*Operation & Maintenance Instruction*

# 3-CWDL WATER COOLED AIR COMPRESSORS

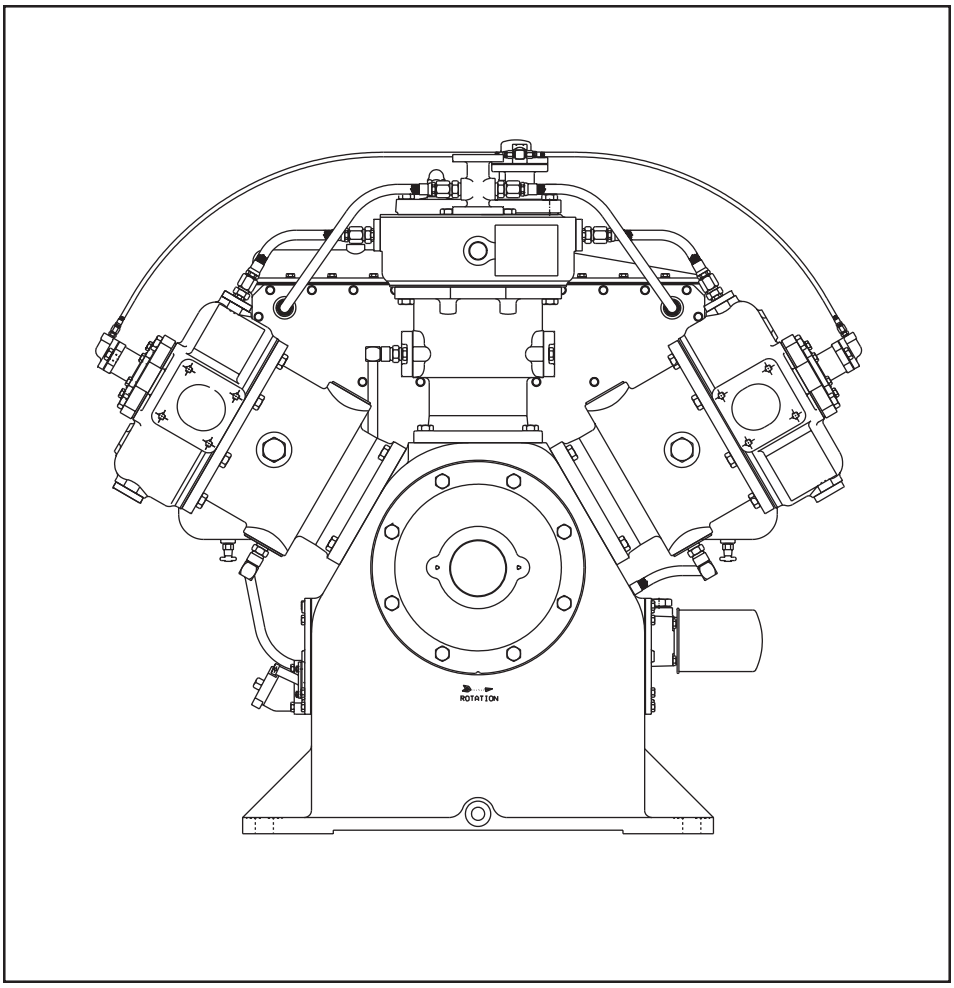
FEBRUARY, 2006

**NOTE: The following description and operation is based on this device and its components being new or this device and its components having been repaired, tested, installed and maintained in accordance with instructions issued by this and any other applicable Wabtec Corporation publications.**

⚠ **WARNING:** At the time any part is replaced in this device, the operation of the complete device must pass a series of tests prescribed in the latest issue of the applicable Wabtec Test Specification. At the time this device is applied to the brake equipment arrangement, a stationary vehicle test must be made to ensure that this device functions properly in the total brake equipment arrangement. (Consult your local Wabtec Corporation Representative for identity of the test specification, with latest revision date, that covers this device.)

**IMPORTANT:** Only Wabtec Corporation supplied parts are to be used in the repair of this device in order to obtain satisfactory operation. Commercially available non-O.E.M. parts are unacceptable.

**NOTE:** The part numbers and their associated descriptions are the property of Wabtec Corporation and may not be replicated in any manner or form without the prior sole written consent of an Officer of Wabtec Corporation.



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## 1.0 PREFACE

**IMPORTANT:** The equipment and/or devices covered in this publication that were manufactured and/or sold by the Wabtec Corporation were designed and constructed to perform in the manner stated herein. Proper installation, periodic inspection, testing, and routine specified maintenance of all operating parts in accordance with instructions issued by this and any other applicable Wabtec Corporation publications must be adhered to. Wabtec Corporation parts must be used during overhaul or routine maintenance to assure proper operation of equipment and/or devices. No responsibility for the workmanship associated with the maintenance of devices will be accepted if the work is done by a repair center that is not operated by the Wabtec Corporation.

**NOTE:** The following equipment description and the description of equipment operation is based on the equipment and all component devices being new or having been repaired, tested, installed and maintained in accordance with instructions and specifications issued by the Wabtec Corporation.

Instructions contained in this publication are presented as a guide for maintenance and repair shop conditioning following the removal of the specific device from the locomotive.

**IMPORTANT:** The Wabtec Corporation is constantly improving its product line and researching and developing new products. Changes in design and function of devices and/or equipment may result from this research and development; therefore, the material in this publication is subject to change without notice.

### 1.1 GENERAL DESCRIPTION

### 1.2 3-CWDL AIR COMPRESSOR

The 3-CWDL is a water cooled, two stage, three cylinder "W" configuration, single acting air compressor. It is designed to provide compressed air for locomotive applications. The compressor is directly driven from the locomotive's diesel engine through appropriate couplings and drive shafts. The compressor is designed for operation at a maximum discharge pressure of 140 psig (965 kPa). The compressor has a stroke of 5 inches (127 mm). See Section 3.0 for designations and the capacities and weights are covered under Section 6.0. Contact your Wabtec Representative or the Wabtec Engineering Department for any additional information.

## 2.0 DESCRIPTION OF MAJOR COMPONENT PARTS

### 2.1 CYLINDERS

Reference Figures 1 & 2

The compressor has two 7.88 inch (200.2 mm) diameter low pressure cylinders and one 5.75 inch (146.1 mm) diameter high pressure cylinder. Both cylinders have a fully jacketed cooling passage.

### 2.2 CYLINDER HEADS AND VALVES

Reference Figures 1 & 2

Each cylinder head has an inlet and discharge valve. The valve assemblies consist of a valve seat, spring seat, springs, and inner/outer valve discs.

Unloaders are installed on the inlet valves so that whenever a set main reservoir pressure is reached and not to exceed 140 psig (965 kPa) the compressor will unload.

**NOTE:** "Cut-In" pressure should be set at 10 to 15 psig less than the "Cut-Out" pressure.

### 2.3 CRANKSHAFT AND CONNECTING RODS

Reference Figure 3

The crankshaft and connecting rods are made of ductile iron. Oil pressurized by the oil pump passes through rifle drilled holes in the crankshaft to lubricate the connecting rod bearings and compressor main bearings.

The connecting rods are fitted with replaceable bearing inserts and wrist pin bushing.

