lifting fixture to the suction cover and find the proper balance point.
- 3 Apply Loctite 515 and an o-ring (when applicable) per recommended procedures.
- 4 Install a minimum of six guide pins to help align the suction cover as shown in Figure 21.
- 5 Using the proper lifting fixture, place the 1st stage suction cover over the guide pins and slide it as close as possible to the 2nd stage casing. For safety, leave the lifting fixture and rigging connected to the casing.
- 6 Make sure the scribe marks between the suction cover and the 2nd stage suction casing are lined up, then install 46 of the 5/8"-11 bolts.
- 7 Remove the guide pins and install the remaining bolts. Remove the lifting fixture. Tighten the suction cover mounting bolts to a final torque of 120-165 lb.-ft.

Figure 21.

Figure 22.


Impeller Nose Seal Installation

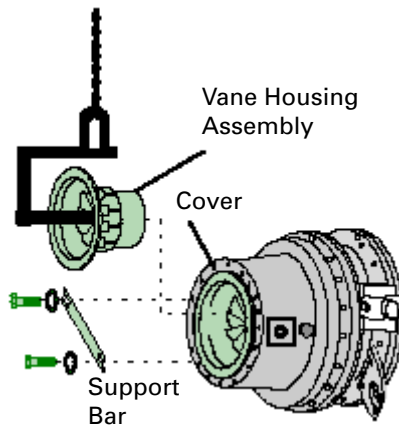
- 1 Thoroughly clean the nose seal to remove any debris or loose chips from the labyrinth teeth.
- 2 Use the original bolts and new locking tab washers. Figure 23.
- 3 Using feeler gauges, center the seal around the nose of the impeller. The proper clearance can be found in Table 5.
- 4 With the seal set properly, tighten the bolts to 20-27 lb.-ft. Recheck the seal clearance.
- 5 Rotate the shaft to ensure it rotates freely.

Figure 23.


1st Stage Vane Assembly Installation

- 1 Thoroughly clean the vane assembly and check to ensure that the vanes move freely. Oil the vane bearings before installing.
- 2 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.
- 3 Use three allen head setscrews to secure the inlet vane in the housing. Tighten the setscrews.

Figure 24.



Install the 1st stage vane operator tang assembly

- 1 Apply Loctite 515 (1/8" bead) to the suction cover flange and around the bolt holes which the vane operator will mount on.
- 2 Insert the vane operator assembly into the suction cover, being careful to ensure that the housing and the lever are positioned in the same locations noted when the vane operator assembly was removed. The tang on the end of the operator shaft should correctly engage the slot on the one lever of the vane assembly. The lubrication ports on the vane operator assembly should be located at the top and bottom. Torque the vane operator assembly mounting bolts to 20 to 27 ft-lbs.
- 3 Move the vane operator lever back and forth to ensure free motion. Return the vanes to the closed position.

Install the 2nd and 1st stage vane actuators

- 1 Install the vane drive supports in their original marked locations.
- 2 Slide the correct washers and the actuator onto the lever stud and secure with a cotter pin. Do the same on the stud on the vane drive support.
- 3 Check the vanes to ensure they have remained fully closed.

If the vane actuator does not fit correctly onto the vane operator lever or if the vanes have failed to remain closed, it will be necessary to reset the lever position. Use the following procedure.

