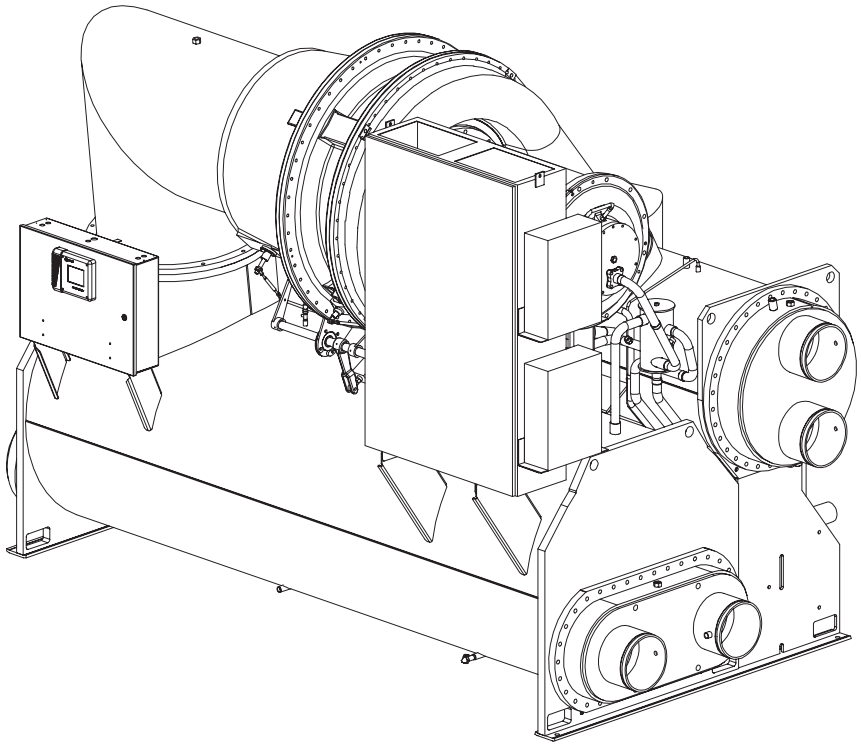
TRANE®

Service
Guide

Water Cooled CenTraVac

CVHF Extended Capacity Compressor Disassembly



2005

CTV-SVG05-EN

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.

Contents

CVHF Compressor Disassembly

Including:

- Economizer Removal
- Suction Elbow Removal
- Compressor Disassembly
- Unit Mounted Starter Removal
- Motor Removal
- Discharge Volute Removal

CVHF and CDHF Unit:

Compressor Sizes 1470 & 1720 Ton

This section describes disassembly (including economizer, suction elbow, unit mounted starter, motor, and discharge volute removal) procedures for the model CVHF 1470 and 1720 ton CenTraVac compressor assemblies.

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

For information on the smaller capacity CVHF compressor sizes 350 through 1280 ton see CenTraVac literature sections CTVH-GCO-03 & 04.

Disassembly.

Proper lifting fixtures are required for handling various components of the CVHF Extended Capacity compressor. Drawings of the tools are available on the LaCrosse Technical Service TraneNet site. Trane assumes no responsibility for the use of materials that do not meet the required specifications, or for improper or faulty manufacturing, assembly or use of these lifting fixtures. Never exceed the maximum safe lifting capacity of the fixture.

Important: *Some of the lifting tools built for the standard CVHF compressor components have a maximum lifting capacity of 1300 lb. The tool maximum weight capacity is stamped on the tool. Some CVHF extended capacity castings exceed this rating and the proper lifting tool must be used.*

⚠ 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 certified for continued use at proper intervals.

Guide Pin Requirements

The disassembly and re-assembly of the CVHF extended capacity compressors will frequently require the use of guide pins to support and locate components. Because of the very high weight of many of the components, it is extremely important that the following be observed:

1. Use multiple guide pins. A minimum of four (4) guide pins per component is required.
2. Guide pins must be of grade 5 or higher.
3. Keep guide pins as short as possible. Guide pins must not exceed 6 inches in length.
4. Always provide an auxiliary means of support for the component being removed or installed. Secure rigging to the component for as much of the process as is possible. Connect safety chains or cables to prevent component drop in the event of a rigging failure.

Recommended guide pin assortment, minimum of six each, usable length not to exceed six inches, grade 5 or better:

- 5/8”-11
- 1/4”-20
- 3/8”-16
- 1/2”-13

During disassembly it may also be desirable to use longer cap screws or bolts as guide pins, to limit the amount of travel the part will have when it is loosened. Cap screws of the same size as shown for the guide pins may be used, working length not exceed 6 inches, grade 5 or better.

It may be advisable to obtain vibration readings for reference purposes prior to disassembly. See General Service Bulletin CVHE-SB-18 (latest revision) for information on allowable vibration limits.

⚠ WARNING

HAZARDOUS VOLTAGE!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

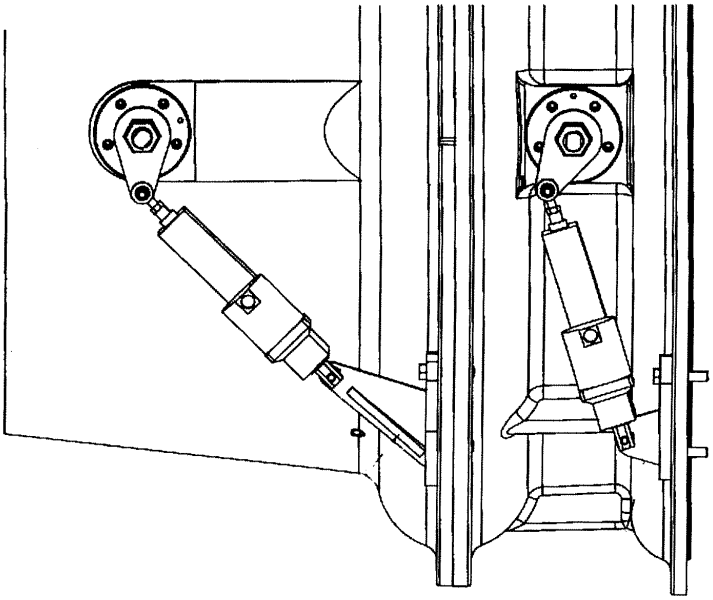
Note: For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN or PROD-SVB06A-FR.