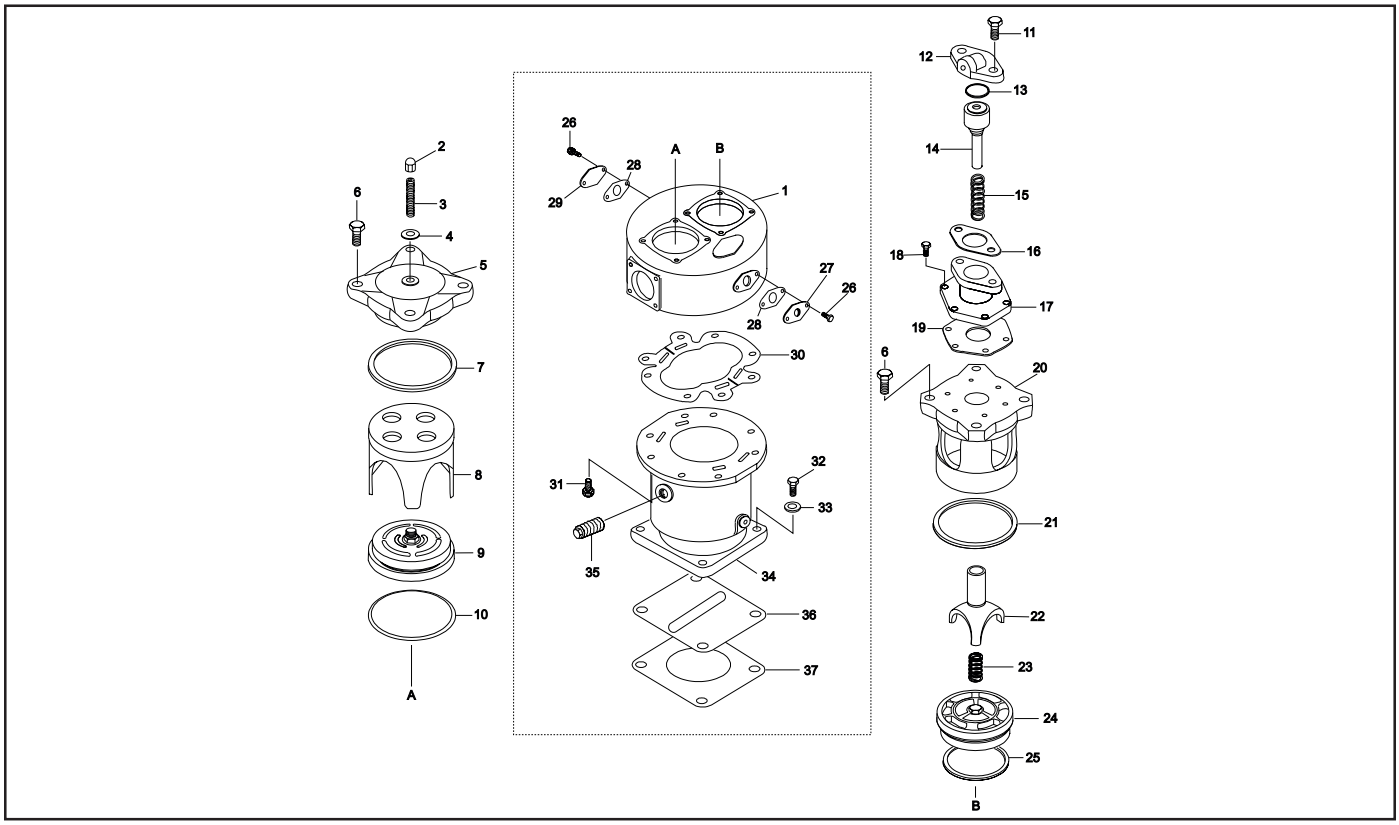



**Figure 1 - Low Pressure Cylinder & Head Assembly**

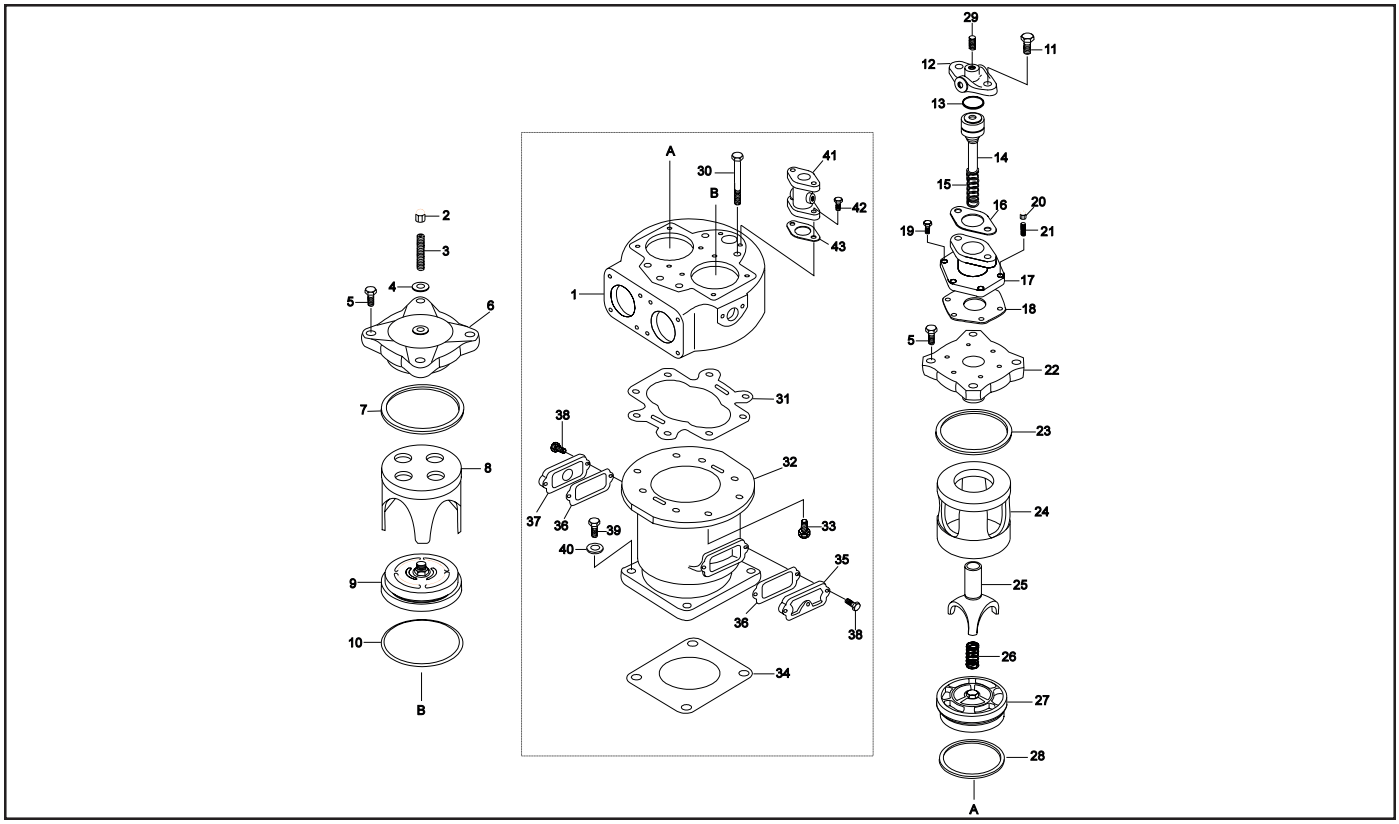



**Figure 2 - High Pressure Cylinder & Head Assembly**

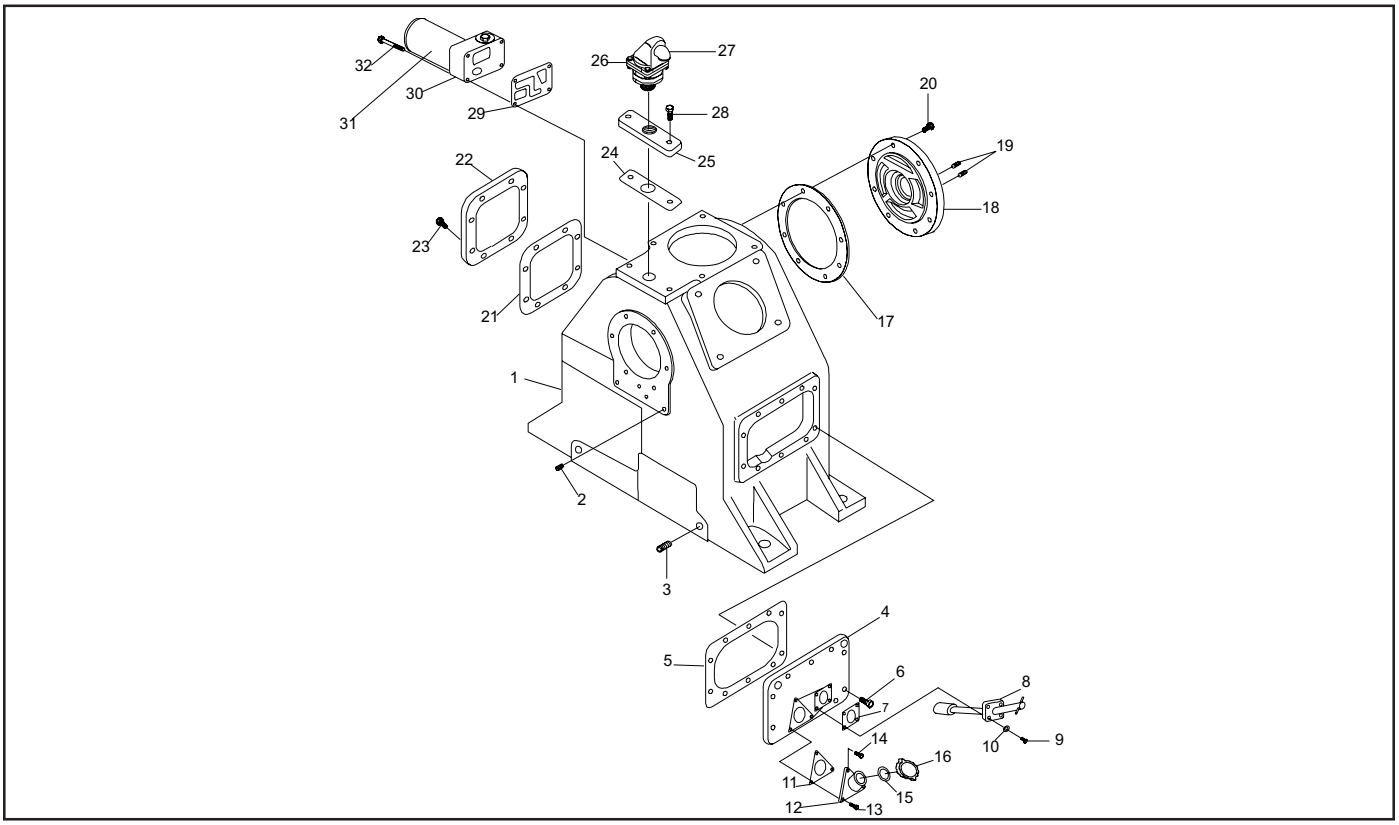



**Figure 3 - Crankcase Assembly**

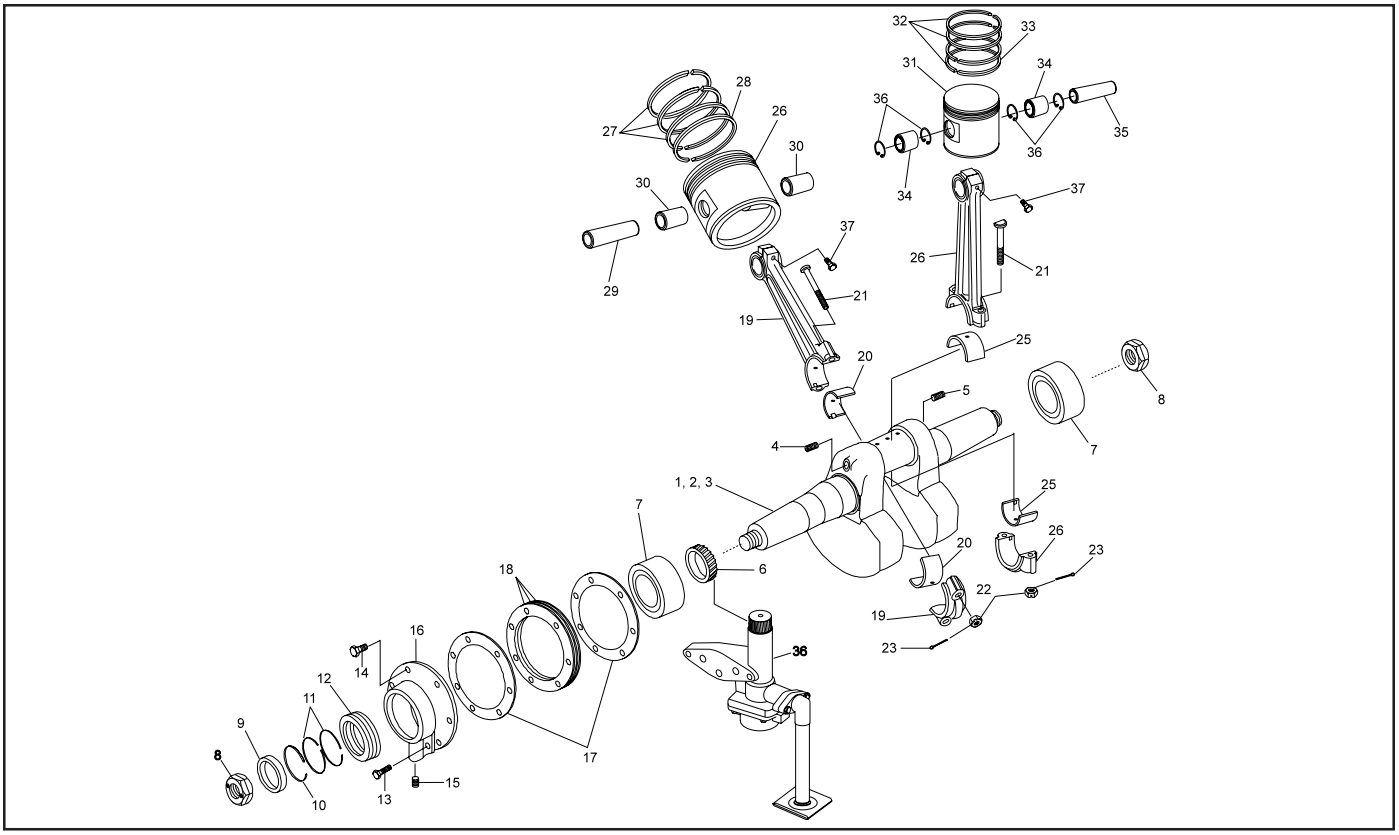



**Figure 4 - Crankshaft Assembly & Pistons**

## 2.4 COMPRESSOR PISTONS

Reference Figure 4

The low and high pressure pistons are constructed of an elliptical ground cast iron. Each piston has one oil and three compression rings. The low pressure piston has a brass wrist pin bushings pressed into the piston. On the high pressure piston needle roller bearings are used.

## 2.5 MAIN BEARING

Two taper roller bearings are utilized in the compressor assembly. The bearings are lubricated from the crankcase oil that passes through the crankshaft.

## 2.6 OIL PUMP

Reference Figures 4 & 5

Lubrication for the compressor is provided by a gear driven oil pump. The pump is operated by a mating helical gear that connects the oil pump to the crankshaft.