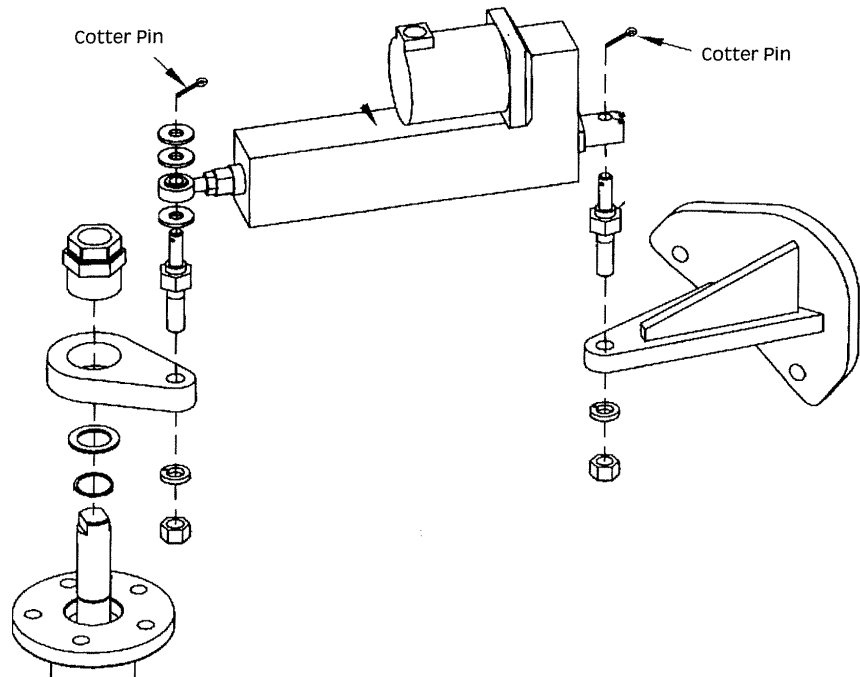
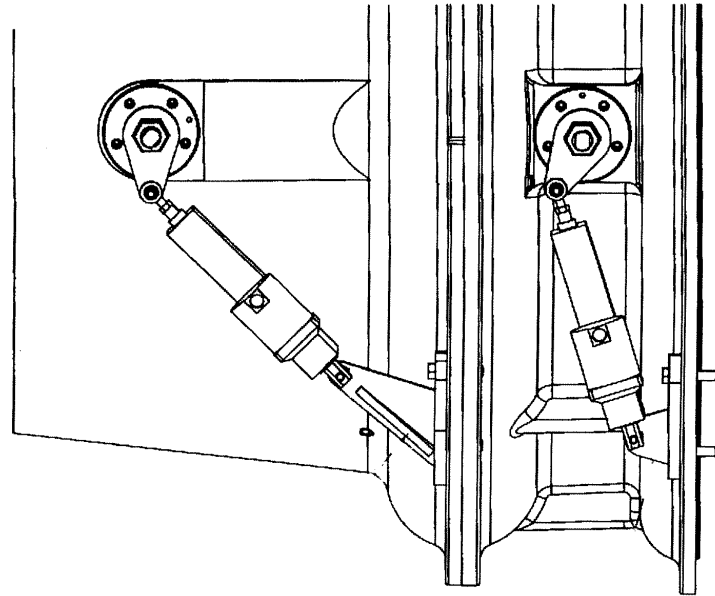
- 1 Use a large open end wrench to hold the vane operator shaft stationary, then use a 1 3/4" wrench to loosen the nut of the keyless bushing.

Note: Loosening the keyless bushing will often result in damage to the bushing, as the break-away torque needed to loosen the Loctite can be very high. It is recommended that the keyless bushing be replaced rather than be re-used.

- 2 Apply Loctite 242 to the threads of the keyless bushing nut.
- 3 With the bushing installed loosely, correctly re-position the vanes to a closed position. The lever arm should also be connected to the IGV actuator.
- 4 Ensure the IGV actuator motor is driven fully "home" or is closed/retracted.
- 5 Again use the large open end wrench to hold the vane shaft closed and stationary, make sure the inlet guide vanes remain in the closed position during this procedure.

- 6 It is recommended to use a torque wrench with 1 3/4" crows foot adapter to tighten the keyless bushing nut. Tighten to 166 Ft.-Lbs. (152 Ft.-Lbs with a typical crows-foot adapter installed on the torque wrench.) Make sure the vanes do not move while tightening the keyless bushing.

Figure 25. Drawing of the actuator assembly



Air Run of Compressor For Balance

- 1 Run the compressor on air with the suction elbow off.
- 2 Measure the vibration levels as indicated in CVHE-SB-18 (latest revision) and, when required, trim balance the compressor to ensure proper balance.