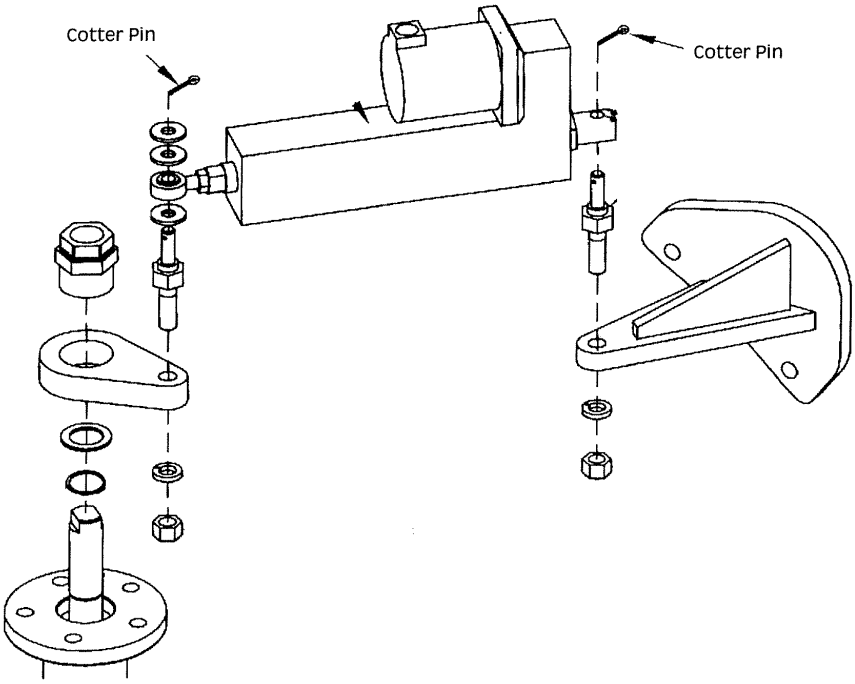
Important: *Be sure to properly lock out ALL potentially hazardous energy sources before servicing is done on the equipment. Follow all proper refrigerant handling procedures. Before disassembly, evacuate the unit to 2.5 mm vacuum and bring the unit back up to atmospheric pressure using dry nitrogen.*

Inlet Guide Vane Linkages.

Unlike the single actuator of the smaller CVHF compressor, the CVHF 1470/1720 uses dual actuators to drive the 1st and 2nd stage inlet guide vanes of the compressor. Each actuator is driven directly by the unit controls in response to a vane "schedule" that ensures proper vane opening.

Figure 1.





Remove the inlet vane actuators.

1 Mark and disconnect all power leads to the inlet vane actuator motors. Disconnect the conduit or bus wire assembly from the actuator motors.

Note: *If desired, the IGV actuators may be placed or secured beneath the compressor without cutting or removing the wire to the actuator. If this is done, it is important that no abnormal stress or force be applied to the wire or bus connections of the actuator, or to the control wiring of the unit. Secure the actuator to the chiller using wire or string.*

2 Remove the cotter pins that secure the actuator to the studs on the vane lever and on the vane drive support, then lift the actuator away.

Note: *Mark on the actuator for 1st or 2nd stage. Repeat for the remaining actuator.*

3 Before removing the vane drive support assemblies, mark the compressor castings by scribing a line around the brackets so they may be reassembled in the same relative positions. This will help ensure that the inlet vane linkages maintain their proper coordination between the stages.

4 Remove the 5/8″-11 x 3″ hex head bolts securing the vane drive support assemblies to the compressor castings.

5 Before removing a vane operator shaft assembly from the compressor, ensure the vanes are in a fully closed position and then scribe or mark the position of the assembly and it's lever arm. This is to assist with achieving proper re-assembly.

CAUTION

COMPONENT ALIGNMENT!

Before disassembling the compressor, scribe lines across the flanges on the exterior edges of all compressor castings in two locations,180 degrees apart. This must be done so that all components can be re-aligned during re-assembly. Failure to complete this step may result in misalignment of the suction elbow upon re-assembly and possible distortion of the compressor. This can cause vibration problems or seal-to-impeller interference and possible damage to the impellers and compressor.

CAUTION

COMPONENT ALIGNMENT!

The following two paragraphs provide instructions to maintain proper component alignment and fit. Make sure the compressor casings are doweled or scribed and the discharge volute is doweled. Failure to maintain proper alignment may result in compressor damage. 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.

Before proceeding further, check to make sure the discharge volute has dowel pins in the flange at the condenser and the compressor foot where it mounts on the evaporator support bracket. These pins are standard on all newer units and will be required if the discharge volute or entire compressor will be removed from the shells. The alignment of the compressor/motor assembly is determined by the position of the discharge volute. A shift in volute position at either the discharge flange or the compressor foot can change the suction elbow to compressor alignment. **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.** Dowel pins should be present in the discharge flange and compressor foot. Units ordered for field disassembly (compressor removal) may have the motor, interstage casings and suction cover doweled as well as the discharge flange and foot.

For additional information on compressor doweling see General Service Bulletin CVHE-SB-10 (latest revision).

If the entire compressor or the discharge volute will need to be removed from the shells, the dowel pins at the discharge flange and foot will have to be removed. First remove the threaded nut on the exposed end of the dowel pin. Then slip washers or a bushing over the pin. Reinstall the nut. As the nut is tightened, the pin will be pulled out of place. The dowel pins allow for precise assembly of the compressor components in their original position.

Note: *It is not necessary to dowel all compressor casings for overhauls when properly scribed as detailed above.*

Important: *Make sure the evaporator and condenser inlet and outlet water valves have been closed (**no water flow!**) and the evaporator and condenser water boxes have been completely drained. Failure to prevent water flow through the unit during repairs could cause severe rusting inside the shells. In humid environments it may be advisable to place a portable light or trouble light (100 -300 Watt) in the evaporator and condenser if necessary to provide enough heat to prevent moisture from condensing in the unit during repairs. In excessively humid environments, consider the use of a nitrogen purge to help prevent corrosion.*

Remove the economizer to allow for compressor volute clearance.

1 Some CVHF units will require cutting the drain line that returns motor cooling liquid to the economizer. Some CVHF units will require cutting the oil supply lines to and from the oil cooler that is within the economizer. Sand the lines to remove paint then cut with a tubing cutter. Do not use a hacksaw to cut the line. Always use a tubing cutter to avoid introducing copper chips (debris) into the unit.

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

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

Figure 2.

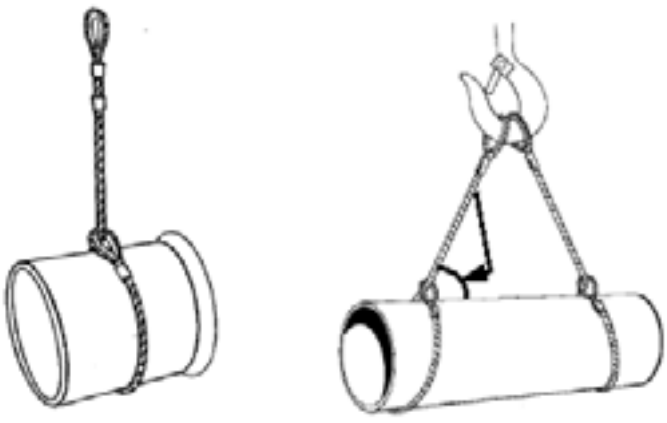


Table 1. Load Angle de-rate for Slings

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

3 Carefully slide the economizer away from the shells.

4 Lightly oil all flanges with compressor oil. Cover all openings with plastic and seal with duct tape to prevent debris from entering the economizer.