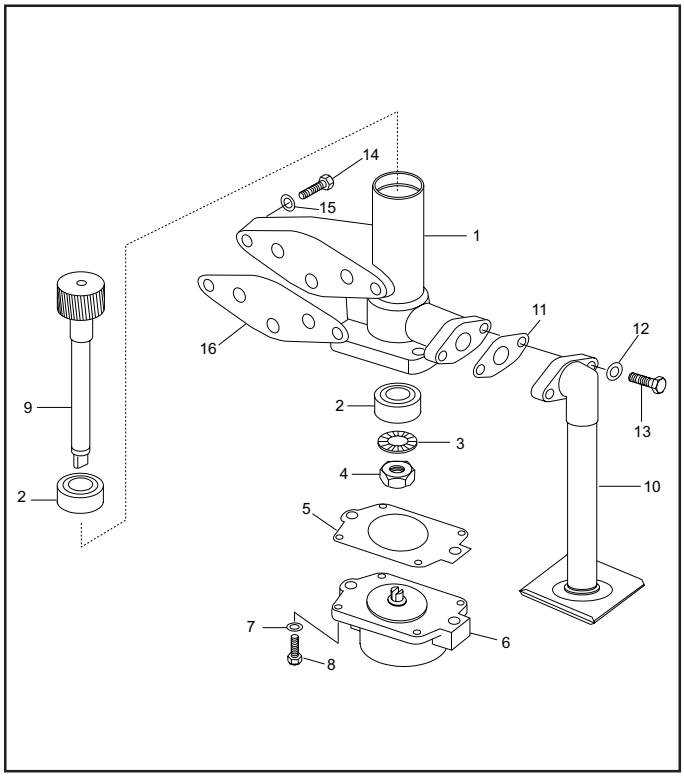



**Figure 5 - Oil Pump**

## 2.7 OIL LEVEL GAGE - FLOAT TYPE

Reference Figure 3

The Float Type Oil Gage provides a leak resistant means to measure the approximate oil level in the crankcase. The Float Type Oil Gage consists of a ball or float which rests in the oil supply. The vertical displacement of this float, as determined by the oil level in the crankcase, rotates (through a gear mechanism) a shaft which runs into the gage. A permanent magnet is attached to the gage end of the shaft. This magnet controls the pointer on the visible side of the gage. The magnet arrangement is used to insure that there is no physical opening from the atmosphere to the inside of the crankcase.

## 2.8 OIL LEVEL GAGE - DIPSTICK ASSEMBLY

Reference Figure 3

The Dipstick Type Oil Level Gage Assembly, when properly installed, is designed to permit oil level in the compressor crankcase to be checked with the compressor running or shut down. No spillage of lubrication oil should occur when an oil level reading is taken.

The dipstick assembly consists of a spring loaded ball check, which is pushed off its seat when the dipstick gage is properly screwed into the dip stick tube to its normal, fully closed, position. This allows the crankcase oil to reach its level within the dip stick tube. When the dipstick gage is removed to take an oil level reading, the ball check seats on the bottom of the tube restricting any oil spilling when the compressor is running.

The dipstick assembly is so designed that no surge of oil should occur within the tube. A positive indication of the oil level is shown on the dipstick gage even when the compressor is operating.

## 2.9 SPIN-ON OIL FILTER & VALVE

Reference Figure 6

The spin on oil filter used on the compressor is a full flow design with a built in pressure relief valve.

The block mounted on the side of the compressors crankcase contains a valve that provides oil pressure control so that during idle it maintains the minimum oil pressure and ensures adequate oil pressure at all compressor speeds.

## 2.10 CRANKCASE BREATHER VALVE

Reference Figure 7

The Crankcase Breather Valve operates as a check valve to provide a partial crankcase vacuum during normal operation of the compressor and to discharge air displaced in the crankcase during the compressor process. The breather valve consists of a body, breather valve, and a metallic filter material.

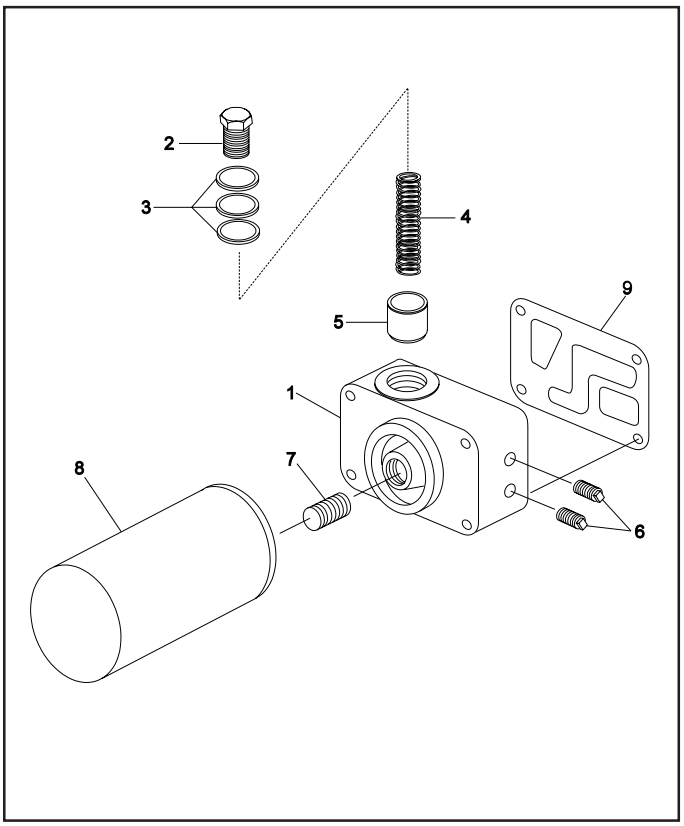



**Figure 6 - Spin-on Oil Filter and Valve**

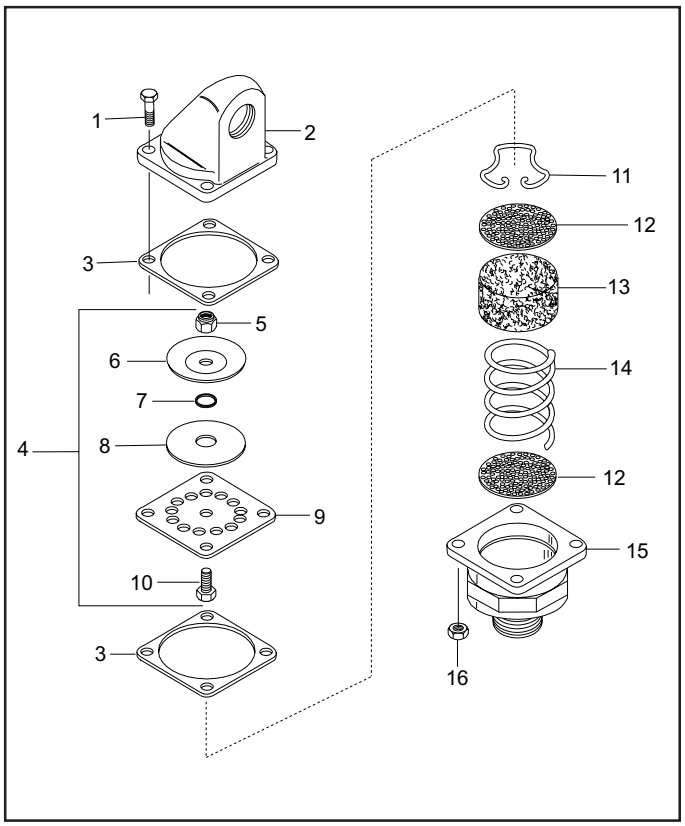



**Figure 7 - Crankcase Breather Valve**

## 2.11 INTERCOOLER & SAFETY VALVES

Reference Figures 8 & 9

The Intercooler is used to cool the air between the first and second stages of air compression. This is done by using the locomotives engine cooling water, which passes through the intercoolers internal passages, to remove the heat generated from the air being discharged from the low pressure cylinders.

A Drain Valve is provided at the bottom of the intercooler for drainage of condensate.

A Relief Valve set at 65 psig (448.2 kPa) is mounted on the intercooler for the purpose of limiting the pressure buildup in the intercooler.

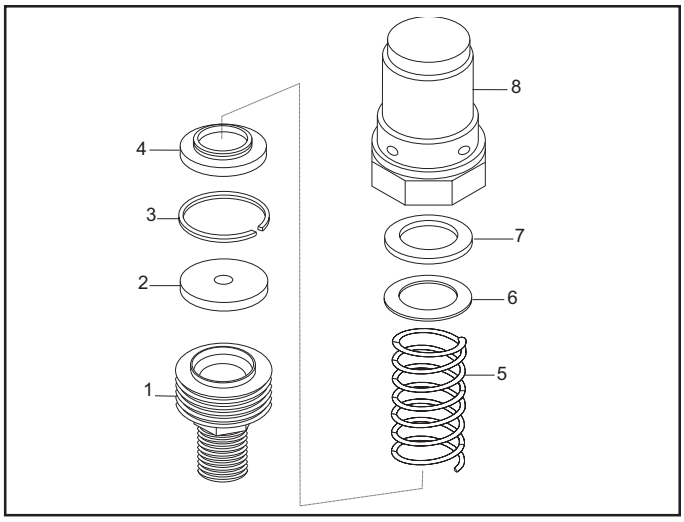



**Figure 8 - A-1 Intercooler Relief Valve Assembly**

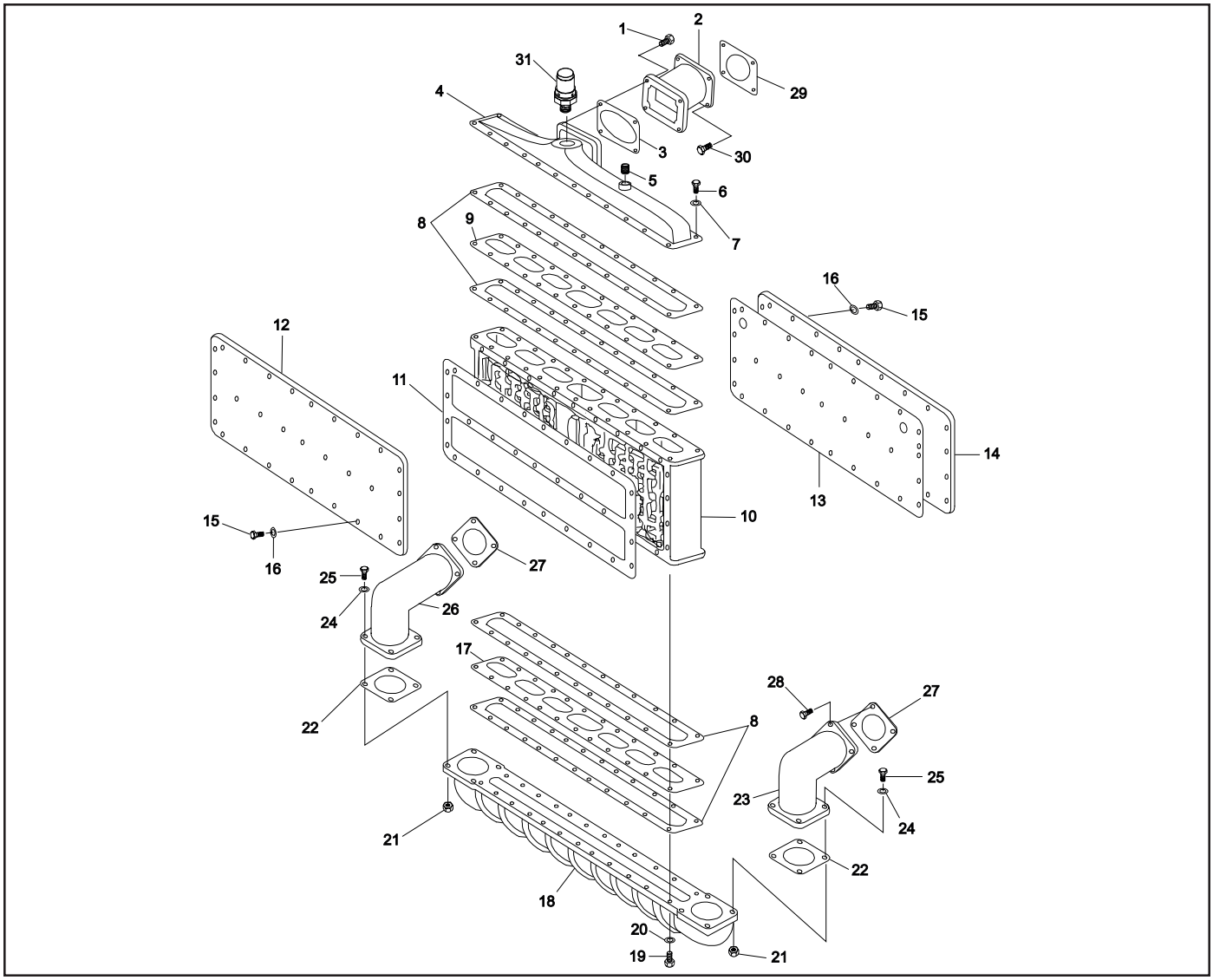



**Figure 9 - Intercooler Assembly**

## 3.0 OPERATION

**IMPORTANT:** The two low pressure cylinder heads when bolted to the larger of the three cylinders are to be fitted with Wabtec Corporation approved air intake filters mounted in the recommended position on the intake flanges.