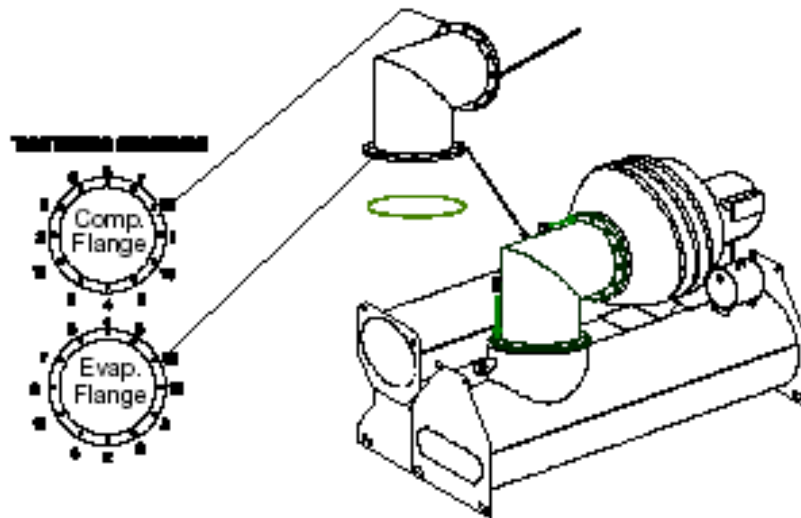
Suction Elbow Installation

- 1 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.
- 2 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 o-ring to help hold it in place while installing the suction elbow. See General Service Bulletin CTV-SB-66 (latest revision).
- 3 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.

- 4 Torque the bolts in the elbow to 120-165 lb.-ft. following a typical crossing pattern as shown in Figure 26. Ensure the elbow flange pulls up square to the suction cover and does not place a strain on the cover.

Figure 26.



CAUTION

Compressor Damage!

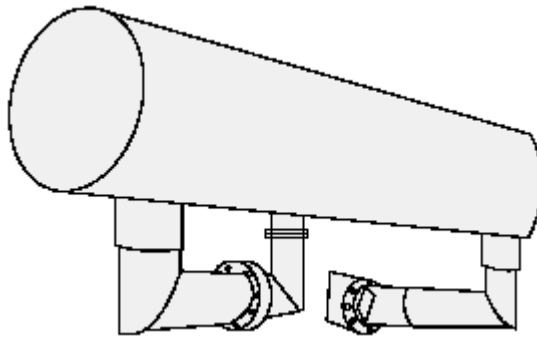
Verify proper elbow flange fit. Failure to maintain proper suction elbow fit up can cause vibration problems or seal- to-impeller interference and possible damage to the impellers and compressor.

- 5 The compressor may be run on air with the suction elbow installed. Refer to General Service Bulletin CVHE-SB-18 (latest revision).
- 6 See Unit Mounted Starter Installation section when the unit-mounted starter is used.

Economizer Installation

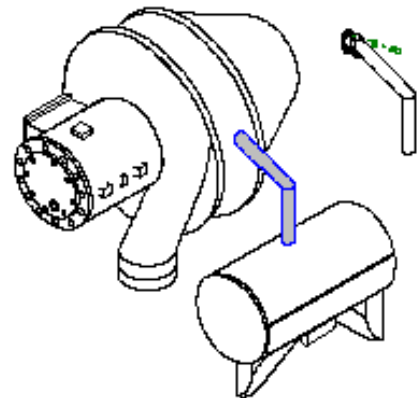
- 1 Clean the flanges on the economizer, evaporator, and the condenser outlet pipe. The bolts holes on the evaporator flange may need to be cleaned up using a bottoming tap to remove rust.

Figure 27.



- 2 Using a sling on either end of the economizer, move the economizer into position. See Figure 27.
- 3 Coat the threads of the bolts for the evaporator flange with an anti-seize compound. Be careful to not over-apply the anti-seize compound, if it gets on the gasket it can prevent a good seal.
- 4 Evenly tighten the bolts to 14 -16 lb.-ft. See Figure 28. Do not overtighten or cause the gasket to extrude from between the flanges.