5 Remove the orifice assemblies and mark them properly. Oil the flanges on the condenser liquid line and the evaporator liquid inlet to prevent rusting. Cover the openings with plastic and duct tape to prevent entry of debris.

Remove the Suction Elbow.

1 Remove the bolts from the suction elbow flanges at the evaporator and compressor.

2 Place a sling in the choke configuration around the suction elbow. Position the sling so the elbow balances properly as it is lifted. Do **NOT** use the weld nut on the suction elbow for lifting. See Table 2 for the weight of the suction elbow.

Figure 3.

3 Clean and lightly oil the suction elbow flanges to prevent rusting and place the elbow on wooden blocks to protect the face of flange. Remove the o-ring, then thoroughly clean the groove in the flange on the evaporator. Lightly oil the flange on the evaporator. Cover the opening with plywood to protect the flange and prevent debris from entering the evaporator during repairs.

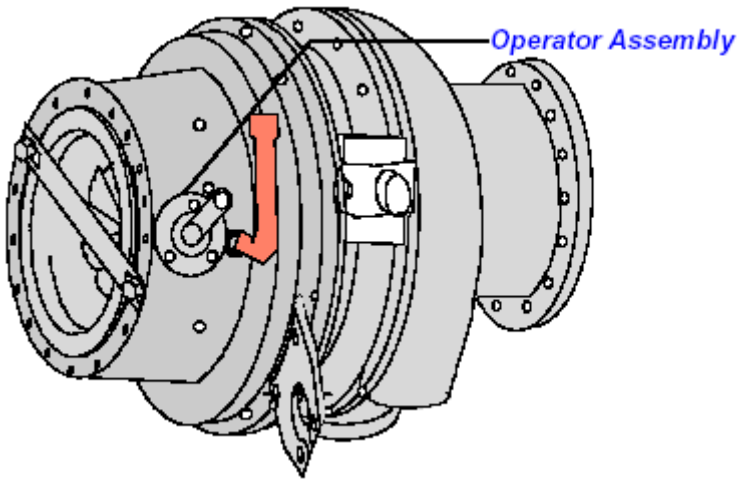
Important: *During the compressor disassembly process, you must mark all components before removing them.*
Mark the face of components with a description or location (e.g.1st stage impeller seal) and the top (12 o'clock) mounting position of all seals, impellers, spacers, casings, plates etc. so they may be re-installed in the same position. This

will be important in maintaining the proper balance and alignment of the rotating components during reassembly. A permanent ink marker or a scribe may be used to mark the components.

Remove the first stage inlet vane assembly.

1 Before removing a vane operator shaft assembly from the compressor, ensure the vanes are in a fully closed position and then scribe or mark the position of the assembly and it's lever arm. This is to assist with achieving proper re-assembly. Loosen and remove the bolts securing the first stage vane operator assembly to the suction cover, then pull the assembly from the suction cover. See Figure 4.

Figure 4.



2 Use a length of L-channel extending across the width of the inlet vanes and two bolts with washers in the suction cover flange to hold the inlet vane assembly in the cover. Remove the three 5/16"-18 x 3/8" countersunk set screws in the suction cover holding the inlet vane assembly in place. See Figure 4.

Figure 5.

3 Using the vane lifting tool shown in Figure 5,lift up slightly on the vane assembly. Remove the L-channel holding it in place and pull the vane assembly away from the suction cover. The weight of the vane assembly is given in Table 2.

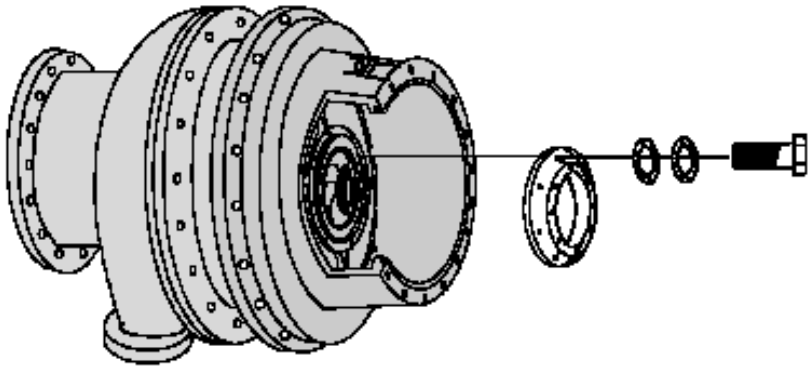
Important: *The first stage inlet guide vane assembly of the extended capacity compressor is substantially heavier than the vane assembly used in smaller compressors. Use of the proper vane lifting device, with a high weight capacity, is required.*

Important: *Immediately spray a rust-preventive penetrating oil into the needle bearings in the inlet vane housing, while manually opening and closing the vanes. Thoroughly oil the bearings to minimize the risk of rust forming in the bearings, which could lead to vane binding.* ***Anytime a unit will be open for major repairs, it is recommended the needle bearings in the vane assembly be replaced.***

Remove the 1/4 inch oil drain line at the bottom of the suction cover.

Measure and record the clearance between the 1st stage seal impeller labyrinth and impeller nose using a feeler gauge. If so equipped, bend the tabwasher tab back allowing the hex head bolts that secure the seal to be removed. The tabwashers are no longer used in production and should be replaced by ramp washers during re-assembly. Remove the seal and store properly along with the retaining bolts. See Figure 6.

Figure 6.



Important: *Mark this seal carefully. On some size units this seal is mounted in a reverse position. Installing it incorrectly could result in improper venting of the suction cover and may lead to oil loss. Do not mix the bolts with those of other seals, as the bolt lengths may vary.*

Remove the suction cover and suction cover o-ring.

1. Remove 4 of the 5/8 inch bolts from the suction cover, at the 2, 4, 8, and 10 o'clock positions, and insert 6 inch long guide pins in their place.
2. Attach a casting lifting fixture to the face of the suction cover flange. See Figure 7.
3. Remove a bolt near the bottom of the suction cover and one near the top of the suction cover, to the side of the lifting fixture, and insert 2 x 4" long 5/8" stop bolts with heads to limit movement of the cover until a proper balance point is obtained.

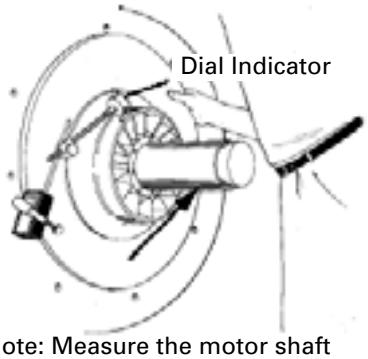
Figure 7.