Each low pressure cylinder discharges into the intercooler system which discharges into a manifold to supply air to the high pressure cylinder for the second stage of compression.

On the down stroke of the low pressure piston, air passes through the air intake filter from atmosphere into the chamber above the two inlet valves in the cylinder head. Partial vacuum created in the cylinder underneath the valve plates, by the downward stroke of the piston, permits atmospheric pressure above the inlet valves to overcome the resistance of a valve spring under the valve plates and forces the valve plate from its seat. Air then flows into the cylinder until the pressure above and below the valve plates are about equal, then the inlet valve is closed by its spring.

On the upward stroke of the low pressure piston, the air is compressed sufficiently to lift the discharge valves against the resistance of both the springs and intercooler pressure. The compressed air then passes through the discharge valve into the intercooler where it is cooled before it flows into the inlet side of the high pressure cylinder head.

The discharge valves are closed by their respective springs when the pressure above the valve becomes equal to pressure underneath.

The cycle of operation described for each low pressure cylinder is repeated in the high pressure cylinder. In this way, the intermediate intercooler pressure is raised to the second stage level which is slightly greater than main reservoir pressure. This main reservoir pressure **IS NOT TO** exceed 140 psig (965 kPa).

The compressor operates “loaded” until the buildup of main reservoir pressure increases to the cutout pressure setting of the compressor control switch or governor which may or may not be supplied by Wabtec Corporation. This setting should normally be 140 psig (965 kPa). At this point the compressor control switch or governor should function to direct air to the unloader line and unloaders.

Air requirements then reduce the main reservoir pressure to the cut-in pressure setting of the compressor control switch or governor and the cycle is again repeated. The cut-in pressure setting should be normally 130 psig (897 kPa).

**NOTE:** “Cut-In” pressure should be at least 10 to 15 psig (68.96 to 103 kPa) less than the “Cut-Out” pressure.

Air displaced in the crankcase during compression processes is discharged by way of the crankcase breather which provides a partial crankcase vacuum during normal operation.

## 4.0 DESIGNATIONS FOR 3-CYLINDER WATER COOLED TYPE COMPRESSORS

Typically Wabtec compressors are designated as follows:

**3-CWDL** where -
“3” = Total number of cylinders
“C” = Compound Compressor
“W” = Water Cooled
“D” = Direct Drive
“L” = Large Oil Capacity

## 5.0 SERIALIZATION

The 3-CWDL compressor is serialized according to the week, year and number of compressors built in that week.

**Example:** *05 04 18; This compressor was built in the fifth week of 2004 and was the eighteenth compressor assembled during the fifth week.*

## 6.0 GENERAL SPECIFICATIONS

## 6.1 3-CWDL TYPE COMPRESSORS

Reference Table 2

## 7.0 SAFETY PROCEDURES AND WARNINGS

Regular operating property and/or shop safety procedures must be followed when performing any work on a 3-CWDL Compressor.

The work area should be clean.

**⚠ WARNING: Extreme care must be taken when handling this device and its components and while performing the many tasks associated with its repair. It is of utmost importance that the workman read, understand and comply with the appropriate warnings listed below during maintenance procedure.**

**The use of an air jet, which must be less than 30 psig, to blow parts clean or to blow them dry after being cleaned with a solvent will cause particles of dirt and/or droplets of the cleaning solvent to be airborne. These conditions may cause skin and/or eye irritation.**

**When using an air jet do not direct it toward another person. Improper use of air jet could result in bodily injury.**

**Personal eye protection must be worn when performing any work on this device or its component parts to avoid any possible injury to the eyes.**

**The use of solvents as cleaning agents and the use of lubricants can involve health and/or safety hazards. The manufacturers of the solvents and lubricants should be contacted for safety data (such as OSHA Form OSHA 20 or its equivalent). The recommended precautions and procedures of the manufacturers should be followed.**

**When performing any test or work on devices or equipment while they are on the vehicle, special precautions must be taken to insure that vehicle movement will not occur which could result in injury to personnel and/or damage to equipment.**

**Assembly may be under a spring load, Exercise caution during disassembly so that no parts "Fly Out" and cause bodily injury.**

**All air supply and/or electric current to this device and/or to any components part must be cut-off before this device and/or any component part is removed from the equipment arrangement.**

**"Bottled" up air under pressure (even though air supply is cut-off) may cause gaskets and/or particles of dirt to become airborne and an increase in sound level when this device and/or any component part are removed from the equipment arrangement.**

**Personal eye and ear protection must be worn and care taken to avoid possible injury when performing any work on this device and/or component part.**

**When performing work where high temperature is involved, use insulated gloves.**

**To prevent receiving electrical shock when performing electrical test, hands must be clear of electrical components, contacts and housing and required "in-lab" grounding procedures must be strictly adhered to. A wooden workbench should be used. Failure to heed this WARNING could result in severe injury or death.**

**An adequate support or lifting device must be available to support the complete unit or its major components during removal, installation and maintenance procedures. Observe weight information stated throughout this repair procedure.**

## 8.0 CLEANING SOLVENTS & LUBRICANTS

## 8.1 CLEANING SOLVENTS

The solvent used to clean specified reusable metal parts **MUST BE** an aliphatic organic solution, such as mineral spirits that will dissolve oil or grease, and that will permit the parts to be cleaned without abrasion.

## 8.2 LUBRICANTS

**NOTE:** The following lubricants are required when working on the 3-CWDL compressor.

Number 2 Silicon Grease, Wabtec Corporation Specification M-7680-2.

Compressor Oil for Heavy Duty Compressors, for operations at ambient temperatures below +10° F (-12° C) ATSM Viscosity Grade Number SUS @ +10° F = 215 (ISO V.G. 46). Wabtec Corporation Specification M-7615-20. This oil shall be a high quality, solvent refined, paraffin base or suitable blend. Additives to inhibit foaming, rust, oxidation, and wear are required. DETERGENTS ARE NOT PERMISSIBLE. Anti-wear additives are recommended.

Compressor Oil for Heavy Duty Compressors, for operation at or above ambient temperature above +10° F (-12° C) ATSM Viscosity Grade Number SUS @ +10° F = 315 (ISO V.G. 68). Wabtec Corporation Specification M-7616-20. This oil shall be a high quality, solvent refined, paraffin base or suitable blend. Additives to inhibit foaming, rust, oxidation, and wear are required. DETERGENTS ARE NOT PERMISSIBLE. Anti-wear additives are recommended.

Compressor Oil for Heavy Duty Compressors, for high ambient temperatures operations at or above +125° F (52° C) ATSM Viscosity Grade Number SUS @ 100° F = 465 (ISO V.G. 100). Wabtec Corporation Specification M-7617. This oil shall be a high quality, solvent refined, paraffin base or suitable blend. Additives to inhibit foaming, rust, oxidation, and wear are required. DETERGENTS ARE NOT PERMISSIBLE. Anti-wear additives are recommended.

Mixing of compressor oil grades or manufacturers is to be avoided.

Ferocite #338 locknut lubricant or its equivalent.

## 9.0 PARTS CATALOG & REPLACEMENT PARTS

### 9.1 PARTS CATALOG

Current Parts Catalogs for the 3-CWDL compressor may be obtained through your Wabtec Corporation Representative or by writing to:

**Wabtec Corporation**
Wabco Locomotive Products
1001 Air Brake Ave.
Wilmerding, PA 15148-0001 USA

The Part Number and the Description of the particular Compressor **MUST BE** furnished when requesting a Parts Catalog. The compressor part number is typically found on a stenciled nameplate attached to the compressor crankcase.

Contents of the Parts Catalogs are subject to change, and it is the responsibility of the owner of the Compressor to obtain the current Parts Catalog.

### 9.2 REPLACEMENT PARTS

**IMPORTANT:** To obtain satisfactory operation of a 3-CWDL Compressor, **ONLY** replacement parts which are supplied by, or parts which are recommended in writing by the Wabtec Corporation are to be used in the maintenance of the particular device.

Replacement part numbers used in this publication cover parts that are available from the Wabtec Corporation.

When ordering replacement parts, give part number and descriptive part name to be sure that the desired parts is ordered.

Consult with your Wabtec Corporation Representative if any additional information is required on replacement parts.

Parts Catalogs are also available on Wabtec's web site **http://techinfo.wabtec.com/** by going directly to the "Technical Info" page.

### 9.3 TOOLS AND FIXTURES

Several drawings included in this publication cover certain tools and fixtures that may be made by others to facilitate proper removal and/or installation of detail parts. Wabtec Corporation assumes no responsibility for the construction and/or use of these tools/fixtures and shall not be held liable for bodily injuries or equipment damages.

## 10.0 MAINTENANCE SCHEDULE

⚠ **WARNING: It is recommended that the procedures listed in this maintenance schedule be performed at least once during the specified time period, or more frequently if service conditions so indicate. Failure to perform the procedures at the specified time period may result in damage to equipment which could possibly cause a malfunction that may result in property damage and/or bodily injury. Shorter maintenance intervals may be necessary, depending on the severity of the service to which the compressor is subjected. IT IS THE USER'S responsibility to determine if more frequent schedules for maintenance are required.**

**EVERY 3 MONTHS**

- Check crankcase oil and if necessary, add oil.
- Check oil pressure and if necessary, remove a shim washer to achieve desired pressure. Replace the Oil Relief Valve Assembly (Part No. 592389) if oil pressure can not be corrected by the removal of the shim (Fig. 6 item 3).

**EVERY 6 MONTHS**

- Check operation of unloaders.
- Check exterior of Intercooler Assembly and clean.
- Inspect, remove and blow clean and, if necessary, replace the compressor intake filters.

**EVERY 12 MONTHS**

- Change crankcase oil (Refer to Section 8.2). Clean interior of crankcase using a natural sponge and mineral spirits. After cleaning, dry the crankcase completely. Replace Oil Filter (Part No. 592286).
- Clean Oil Pump Strainer, Replace if necessary (Part No. 653722).
- Replace Compressor Intake Filters.

**EVERY 24 MONTHS**

- Replace or overhaul all Discharge Valves [Part No. 592409 (high pressure) and 592405 (low pressure)]. Replace or overhaul all Inlet Valves [Part No. 592410 (high pressure) and 592406 (low pressure)]. (The life of the Inlet Valves depends on the severity of service, available cooling air, oil passing rate of compressor, efficiency of inlet air filtration, etc. A two year valve change period is recommended by Wabtec Corporation. Individual operating conditions will have a strong influence on the valves life.)
- Clean and inspect unloader mechanism.
- Replace Crankcase Breather Valve (Part No. 575308).

**EVERY 36 MONTHS**

- Clean and inspect unloader mechanism.
- Renew valves.