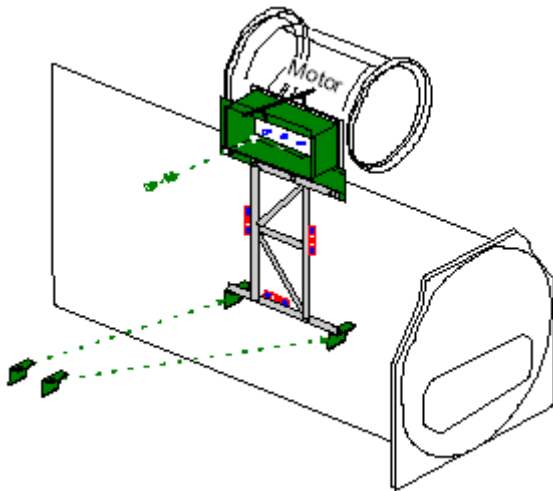
Figure 28.



Unit Mounted Starter Installation

- 1 Clean off the flange on the motor housing and transition piece between the starter and motor housing.
- 2 Use a new gasket between the transition piece that bolts to the motor terminal board casting flange. See Figure 29.
- 3 Lift the unit mounted starter into position using the eye bolts in top of starter.
- 4 Bolt the starter to the motor housing flange and the lower evaporator mounting brackets.
- 5 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.

Figure 29.



Motor Cooling Lines

- 1 Clean the motor cooling line flanges and motor housing.
- 2 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.
- 3 Install the drain lines using new gaskets.
- 4 Tighten the bolts.

Oil Supply Line Orifice

- 1 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.



CVHF Compressor Assembly

Table 2. CVHF/CDHF Extended capacity - compressor/component weights

Unit Type	Nominal Unit 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	1470-		1000	750	2133		290	2210	300	712 lbs.	2250 lbs.	13120 lbs.
CDHF	1720	836 lbs.	lbs.	lbs.	lbs.	100 lbs.	lbs.	lbs.	lbs.	(323 kg.)	(1021 kg.)	(5951 kg.)
(ext cap)	3000-3500	(379 kg)	(454 kg.)	(340 kg.)	(968 kg.)	(45 kg.)	(132 kg.)	(1002 kg.)	(136 kg.)			

Table 3. Bolt Torque (metal to Metal Flanges)

Size	Thread TIP/Class	Torque (lb.-ft.)*	
		Minimum	Maximum
1/4"	UNC 20	5	7
5/16"	UNC 18	11	15
3/8"	UNC 16	20	27
1/2"	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

Compressor Size	Low Voltage (208-600 volts)			Medium Voltage (2300-6600 volts)		
	Rotor/Shaft	Stator/Housing	Total	Rotor Shaft	Stator/Housing	Total
1470/1720	788 lbs. (357 kg.)	3322 lbs. (1507 kg.)	4110 lbs. (1865 kg.)	812 lbs. (369 kg.)	3397 lbs. (1541 kg.)	4209 lbs. (1910 kg.)

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

Table 5. CVHF/CDHF Extended capacity compressor clearances

Unit Model and Size	Shaft Runout Max	Interstage Seal to Spacer (all stages)	1st Stage Impeller Nose Runout Max	2nd Stage Impeller Nose Runout Max	1st Stage Impeller Nose Seal	2nd Stage Impeller Nose Seal	Bearing Oil Seal*
CVHF 1470/1720, CDHF 3000/3500	0.0015"	0.0080" to 0.0140"	0.0050"	0.0040"	0.018" to 0.026"	0.010" to 0.018"	0.0040"-0.0070" Total

*Seal may be lightly touching the bottom of the shaft and with the maximum clearance at the top.