4. Attach an overhead hoist of sufficient lifting capacity to the lifting plate. See Table 2 for the weight of the suction cover. Remove the remaining bolts (leaving in place the 6 inch long guide pins and the 4 inch long stop bolts) and pick up slightly on cover. It may be necessary to use jacking bolts to push the cover away from the casing. If necessary, move the pick-up point on the lifting tool until the cover is balanced.

5 Once the cover is balanced properly with the lifting tool, remove the stop bolts at the top and bottom of the cover and remove the suction cover. Oil the cover flanges lightly and store it properly to prevent rust or damage to the sealing surfaces. Remove the guide pins. Some compressors may not have an o-ring at this location.

Measure and record the total indicated runout (TIR) on the nose of the 1st stage impeller. Use a dial indicator with a magnetic base for measuring runout. See Figure 8.

Figure 8.



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

Measure and record the total indicated runout (TIR) at the end of the shaft. Some motor sizes have an extension on the end of the shaft where the runout can be measured without having to remove the impeller locknut. Many motors will require removal of the locknut and 1st stage impeller to provide a surface for measuring runout. The allowable shaft TIR is .0015". See note in Figure 8

If it is anticipated that the present compressor seals along with other components will be used during re-assembly, it is advisable to record clearances and runout measurements. The form at the back of this section can be used to record the tolerances. The recommended tolerances can be found in Table 3.

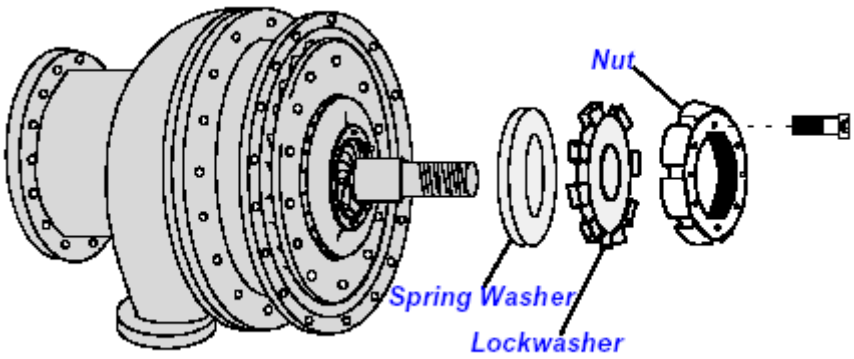
Remove the impeller locknut.

Note: *Some units are equipped with a standard locknut, while some units have a balance style locknut. The balance style locknut has small tapped holes in the face for the purpose of installing balancing screws and weights.*

Important: *When the unit has a balance style locknut with weights attached, and the motor and all rotating compressor components will be re-used, it is necessary to mark all rotating components such as the locknut, spacers, impellers and motor shaft. This is required to ensure the components can be re-assembled in the exact position as they were removed. Failure to mark all components and reassemble them properly could lead to an out of balance condition and require the assembly to be trim balanced. If the motor/rotor or other rotating components located on the shaft will be replaced, it is not necessary to mark all components. Whenever replacing individual rotating components with new ones, the balance weights from the locknut should be removed.*

All major rotating components are individually balanced to specification before the compressor is assembled. Even though each major rotating component in the compressor is individually balanced, a small percentage of the compressors assembled in the factory and in the field may be beyond the allowable limit for unbalance. When this occurs, the compressor will need to be trim balanced in the field after re-assembly, using a balance style locknut and weights. Refer to Service Bulletin CVHE-SB-18 (latest revision) for information on allowable vibration limits.

Figure 9.



Important: *When all components will be reused during re-assembly, mark the position of the locknut relative to the end of the motor shaft. It is best to mark these at the location of the keyway for the 1st stage impeller. A small center punch can be used to place a mark on the locknut and the end of the shaft. Do not remove the balance screws or weights from the balance locknut when all components will be reused!*

1. Bend the lockwasher tab back from the slot on the impeller locknut.
2. Remove the impeller locknut, lockwasher, spring washer, and steel spacer as applicable. Use a spanner wrench to remove the locknut. See Figure 9.The locknut has right hand threads. To loosen impeller locknut, turn it counter clockwise. Use a wire cable tie or tape to keep the items together. Tape the end of the shaft to prevent damage to the threads. Note: It is recommended that the lockwasher be discarded and replaced with a new lockwasher during re-assembly.
3. Discard old or damaged lockwashers. Save the conical spring washer for reuse.

CAUTION

POSSIBLE COMPRESSOR FAILURE!

Use undamaged or new lockwashers for re-assembly. Once a locking tab has been bent over on a lockwasher it may become weak and break off if reused. This could cause the impeller locknut to loosen and come off during operation, causing major damage to the compressor and motor.

Figure 10.

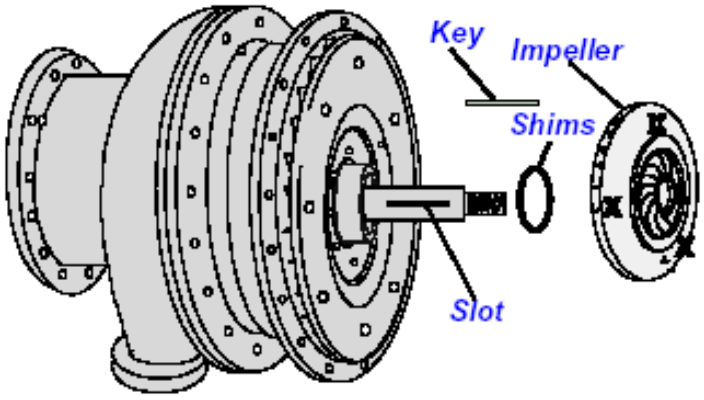
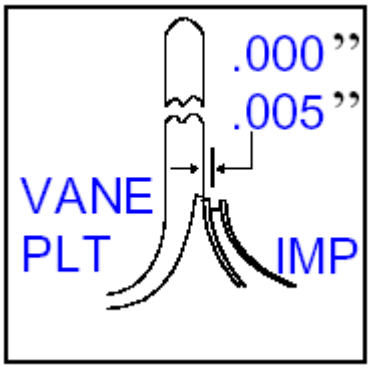


Figure 11.



1 Before removing the impeller, check the alignment of the impeller inside back discharge surface to the diffuser plate. The impeller surface should be aligned as shown in Figure 10. When reusing all rotating components and the alignment is not as specified above, measure and record the amount of shim(s) that may need to be added or removed during re-assembly.

2 It may be necessary to use a puller to remove the impeller. When using a puller, make sure the face of the puller is parallel to the face of the impeller hub to ensure a straight pull. Take care not to damage the machining center in the end of the shaft. If necessary, a small amount of heat may be required to loosen the impeller on the shaft. When heating impeller, use a large (Rosebud) tip with a soft gentle flame. Do not overheat the impeller. The impeller should be heated so that it is warm to the touch. Do not exceed 120 degrees F.

3 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 away from 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.