**AT LEAST ONCE EVERY 4 YEARS (48 MONTHS)**

- The four year overhaul period is recommended for the compressor.

**IMPORTANT:** The four overhaul period represents the TIME PERIOD between overhauls that is recommended by Wabtec Corporation. The actual time of compressor operation or service before an overhaul is performed is heavily influenced by the type of service in which the compressor is used, the mileage of the locomotive between overhauls, the ambient temperature in which the compressor operates, the running speed of the compressor, oil change periods, the environmental conditions, and inlet air filtration.

The actual time periods between overhauls **MUST BE** established by the USER and should be based on USER conditions and experience.

The compressor is to be removed from the locomotive for regular overhaul utilizing genuine Wabtec replacement parts.

## 11.0 MAINTENANCE PROCEDURES

## 11.1 "ON-CAR" MAINTENANCE

**CAUTION:** During some of the following procedures, components may be very HOT. Care and proper precautions shall be taken to prevent burns or other bodily injuries.

**11.1.1** Check Oil Level

**11.1.2** Locate the oil level gage or dipstick. The oil level gage or dipstick is located on the opposite side of the spin-on oil filter.

**11.1.3** If the oil level gage is the float type gage, the oil level can be read directly from the float gage. If the oil level gage is the dipstick type gage, the oil level must be checked by removing the dipstick and reading the oil level measured on the dipstick.

**NOTE:** Either method can be checked while the compressor is running.

**11.1.4** Drain Condensate from Intercooler

**11.1.5** Locate the intercooler drain valve. The drain valve is located on the bottom of the intercooler assembly.

**11.1.6** Carefully open the drain valve and allow any condensate to drain from the intercooler.

**11.1.7** Once condensate has been drained close the drain valve.

**11.1.8** Change the Oil in the Compressor

**CAUTION:** Crankcase oil may be very HOT if the compressor was recently run.

**11.1.9** Locate the oil filler cap nut and remove.

**11.1.10** Locate the drain plug on the crankcase. The drain plug is located below the main bearing plate.

**11.1.11** Remove the drain plug and allow the crankcase oil to drain into a suitable drain pan.

**11.1.12** Remove the small side cover on the crankcase to allow access to the oil pump strainer.

**11.1.13** Clean the Oil Pump Screen

**11.1.14** Locate the screen assembly and remove the $^{5}/_{16}$" bolts and washers.

**11.1.15** Remove the oil screen gasket.

**11.1.16** Clean the oil screen assembly using mineral spirits and a lint free cloth.

**11.1.17** Using mineral spirits and a lint free cloth clean the interior of the crankcase.

**IMPORTANT:** Unapproved rags, paper towels and other "loose" materials should not be used when cleaning the interior of the crankcase as lint or debris can be left in the crankcase. Any lint or debris left in the crankcase can cause clogging of oil passages and eventual damage to the compressor.

**11.1.17** Apply a new gasket and reinstall the screen assembly and hardware.

**11.1.18** Reinstall the oil drain plug.

**11.1.19** Reinstall the side cover using a new side cover gasket.

**11.1.20** Remove the spin-on oil filter and discard.

**11.1.21** Apply a light coating of oil to the rubber seal on the new spin-on oil filter.

**11.1.22** Install the new oil filter.

**11.1.23** Refill the crankcase with approved oil through the oil filler.

**11.1.24** Reinstall the oil filler cap nut.

**11.1.25** Remove, Inspect and Replace Discharge Valves.

**11.1.26** Remove discharge valve cover and gasket.

**11.1.27** Remove the discharge valve and valve seat gasket located under the discharge valve.

**11.1.28** Inspect the valve and gaskets for any damage or excessive carbon buildup. Repair, clean or replace any parts as needed.

**11.1.29** Reinstall the discharge valve in reverse order.

**11.1.30** Remove, Inspect and Replace Inlet Valves

**11.1.31** Remove inlet cover clamp and gasket.

**11.1.32** Remove the inlet valve and valve seat gasket located under the inlet valve.

**11.1.33** Inspect the valve and gaskets for any damage or excessive carbon buildup. Repair, clean or replace any parts as needed.

**11.1.34** Reinstall the inlet valve in reverse order.

## 11.2 REMOVAL FROM LOCOMOTIVE

**⚠ WARNING: A lifting and support mechanism capable of safety handling 3000 pounds (1360.8 kilograms) is to be used during compressor removal.**

Apply locomotive handbrake and/or parking brake. All power to the compressor is to be cut-off. Wheel chocks are to be applied to the wheels to prevent vehicle movement. WARNING placards are to be placed on and about the vehicle indicating that work is to be performed.

**⚠ WARNING: Allow the compressor to cool to ambient temperature to minimize the risk of personal injury.**

**11.2.1** Disconnect the compressor crankshaft coupling and all auxiliary devices that may inhibit the removal of the compressor.

**⚠ WARNING: Make certain that all air pressure has been vented from the compressor intercooler and all associated piping prior to continuing.**

**11.2.2** Disconnect the unloader piping and the compressor discharge and vacuum lines from the compressor.

**11.2.3** Drain the oil from the compressor crankcase.

**11.2.4** Drain the cooling water from the compressor cylinders and intercooler.

**11.2.5** Remove the compressor from the locomotive following the builder and/or owner operating instructions. It is advisable to leave the mounting base shims in their respective positions, preferably by wiring them in place if the same compressor is to be reinstalled in the same locomotive from which it was removed. This will aid considerably in properly aligning the machine as well as saving considerable time and effort.

**11.2.6** Transport the removed compressor to the shop area for maintenance. The transporting mechanism must be able to support 3000 pounds (1360.8 kilograms).

**11.2.7** Installation of an overhauled or replacement compressor should be done in reverse order of removal following locomotive builder - owner/operator instructions.

**11.2.8** Remove all WARNING placards and wheel chocks before attempting to move the locomotive.

## 11.3 COMPONENT DISASSEMBLY

**NOTE:** The figures used throughout this publication are for illustrative purpose only. Actual components may vary slightly from those shown.

**IMPORTANT:** During the disassembly process discard all gaskets, cotter pins, lock nuts, and lock wires removed from the compressor.

The external surface of the unit **MUST BE** thoroughly cleaned before disassembly. Use a low pressure jet of clean, dry air to blow the surface clean.

⚠**WARNING: Protective clothing including eye protection should be worn during the cleaning of the compressor.**

**11.3.1** Crankshaft Coupling

To avoid damaging the crankshaft bearings, exercise care when removing or installing the crankshaft coupling half. If the couplings have a shrink fit on the shaft, quick heating of the coupling hub, while using a gear puller, will aid in the removal. When hydraulic removal feature is incorporated into the shaft or coupling, it should be used. Remove the coupling drive key if used.

**11.3.2** External Details

Remove the intercooler, intake filters, unloader tubing, crankcase breather, and side.

**IMPORTANT:** If the compressor is equipped with an oil level float gage, remove the gage before removing the side covers to prevent damage to the float lever.

**11.3.3** Cylinder Assemblies

**11.3.4** Remove the hex head cap screws from each cylinder head and then remove the head from each cylinder

**11.3.5** Remove the cylinder head gaskets and discard.

**IMPORTANT:** During disassembly, the location of all moving components (piston, wrist pin, connecting rod, bearing halves, and connecting rod cap) associated with each cylinder on the compressor should be recorded as it is recommended that these components be returned to their original position during reassembly.

**11.3.6** Remove the hex head cap screws from the base of each cylinder and then remove each cylinder from the crankcase.

**IMPORTANT:** Express care that the piston assembly does not fall against the rod.

**11.3.7** Remove and **SCRAP** all gaskets.

**IMPORTANT:** When removing the various gaskets CARE **MUST BE** TAKEN so that no damage is done to the machined metal surfaces. NO WIRE BRUSHES OR GRINDING TOOLS ARE TO BE USED WHEN REMOVING THE GASKETS. The proper and careful use of a putty knife or an air chisel is permissible. Appropriate procedures, in accordance with the instructions of the owner/maintainer of the compressor are to be followed in the disposal of gasket material removed during the tear down.

**11.3.8** Remove the connecting rod caps, and then remove the connecting rod and piston assemblies.

**IMPORTANT:** The connecting rod caps and the associated connecting rod work together as a “matched” set of parts. KEEP THE CONNECTING ROD CAPS WITH THEIR MATING CONNECTING ROD AT ALL TIMES. Remove piston from connecting rod. Scrap the rings.

**11.3.9** Crankcase Disassembly

**11.3.10** Remove the oil pump assembly and gasket from the interior of the crankcase.

**IMPORTANT:** The following procedure must be strictly adhered to in order to prevent damage to the main bearings. Damage to the main bearings that go undetected can cause short compressor life and can result in spontaneous machine failure that could result in bodily injury.

**11.3.11** Remove the crankshaft key from the end of the crankshaft.

**11.3.12** Remove the oil seal and housing in the following manner: Drill four 0.125" diameter (3.175 mm) holes on the outside shield of the oil seal. Insert four self-tapping metal screws into the shield, then using the screws as gripping points, pry out the seal. Certain types of nail pullers have been found satisfactory for this purpose. Scrap the oil seal.

**11.3.13** Remove the retaining ring and oil introducing ring from the bearing plate.

**11.3.14** Remove the hex head cap screws that secure the bearing plate to the crankcase.

**11.3.15** Place the crankcase so that the axis of the crankshaft is vertical and the main bearing plate is facing upward.

**11.3.16** Remove the hex head cap screws that secure the main bearing plate to the crankcase.

**11.3.17** Remove the crankshaft.

⚠**WARNING: A lifting mechanism capable of safely handling a minimum of 400 pounds (181.4 kilograms) is to be used during crankshaft removal and installation.**

**11.3.18** Cylinder Heads

**11.3.19** Inlet Valves

**11.3.20** Remove inlet cover clamp and gasket.

**11.3.21** Remove the inlet valve and valve seat gasket located under the inlet valve.

**11.3.22** Discharge Valves

**11.3.23** Remove discharge valve cover and gasket.

**11.3.24** Remove the discharge valve and valve seat gasket located under the discharge valve.

**11.3.25** Oil Pump Assembly

**11.3.26** Remove the oil pump screen assembly (Figure 5-10) from the oil pump body (Figure 5-1).

**11.3.27** Remove the oil pump (Figure 5-6) from the oil pump body (Figure 5-1).

**11.3.28** Oil Pressure Relief Valve

**11.3.29** Carefully remove the pressure adjusting cap (Figure 6-2) and shims (Figure 6-3) from the oil relief valve body (Figure 6-1).

⚠**WARNING: Care must be exercised when removing the pressure adjusting cap as the contents of the valve assembly are spring loaded.**

**11.3.30** Remove spring (Figure 6-4) and pressure relief valve (Figure 6-5).

## 12.0 CLEANING

Clean all other serviceable metal parts to facilitate inspection. After the parts have been cleaned, they **MUST BE** completely dried. Use a low pressure jet of clean, dry air to blow the parts dry.

Make certain that all drilled oil passages in connecting rods, crankshaft, etc. are clean and free of obstructions.

**IMPORTANT:** ALL gaskets, rubber parts, self-locking hardware and cotter pins are to be SCRAPPED. Only NEW Wabtec Corporation parts are to be used in place of the scrapped parts during the assembly procedure to permit the best fit and performance.

Springs may be wire brushed to assist in the removal of dirt and scaly deposits.

## 13.0 CONDEMNING LIMITS

Reference Table 1

"Table 1" includes minimum and maximum condemning limits as applied to all main wearing parts for the 3-CWDL Compressor.