Compressor Motor Record Sheet

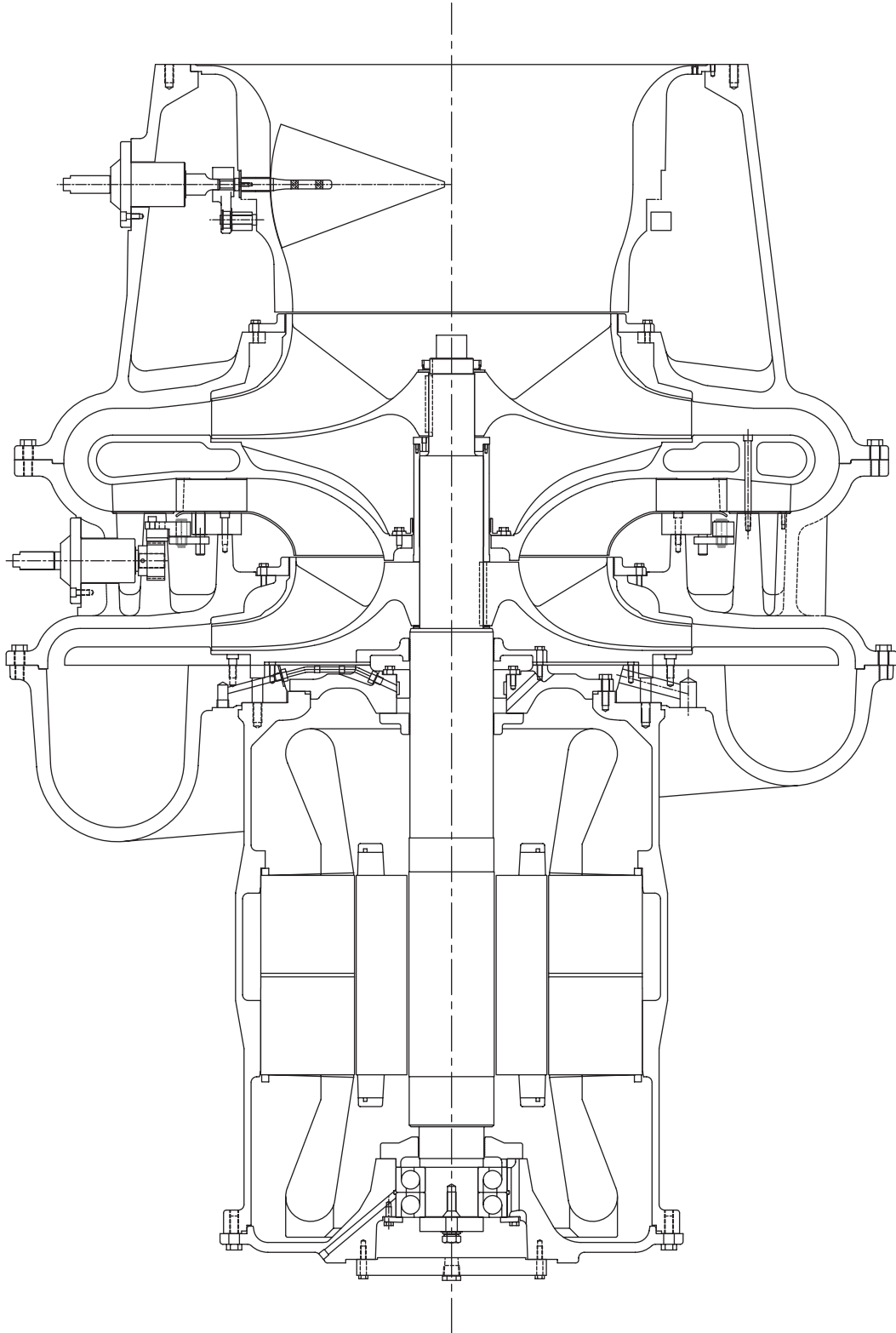
<i>Job Name:</i>	<i>Disassembly:</i>	<i>CVHE:</i>
<i>Technician:</i>	<i>Assembly:</i>	<i>CVHF:</i>
<i>Date:</i>	<i>City:</i>	<i>CVHG:</i>
<i>Unit Model:</i>	<i>Serial #:</i>	

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

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

Comments:

Figure 30. Cross section cut-away of 2-stage CVHF compressor/motor assembly





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