4 Remove the impeller. See Figure 10.

5 Mark the impeller 1st stage.

Remove the impeller key and shims from behind the impeller. Clean the impeller, key and shaft. Tape the shims together and secure them to the impeller along with the key. Keep the parts for each stage together, and keep them separate from the other stage.

Measure and record the clearance between the 1st stage shaft seal and spacer. If the shaft seal has the lockwashers with bent over tab, bend them over using a screw driver. It is recommended the tab type lock washers be discarded and replaced by the ramp type washers shown in Figure 12. Remove the hex head bolts and ramp washers and remove the seal and mark it properly.

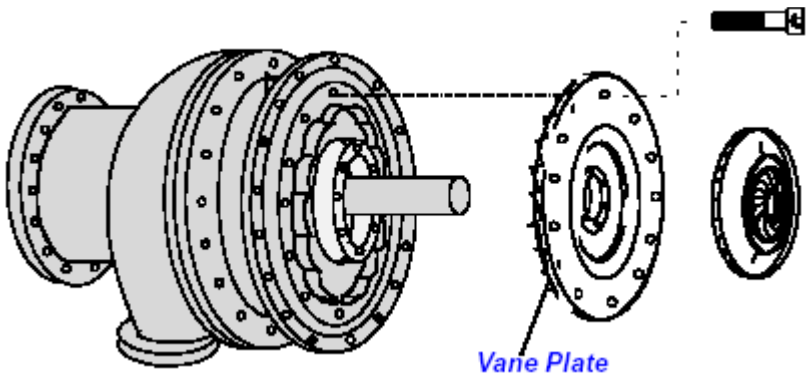
Remove the 1st stage spacer and spacer tube (some compressors).

1 Mark the spacer and spacer tube with its position on the shaft with the first stage impeller keyway at the 12 o 'clock position. The shaft spacer has tapped pull-off holes that can be used to pull the spacer if needed. Using the pull-off holes may be required on units where corrosion has occurred due to leaks and moisture or other causes.

2 Mark the spacer and spacer tube for top and 1st stage.

Remove the second stage vane plate. See Figure 12. Refer to Table 2 for the weight of the vane plate.

Figure 12.



1 Remove four 3/8"-16 socket head cap screws.

2 Mark the vane plate for TOP and 2nd STAGE.

3 Install two 3/8"-16 x 8" stop bolts with heads in two of the bolt holes. Install two 3/8"-16 x 8" guide pins (no heads, may be threaded rod only if grade 5 or better) in the remaining two bolt holes.

4 Remove the remaining socket head screws holding the vane plate to the interstage casing.

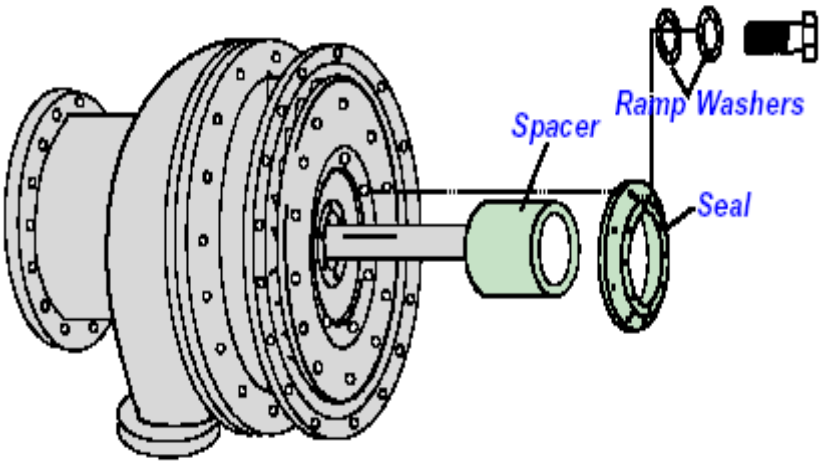
5 Back the vane plate away from the interstage casing on the guide and stop bolts only as far as is needed to pass a sling behind the vane plate.

6 Place a nylon sling through the center of the vane plate in the choke configuration.

7 Lift the plate slightly with the nylon sling and remove the two remaining stop bolts with heads.

8 Remove the vane plate, being careful not to damage the rotor shaft. You may leave the guide pins installed.

Figure 13.



Remove the 2nd stage vane operator assembly. See Figure 12.

1. Before removing a vane operator shaft assembly from the compressor, ensure the vanes are in a fully closed position and then scribe or mark the position of the assembly and it's lever arm. This is to assist with achieving proper re-assembly.
2. Loosen and remove the bolts securing the second stage vane operator assembly to the suction cover, then pull the assembly from the suction cover. The weight of the vane operator assembly is approximately 65 lbs. Lightly coat all bare metal surfaces with compressor oil.

2nd Stage Vane Assembly and Shroud

The CVHF 1470/1720 compressor uses a 2nd stage vane design that differs from the vane design used on smaller CVHF compressors. Instead of having a combination vane and shroud plate assembly, the CVHF 1470/1720 uses a two-part assembly, with the Inlet Guide Vanes separate from the shroud plate. When removing the two-part assembly, the outer shroud should be removed first.

Remove the outer shroud.

1. Mark the shroud for TOP.
2. Leave the two guide pins installed for the vane plate removal in place.
3. Re-install two of the 3/8"-16 stop bolts through the outer shroud.
4. Remove the 1/4"-20 x 3/4" flathead screws that secure the outer shroud. These screws use a thread locking compound and may be difficult to remove. Use an allen head socket for removal. Make sure the allen head socket is in good condition and does not have rounded edges. A hand impact driver may be helpful in removing screws.
5. Slide the outer shroud away from the interstage casing on the guide and stop bolts only as far as is needed to pass a sling behind the shroud plate.
6. Attach a sling or cable to the outer shroud in a choke configuration. Remove the two stop bolts and remove the shroud from the compressor. Immediately coat the shroud with compressor oil or rust preventive oil to stop corrosion or rust.

Remove the 2nd Stage Inlet Guide Vane Assembly

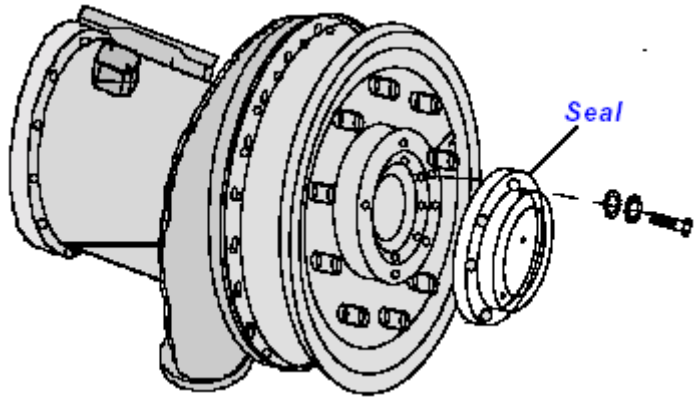
1. Mark the vane assembly for TOP.
2. To remove the vane assembly, remove two of the 3/8"-16 vane mounting screws and install two 3/8"-16 x 6" long stop bolts in their place.
3. Remove the remaining vane mounting screws.
4. Carefully slide the vane assembly several inches away from the interstage casing.
5. Secure the appropriate lifting device to the inlet guide vane assembly, remove the stop bolts, then remove the inlet guide vane assembly from the compressor. See Figure 14.
6. Inspect the vane assembly and perform any needed repairs. Liberally coat the inlet guide vane assembly with compressor oil to prevent corrosion. Protect the assembly by wrapping it in plastic and storing it in a safe location.