**IMPORTANT:** The dimensions given in "Table 1" are based on the use of parts supplied by the Wabtec Corporation.

## 14.0 REPAIR

## 14.1 CYLINDERS

**14.1.1** Replace any cylinder that is found to be damaged beyond repair.

**14.1.2** All reusable cylinders should be refinished, preferably by honing, to eliminate any irregularities on cylinder walls. The finish on the cylinder walls after refinishing **MUST BE** between 25 and 40 microinches (0.64 and 1.016 micro meters). The crosshatch hone marks should be 25° to 35° from the horizontal for both the low pressure and the high pressure cylinders.

If the cylinder is not within the limits specified in "Table 1", the cylinder may be remanufactured. Consult your Wabtec Corporation Representative for information on remanufacturing the cylinders.

**14.1.3** Also, the mounting flange on the cylinder must be perpendicular to the bore within 0.002" (0.050 mm) T.I.R. (Total Indicator Reading) as determined by the dial indicator reading.

If the mounting flange face is not perpendicular, it may be corrected by removing the least possible amount of metal from the face of the flange while maintaining the same setting with which the cylinder was bored. Minimum cylinder lengths are specified in "Table 1".

## 14.2 PISTONS

If a piston is broken or contains excessive scuff marks and falls outside the condemning limits shown in Table 1, replace the piston. Minor scuffs and scratches can be smoothed or rounded with a file.

**14.2.1** Low Pressure Pistons

**14.2.2** The low pressure pistons have removable bushings that can be replaced if worn. Replace the old bushing with a new bushing (Part No. 592204).

Replacing the bushing requires either the bushing to be cooled with liquid nitrogen and dropped into the piston at room temperature or cool the bushing with dry ice and heat the piston to 200°F - 300°F (90°C - 150°C).

**14.2.3** High Pressure Pistons

**14.2.4** The high pressure piston has removable roller bearings (Part No. 592305) that are held in place with retaining rings.

Before removing the bearings, support the piston on the bearing removal fixture (See Figure 10). Use a $2^{1}/_{32}$" (51 mm) diameter driving tool to remove the old roller bearings.

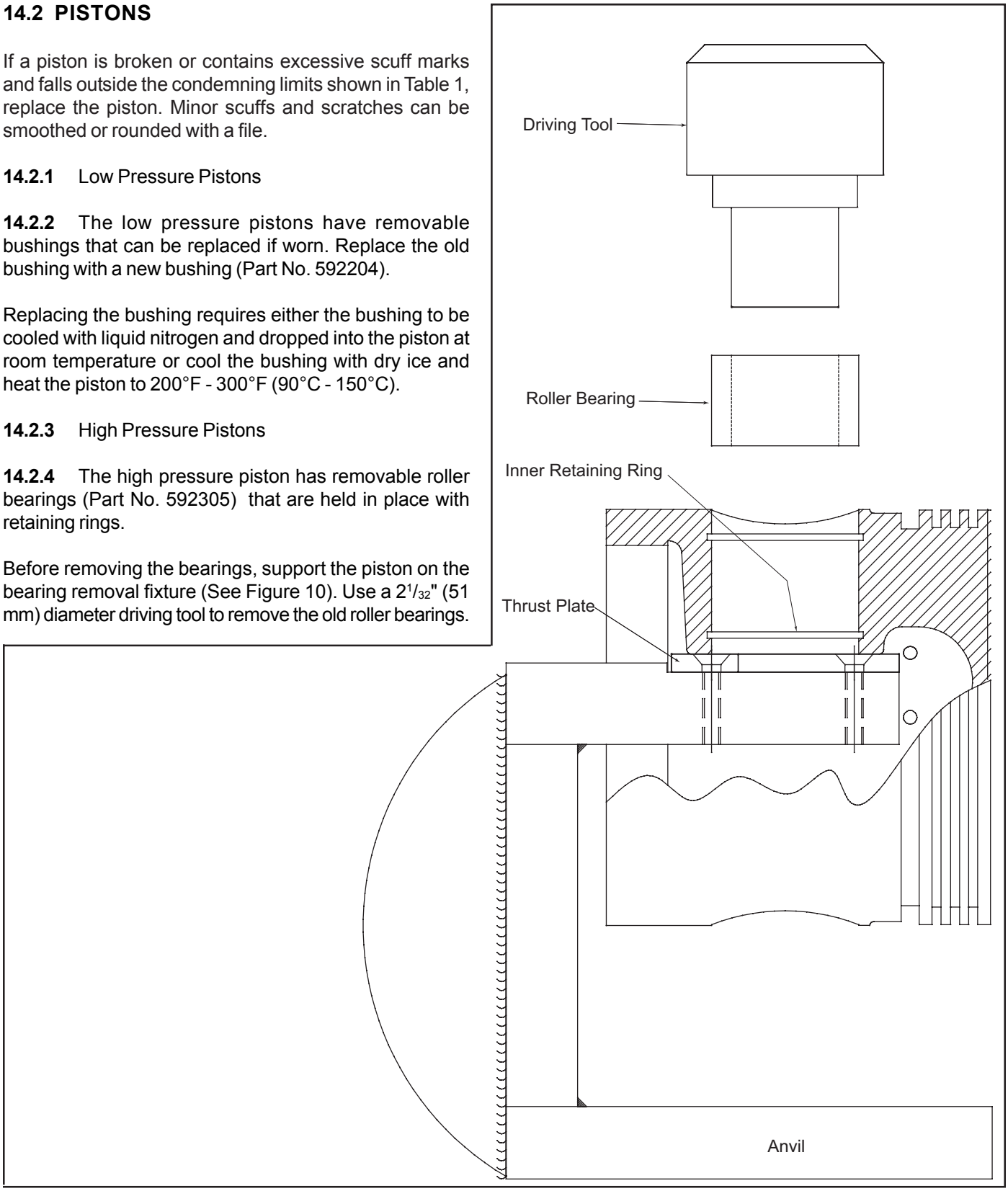



**Figure 10 - Bearing Removal Fixture**

## 14.3 PISTON RINGS

Reference Figure 11

**14.3.1** During any major overhaul or repair, new piston rings are to be installed on the piston using a suitable piston ring installation tool.

New standard rings are:

- H.P. Compression, (Part No. 592378)
- H.P. Oil, (Part No. 592382)
- L.P. Compression, (Part No. 592376)
- L.P. Oil, (Part No. 592380)

**14.3.2** The rings should be expanded just enough to clear the piston. Care must be exercised when installing the piston rings to prevent breakage or distortion. The position of the piston rings is shown in Figure 11. Consult your Wabtec Corporation Representative for information on the correct piston rings for specific applications.

**14.3.3** When the piston rings have been properly installed, measure the ring side clearance using the appropriate feeler gage and not that the side clearance is within the specified limits. If the side clearance is beyond the specified limits, excessive oil passage may occur.

**14.3.4** Using the appropriate feeler gage, measure the gap of each piston ring and note this measurement is within the specified limits. If the piston ring gap is beyond the specified limits, piston seizure or cylinder scoring may result.

**IMPORTANT:** Make certain that the piston ring gaps are not in a line as this may cause excessive oil passage.

## 14.4 CRANKCASE

**14.4.1** Replace the crankcase if it is cracked, broken or otherwise damaged beyond repair.

**14.4.2** If the main bearing bores are eccentric or worn more than 0.002 inches (0.050 mm), they may be rebushed using a repair bushing. Consult your Wabtec Corporation Representative for information on the replacement bushings.

## 14.5 MAIN BEARING END PLATE

**14.5.1** Replace the main bearing end plate if it is cracked, broken, exceeds condemning limits established in Table 1 or otherwise damaged beyond repair.

## 14.6 MAIN BEARING COVER PLATE

**14.6.1** Replace the main bearing cover plate if it is cracked, exceeds condemning limits established in Table 1 or otherwise damaged beyond repair.

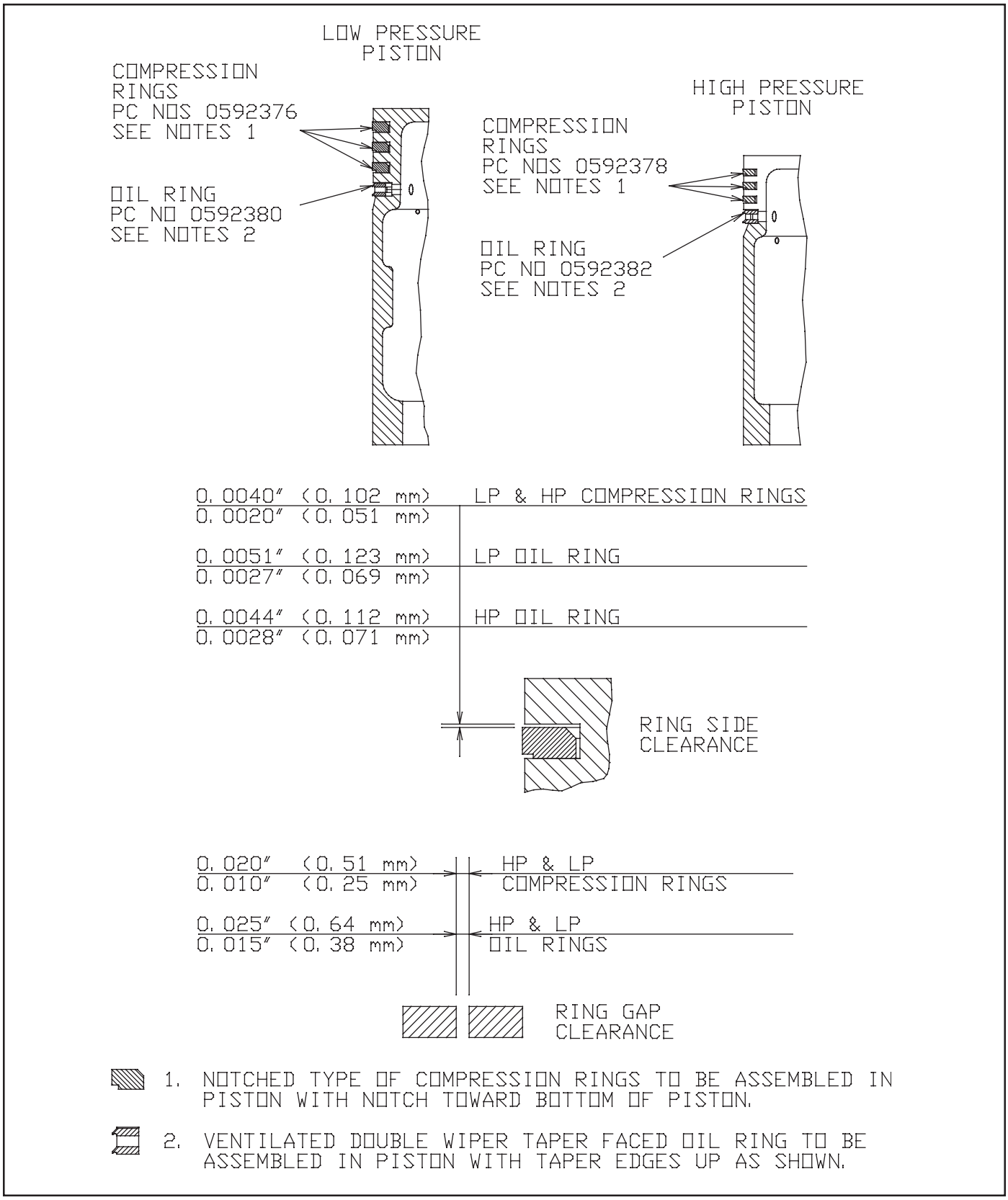



**Figure 11 - Piston Ring Identification & Installation Instructions**

## 14.7 CRANKSHAFT

Reference Figure 12

**14.7.1** Replace the crankshaft if an accurate and complete check reveals any of the following defects:

**14.7.2** Bent more than 0.002" maximum or cracked.

**14.7.3** Crankpin is at condemning limit or beyond the condemning limit, as listed in “Table 1”.

**14.7.4** Main bearing journal worn to less than condemning limit as listed in “Table 1”.

**14.7.5** Taper or threads damaged to the extent of not being suitable for reconditioning.

**14.7.6** Keyway damaged beyond repair.

**14.7.7** The crankshaft should be checked for alignment as follows:

**14.7.8** Make sure the centering holes located on the ends of the crankshaft are clean and true.

**14.7.9** Place the crankshaft in a checking device similar to the one shown in Figure 12 and make sure the crankshaft is running true.