Figure 14.

Remove the 2nd stage impeller nose seal. Refer to Figure 15.

1. Measure and record the seal clearance. Table 3 provides proper clearances.
2. Mark the seal for TOP and 2nd STAGE.
3. Remove the 3/8”-16 x 1” hex head screws and tab or ramp washers.
4. Remove the seal.

Figure 15.



Measure and record the total indicated runout (TIR) on the nose of the 2nd stage impeller.

Remove the 2nd stage casing and o-ring.

Note: *Some compressors may not have an o-ring in this location. See Table 2 for the weight of the 2nd stage casing.*

1. Remove four of the 5/8” bolts from the 2nd stage casing, at the 2, 4, 8, and 10 o’clock positions, and insert four 5/8”-11 x 6” long guide pins in their place.
2. Attach a casting lifting fixture to the face of the 2nd stage casing.
3. Remove a bolt near the bottom of the 2nd stage casing and one near the top of the casing, to the side of the lifting fixture, and in their place insert two 4” long 5/8”-11 stop bolts with heads. This is to limit movement of the casing until a proper balance point is obtained.
4. Attach an overhead hoist of sufficient lifting capacity to the lifting plate.
5. Remove the remaining bolts (leaving in place the 6 inch long guide pins and the 4 inch long stop bolts) and pick up slightly on the casing. It may be necessary to use jacking bolts to push the casing away from the discharge volute. If necessary, move the pick-up point on the lifting tool until the casing is balanced.
6. Once the casing is balanced properly with the lifting tool, remove the stop bolts at the top and bottom of the casing and pull the casing away from the compressor. Oil the cover flanges and any exposed surfaces lightly and store it

properly to prevent rust or damage to the sealing surfaces. See Figure 16. Remove the guide pins.

Figure 16.

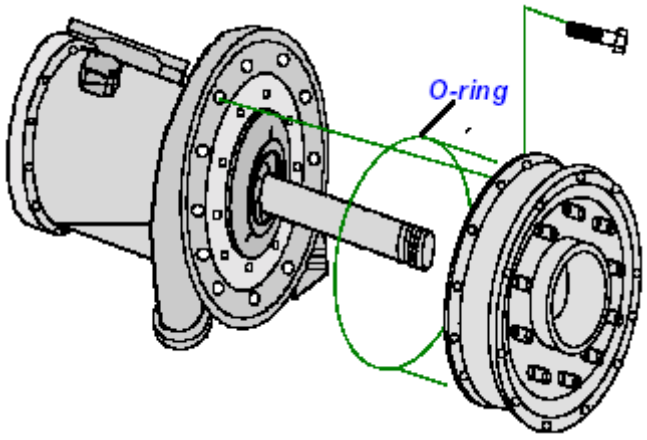
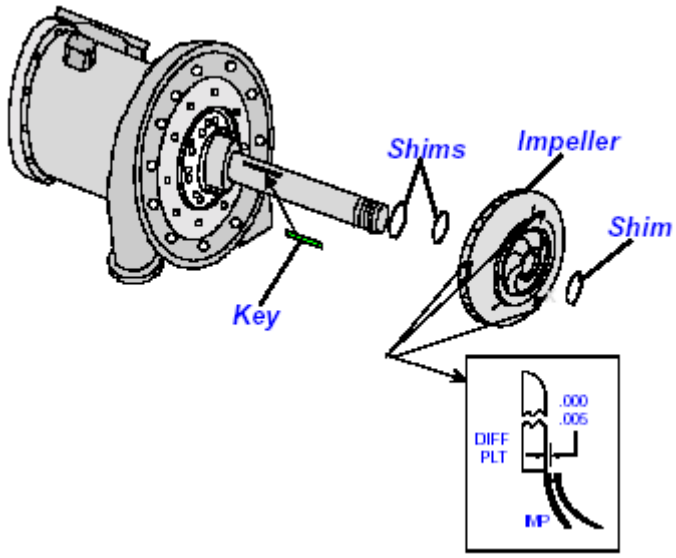


Figure 17.



Remove the 2nd stage impeller and the shim(s) in front of impeller. Tape the shims to the spacer removed earlier.

1. Before removing the impeller, check the alignment of the impeller inside the back discharge surface to the diffuser plate. The impeller surface should be aligned as shown in Figure 17. When re-using all rotating components and the alignment is not as specified, measure and record the amount of shims that may need to be added or removed during re-assembly.
2. A puller may be necessary to remove the impeller. When using a puller, make sure the face of the puller is parallel to the face of the impeller hub to ensure a straight pull. Take care not to damage the machining center in the end of the shaft. If necessary, a small amount of heat may be required to loosen the impeller on the shaft. When applying heat, use a torch with a large (Rosebud) tip and a soft gentle flame. Do not overheat the impeller. The impeller should be heated so that it is warm to the touch. Do not exceed 120 degree F. .
3. 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 away from the compressor shaft. It is recommended that a soft nylon 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.
4. Mark the impeller 2nd STAGE.

Remove the impeller key and shims from behind the impeller. Tape the shims together and secure them to the impeller along with the key.

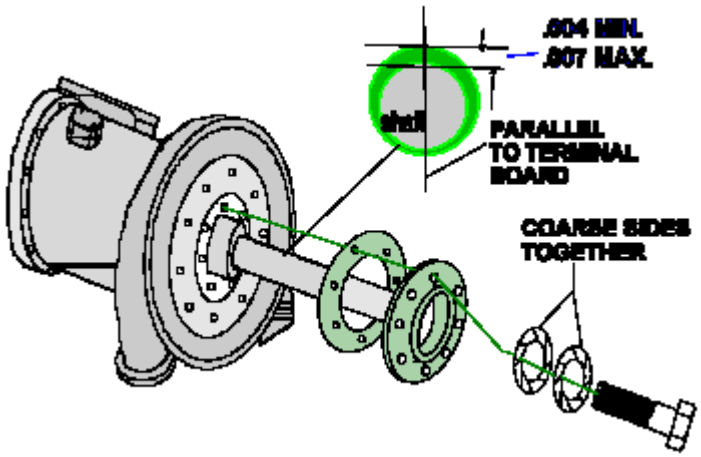
Note: *It is important that the thicker steel spacer be installed against the shaft shoulder with the chamfer facing the shaft shoulder.*

Remove the bearing oil seal and gasket. See Figure 18.

1 Measure and record the seal clearance.

Important: *Excessive clearance of this seal will cause oil loss. Measure the seal clearance all the way around as shown. The total clearance between the shaft O.D. and seal I.D. will be 0.0040" to 0.0070". This seal is set in the factory with the bottom of the seal brought up to the bottom of the shaft and all the clearance (.004"-.007" total) at the top. The clearance between shaft and seal at the sides (3 and 9 o 'clock positions)should be equal. See Figure 19.*

Figure 18.



2 Mark the seal for TOP.

Important: *The seal may have a small oil drain hole in the back which must be correctly aligned during re-assembly. The drain hole must be at the 6 o 'clock position.*

3 Remove the hex head screws and tab or ramp washers securing the seal and gasket.

Remove the bearing oil seal mounting plate and gasket.

1 Mark the plate for TOP.

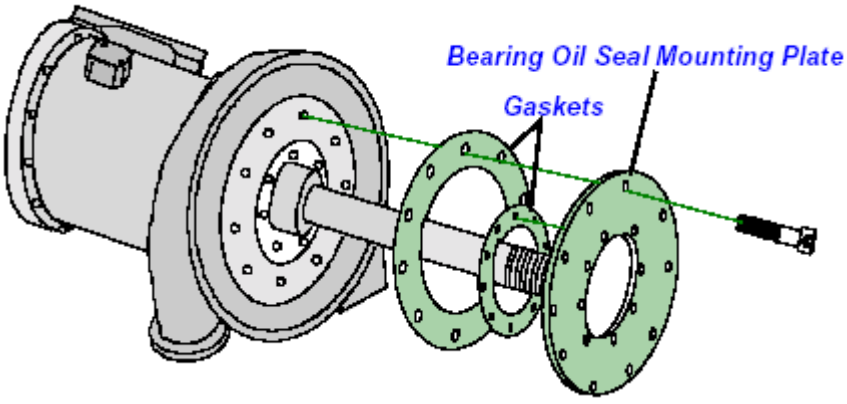
2 Remove four 3/8"-16 x 1" socket head screws and insert two 3/8"-16 stop bolts approximately 6 inches in length and two 3/8"-16 guide pins approximately 6 inchs in length.

3 Remove the remaining screws and slide the seal mounting plate away just far enough to pass a sling behind it. Pass a nylon sling in a choke configuration through the plate, remove the two stop bolts, and lift the plate away from the compressor. Place a container under the plate since some oil will drain out when the plate is removed. See Figure 20. Lightly coat the plate with compressor oil to prevent rust.

Volute diffuser plate removal.

It will be necessary to remove the volute diffuser plate if you are changing the motor AND if the

Figure 19.

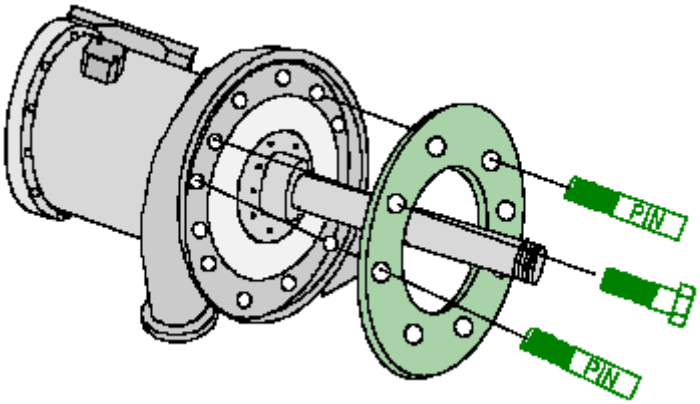


motor is 5800 or 5800L frame size. If you are not removing the motor from the chiller, or if the motor is a 5000 frame size, the volute diffuser plate may remain in place.

To remove the volute diffuser plate:

1. Remove four 1/2" allen head cap screws and insert two 6 inch long guide pins and two 4 inch long stop bolts.
2. Remove the remaining allen head cap screws and slide the diffuser plate away from the volute just far enough to allow the connection of the lifting clevis. See Figure 20.
3. It is recommended that the correct lifting clevis be used to secure the volute diffuser plate to the rigging equipment. The high weight and sharp edges of the diffuser plate make the use of a sling or cable less reliable. See Table 2 for the weight of the diffuser plate.
4. Lift the diffuser plate and remove the stop bolts.
5. Slide the diffuser plate away from the volute. Oil the diffuser to prevent rusting.

Figure 20.



Unit mounted starter removal (when applicable). Refer to applicable starter literature for more details.

1. Attach a small chain to the lifting eye bolts on top of the starter. Pick up slightly on the chain to take up slack.
2. Remove the motor leads from the motor terminal studs. Mark each lead carefully with the corresponding motor terminal number stamped on the motor terminal board. Remove other electrical connections as necessary to allow enough room to remove the starter and mark them carefully.
3. Remove the bolts holding the starter to the motor housing and the bolts (when applicable)on the lower support bracket and move the starter away from the motor, being careful not to damage the motor terminals.

Motor removal.

1. Sand the external oil supply and drain lines to remove paint, then cut them with a tubing cutter. Do not use a hacksaw to cut the lines. Always use a tubing cutter to avoid introducing copper chips (debris) into the unit.
2. Heat the internal oil supply line to loosen and remove line. Bleed nitrogen through the line when heating to prevent build up of copper oxides inside the line. Use a wet rag to protect the threaded connections from excessive heat.
3. If the motor is to be replaced or remanufactured, remove the bearing oil supply orifice on the thrust (ball) bearing end of the motor. The orifice threads into the motor bearing housing.

Important: *Save the orifice for reuse.*

Important: *Failure to use a properly sized orifice on the ball bearing supply line could result in excessive oil flow and possible oil loss problems.*

4. Remove the flange bolts for the motor cooling refrigerant supply line and drain lines. In some instances, the drain lines may need to be cut to provide enough clearance for motor removal. Sand the drain line to remove paint then cut it with a tubing cutter. Do not use a hacksaw to cut the line. Always use a tubing cutter to avoid introducing copper chips (debris) into the unit.

Important: *Remove the motor cooling orifice located between the motor housing and the motor cooling supply line flange. Save the orifice for reuse.*

5. Using two slings in the choke configuration, position them at each end of the motor housing. Refer to Table 4 for motor weights.
6. Remove two of the bolts holding the motor assembly in the discharge volute and install two

5/8"-11 guide pins (2-3 inches in length) so they are 180 degrees across from each other.

Note: *On units with 5000 frame motors the motor retaining bolts will be on the motor side of the discharge volute. On units with 5800 or 5800L frame motors the motor retaining screws will be on the compressor side of the discharge volute. For units with 5800 and 5800L frame motors it will be necessary to first remove the volute diffuser plate to gain access to the motor retaining screws. Removal of the volute diffuser plate is described earlier in this literature.* See Figure 21.