**14.7.10** Check the crankshaft for proper alignment. If the requirements are not met, the crankshaft must be replaced.

**14.7.11** During major overhaul always replace the main bearings using NEW Wabtec main bearings, Part No. 592272.

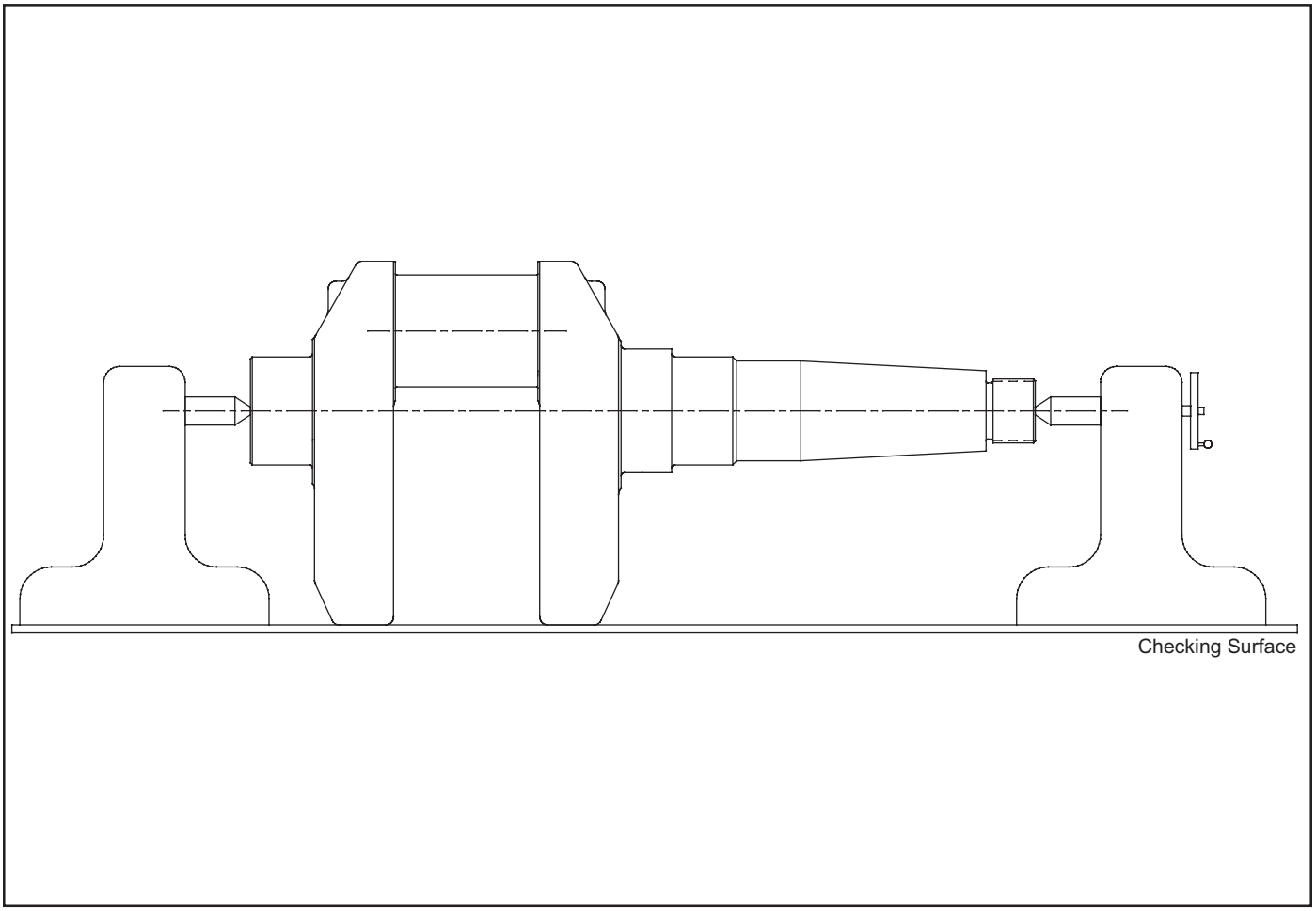



**Figure 12 - Crankshaft Undersize Dimensions & Alignment Specifications**

## 14.8 CONNECTING RODS

Reference Figure 13

**14.8.1** The connecting rod must be visually inspected before removing the insert bearing and connecting rod bushing. The satisfactory alignment of the connecting rod will be reflected by the wear patterns. If the wear pattern is straight across the bearing, no further action is required.

**14.8.2** Procedure for Checking Alignment of Connecting Rod

**14.8.3** If during a visual inspection of the used insert bearings reveal an uneven wear pattern, check the alignment.

**14.8.4** With the piston removed from the connecting rod, insert the wrist pin into the connecting rod at the wrist pin end. Insert a similar diameter pin of the correct size into the crankpin end of the connecting rod and tighten the connecting rod cap securely to the pin with 100 to 150 foot-pounds torque (135.1 to 202.7 Nm.) for castle nuts.

**14.8.5** Place the pin at the crankpin end of the connecting rod between a pair of "V" blocks on a flat checking surface as shown in Figure 13. With the connecting rod perpendicular to the checking surface, check the distance from the checking surface to the highest point at both ends of the wrist pin. This check should be made with a dial indicator. The reading from the checking surface to both ends of the wrist pin **MUST BE** within 0.001" (0.025 mm) for every 6" (152.4 mm) length of wrist pin.

**14.8.6** Turn the wrist pin end of the connecting rod downward until the connecting rod is horizontal to the checking surface. With the connecting rod in this position, check the distance from the checking surface to the highest point at both ends of the wrist pin. This check should be made with a dial indicator. The readings from the checking surface to both ends of the wrist pin **MUST BE** within 0.001" (0.025 mm) for every 6" (152.4 mm) length of wrist pin.

**14.8.7** Connecting Rod to Crankpin Fit

**14.8.8** The fit of the connecting rod on the crankpin is designed for insert bearings made to specifications of the Wabtec Corporation. Always use NEW insert bearings for wear adjustments. Cover the crankpin with a film of oil before placing the connecting rod and cap in place. Always use new insert bearings (Part No. 592200).

**14.8.9** Connecting rod caps **MUST BE** fitted with bolt (Part No. 592208), castle nut (Part No. 68770), and cotter pin (Part No. 522772), which are available from the Wabtec Corporation. The correct torquing method is to torque the castle nuts evenly to 100 foot-pounds (135.1 Nm.); then continue torquing the nuts until the new cotter pin can be inserted through the slot in the nuts and drilled hole in the bolts.

**CAUTION:** DO NOT EXCEED 150 foot-pounds (202 Nm.) torque.

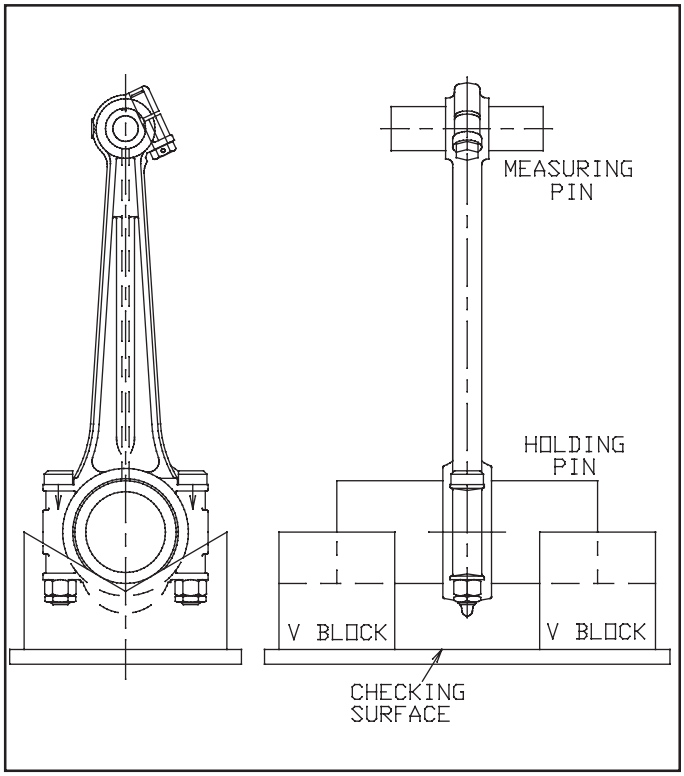



**Figure 13 - Connecting Rod Arrangement for Checking Alignment**

## 14.9 OIL PUMP

**14.9.1** Prior to disassembling the oil pump, inspect the exterior of the pump for any signs of wear or damage.

**14.9.2** Remove the oil pump (Figure 5-6) from the oil pump body (Figure 5-1). Check the oil pump drive gear (Figure 5-9) end play. The end play should be between 0.001 and 0.004 inches. Adjust lock nut if necessary.

**14.9.3** Check the oil pump and oil pump drive gear interface key and slot for excess wear or damage. Replace if necessary.

## 14.10 OIL LEVEL GAGE - FLOAT TYPE

**14.10.1** The Oil Level Gage **MUST BE** inspected to determine whether it is working properly. Replace the complete assembly if worn, broken or inoperative.

**14.10.2** A New Oil Level Gage Dipstick can be used as a replacement for the Float Type Oil Level Gages without modification to the compressor crankcase.

**14.10.3** Consult your Wabtec Corporation Representative for ordering and/or specific installation information concerning the Oil Level Gage Dipsticks.

## 14.11 MAIN BEARINGS

The main bearings **MUST BE** washed in aliphatic solvents (mineral spirits), completely dried by blowing with a low pressure jet of clean, dry air, and then examined carefully. If worn, pitted, damaged, or otherwise unserviceable, the bearing(s) **MUST BE** replaced.

If there is any question as to whether the bearing is serviceable or not, it is to be replaced. If a careful examination reveals that the bearing is in serviceable condition, the bearing is to be lubricated with oil immediately after examination and then wrapped in Volatile Corrosion Inhibitor (VCI) paper.

## 14.12 CYLINDER HEADS AND VALVES

**14.12.1** Cylinder Heads

**14.12.2** All cylinder heads can be reused provided they are not damaged. If cracked, cut, broken, excessively worn, or damaged in any way, the head is to be SCRAPPED and replaced with a NEW Wabtec Corporation part.

**14.12.3** Use a caustic type cleaner or other suitable cleaning solution that is capable of removing attached carbon.

**14.12.4** After the cylinder heads have been cleaned, they **MUST BE** dried completely. Use a low pressure jet of clean dry air to blow the cylinder heads dry.

**14.12.5** Valve seats must be visually inspected for nicks and cracks.

**14.12.6** Valves

**14.12.7** Valve parts, except valve gaskets, may be reused if they are in a serviceable condition or have been adequately repaired.

## 14.13 UNLOADER

Reference Figure 14

**14.13.1** After disassembling and cleaning the unloader valve parts with mineral spirits and drying them completely by blowing with a jet of clean, dry air, inspect the unloader valve and valve seat for any nicks and grooves that can affect the sealing surface.