7 See Table 4 for motor weight. Pick up on the slings to take up slack and remove the remaining bolts that secure the motor to the volute. Lift the motor slightly and move away from the volute, being careful not to damage the motor shaft.

8 Oil the shaft and cover all openings to prevent debris from entering the motor.

Discharge volute removal.

1 Remove the dowel pins on the discharge flange at the condenser and on the foot of the volute. First remove the threaded nut on the exposed end of the dowel pin. Then slip washers or a bushing over the pin and reinstall the nut. As the nut is tightened, the pin will be pulled out of place. The dowel pins allow for precise assembly of the compressor components in their original position.

2 Use the appropriate lifting tool or place a large sling in the choke configuration through the center of the volute. Take up the slack in the rigging. See Table 2 for volute weights. Ensure the rating of the rigging exceeds the weight of the component.

3 Remove the bolts at the discharge flange and the compressor foot and then lift the volute. See Table 2 for volute weights.

4 Clean and oil the discharge flange on the condenser and cover the opening to prevent entry of debris

Inspect all components for damage or excessive wear. Do not re-assemble the compressor using faulty components. Clean each component and apply a light coat of compressor oil to protect it from moisture and corrosion (especially o-ring and gasket surfaces).

This is a good opportunity to closely check the impeller bores 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.

Note: *Refer to CenTraVac Literature Section CTV-SVG06-EN for the CVHF 1470 / 1720 ton compressor re-assembly procedures.*

Figure 21.

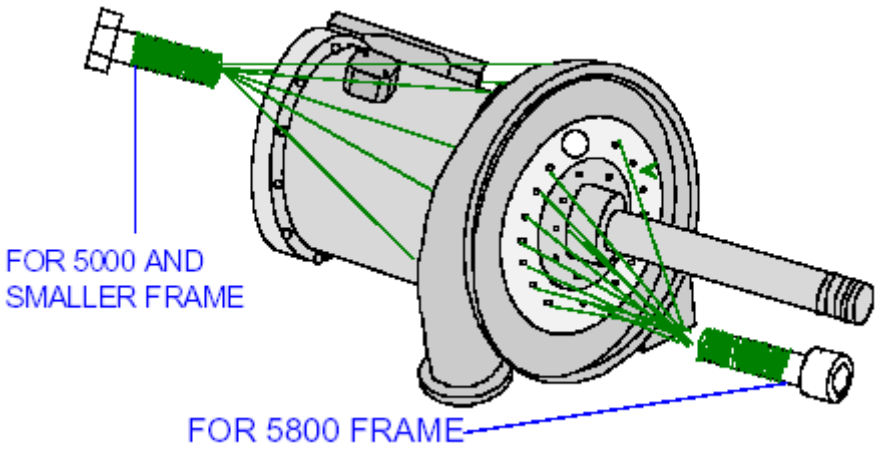


Table 2. CVHF/CDHF Extended capacity - compressor/component weights

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

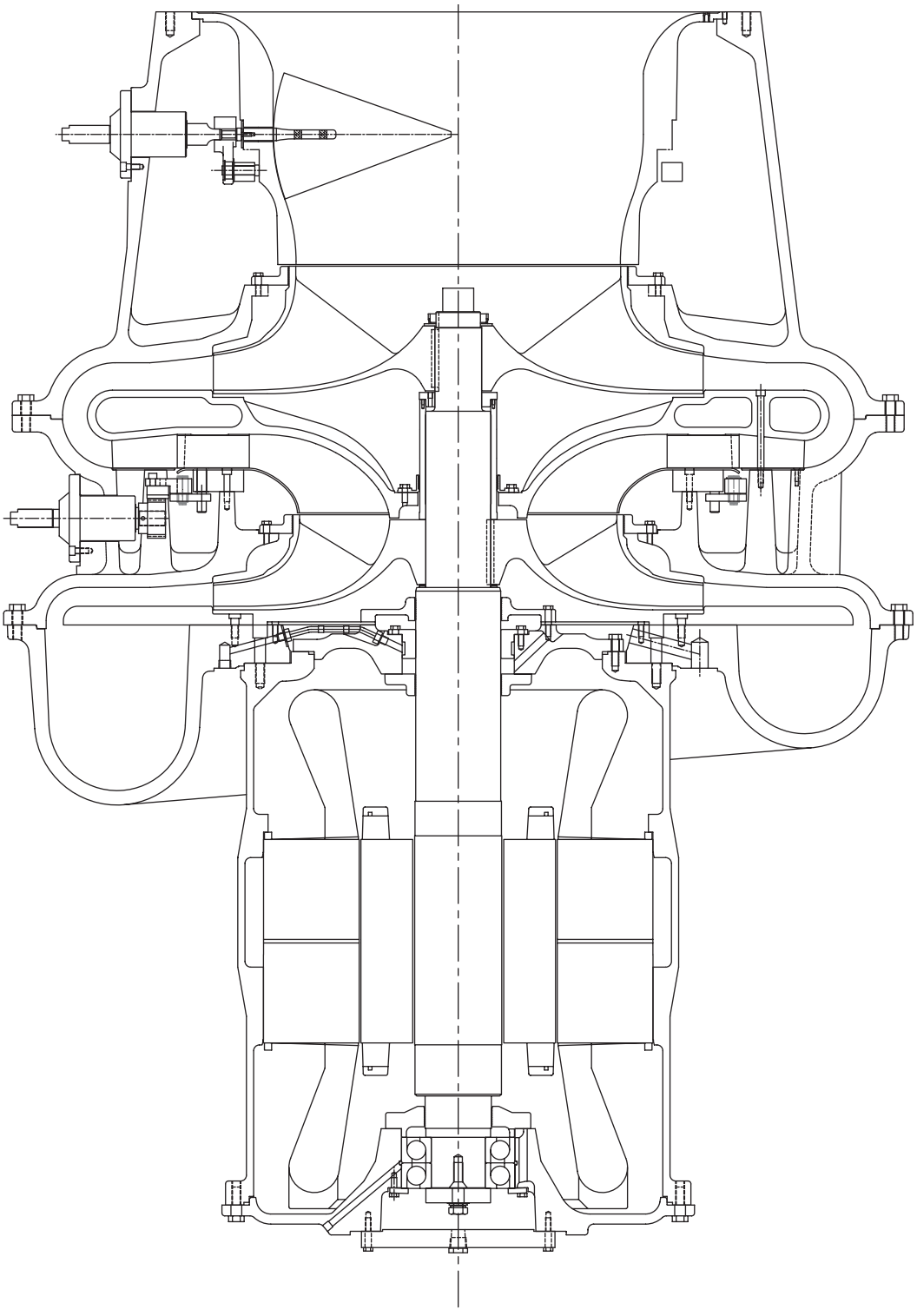
Table 3. CVHF/CDHF Extended capacity compressor clearance

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.							

Table 4. CVHF/CDHF Extended capacity - 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.						

Figure 22.



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)*

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