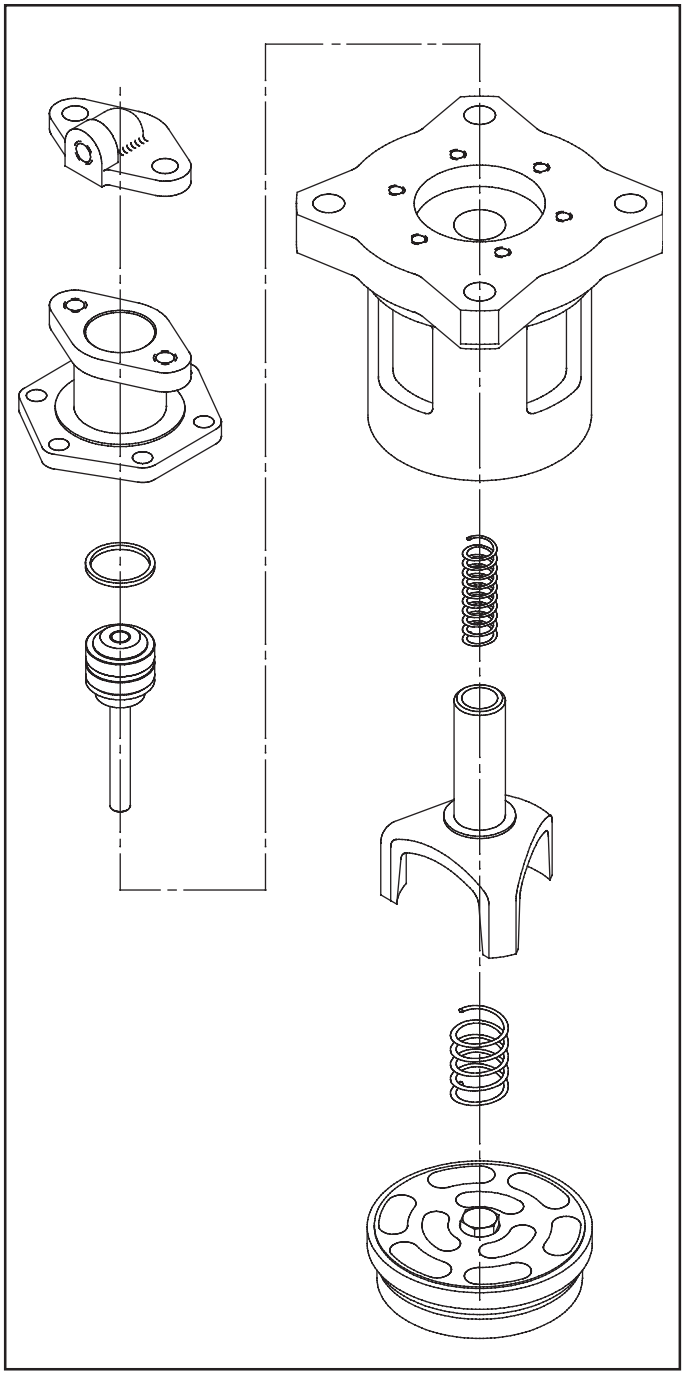


**Figure 14 - Unloader Assembly**

## 14.14 INTERCOOLER

**IMPORTANT:** New gaskets should be used when reassembling the intercooler.

**14.14.1** Disassemble the side plates from the main body of the intercooler.

**14.14.2** Remove and **SCRAP** all gaskets.

**14.14.3** Clean the Intercooler inside and out using an inhibited alkaline cleaner or solvent and water to remove any oil film and accumulated dirt. Thoroughly flush with hot water and blow dry.

**14.14.4** Test the intercooler assembly to verify that there are not any leaks, by attaching a test fitting and blanking pad. Apply 50 psi air pressure to test fitting and submerge assembly into a water tank.

## 14.15 SAFETY VALVES

**14.15.1** The safety valves used on the intercooler must be tested in accordance with the following Wabtec Corporation Test Specifications.

A-1 Intercooler Relief Valve set at 65 psig Part No. 564072-0065 Wabtec Corporation Test Specification T-2625-0.

## 14.16 CRANKCASE BREATHER

The metallic filter (Part No. 540223) in the crankcase breather must be replaced to avoid disintegration due to fatigue. The breather valve diaphragm (Part No. 575308) must also be replaced. All other breather parts must be replaced if necessary.

## 14.17 TORQUE VALUES

The following torque limits are recommended when tightening the nuts and bolts on the compressor:

**TORQUE VALUES CHART**

| Part | Torque |
|---|---|
| 5/8" bolts & nuts | 90 ft.-lbs. (122.94 Nm.) |
| 1/2" bolts & nuts | 50 ft.-lbs. (67.9 Nm.) |
| 3/8" bolts & nuts | 20 ft.-lbs. (27.12 Nm.) |
| 5/16" bolts & nuts | 11 ft.-lbs. (14.91 Nm.) |
| 1/4" bolts & nuts | 5.5 ft.-lbs. (7.45 Nm.) |
| Connecting Rod Castle Nuts | 100 - 150 ft.-lbs. (135.6 - 203.4 Nm.) |
| Coupling Nut | 500 ft.-lbs. (678 Nm.) |

## 15.0 ASSEMBLY

**NOTE:** The following procedures describe the process of completely reassembling an entire compressor following an overhaul. For specific individual component assembly procedures please refer directly to the section regarding the component of interest.

## 15.1 CRANKSHAFT

**15.1.1** Install the main bearings (Figure 3-4) and oil pump drive gear (Figure 3-3) onto the crankshaft (Figure 4-1) by heating the bearings to a temperature of 190°F (88°C) in an oil bath or dry oven. Allow the assembly to cool before continuing.

⚠**WARNING: Insulated gloves must be worn and extreme care taken to prevent burns to hands, face, and other parts of body from hot bearings.**

## 15.2 MAIN BEARING PLATE & CRANKCASE

**15.2.1** Press the main bearing cup into the main bearing plate.

**15.2.2** Place the crankcase in a vertical position with the face of the main bearing housing upward.

**15.2.3** Press the second main bearing cup into the pump side of the crankcase.

**15.2.4** Apply a lifting device to the crankshaft. Lower the crankshaft (oil drive gear end) into the crankcase until the main bearing seats in its bore inside the crankcase.

**IMPORTANT:** In order to minimize the possibility of damaging the main bearing and crankcase during the crankshaft reassembly, the crankshaft must remain in a vertical line with respect to the crankcase at all times.

**15.2.5** Place main bearing plate gasket (Figure 3-17) onto the crankcase (Figure 3-1). Bolt the main bearing plate to the crankcase using eight cap screws.

**15.2.6** Rotate the crankcase assembly to the normal upright position.

**15.2.7** Place a bearing plate gasket onto the crankcase. Install 6 of each shims (Figure 4-19) over the gasket. Place another bearing plate gasket over the shims.

**15.2.8** Bolt the main bearing plate (Figure 4-14) to the crankcase.

**15.2.9** Adjust the amount of shims applied in step 15.2.7 so that the crankshaft axial end play is between 0.008 to 0.013 inches.

**15.2.10** The crankshaft must rotate freely before continuing with the assembling procedure.

## 15.3 OIL INTRODUCING RING

**15.3.1** Install o-rings (Figure 4-9) onto the oil introducing ring (Figure 4-10). Insert the oil introducing ring into the bearing plate (Figure 4-14) and tighten the set screw (Figure 4-17) in the bearing plate.

**15.3.2** Install the oil introducing retaining ring.

## 15.4 OIL SEAL

**NOTE:** When installing the oil seal, care must be exercised to insure that the seal is not damaged by the keyway or shoulder of the crankshaft.

**15.4.1** Prior to installing an oil seal on a shaft, the seal should be “stretched” by first installing it over a 3.25" (82.55 mm) pre-assembly cone. This will help prevent damage occurred when assembling over keyways and shoulders.

**15.4.2** After “stretching” the seal, place the seal over the shaft by hand. Move the seal into position at the bearing plate bore. With the seal O.D. against the bearing plate bore, place the tool over the crankshaft until it contacts the oil seal and tap the tool until the oil seal is $^1/_8$" below the outside machined surface of the bearing plate.

## 15.5 OIL PUMP

**15.5.1** Install the oil pump assembly into the crankcase using a new oil pump gasket (Figure 5-16). Make sure the helical gear meshes between the crankshaft and the oil pump.

## 15.6 CYLINDERS & PISTON ASSEMBLY

**15.6.1** Apply a liberal amount of oil to all mating parts before assembly.

**15.6.2** Mount the low pressure cylinders to the crankcase using (2-2) new low pressure cylinder gaskets (Part No. 592244) and (2-1) new baffle plate (Part No. 592381) as shown in Figure 2. Install the high pressure cylinder using (2-1) new high pressure cylinder gasket, (Part No. 592244).

**15.6.3** The rings are installed as shown in Figure 11. Make certain the piston ring gaps are not aligned. Using the proper ring compressor tool, lower the piston - connecting rod assembly into the cylinder.

Care must be taken when lowering the piston assembly into the cylinder so as not to damage the piston rings, cylinders and the crankpin of the crankshaft. See Figure 16 for low and high pressure ring compressor tools.

When placing the connecting rod caps in position for assembling, make certain that the lettering stenciled on the cap agrees with the stenciling on the rod as the rod and cap are machined as a matched set. Cover the crankpin with a film of oil before placing the connecting rod and the cap in place. Install new insert bearing set (Part No. 592200) in the rod and cap before assembling the crankshaft.

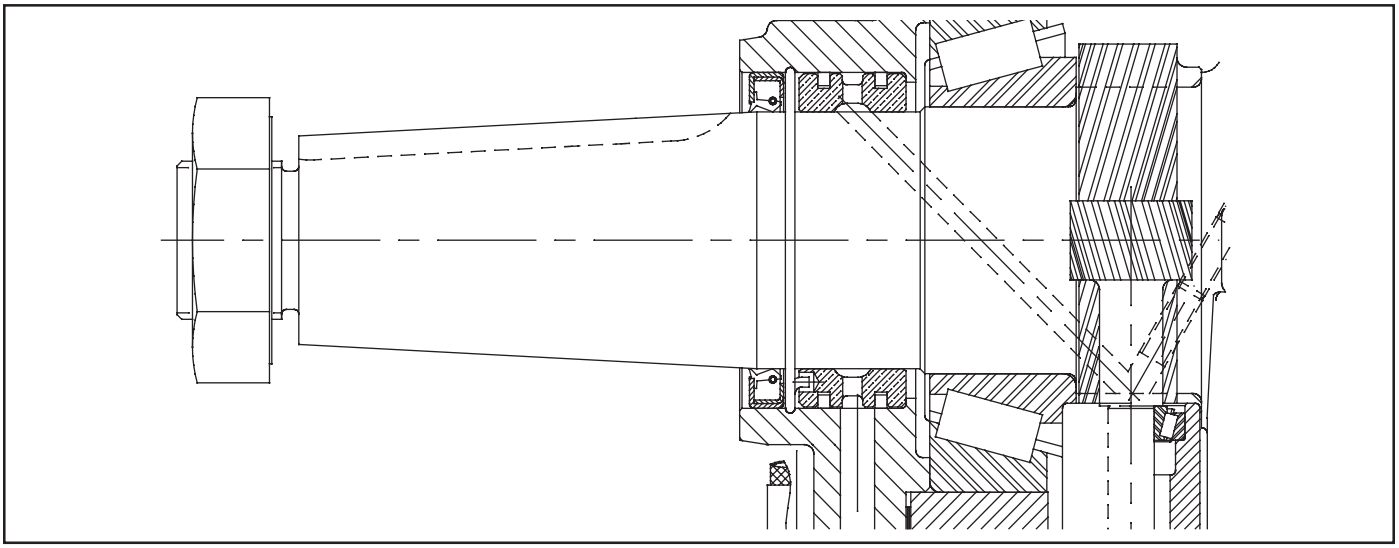


**Figure 15 - Oil Seal Installation**

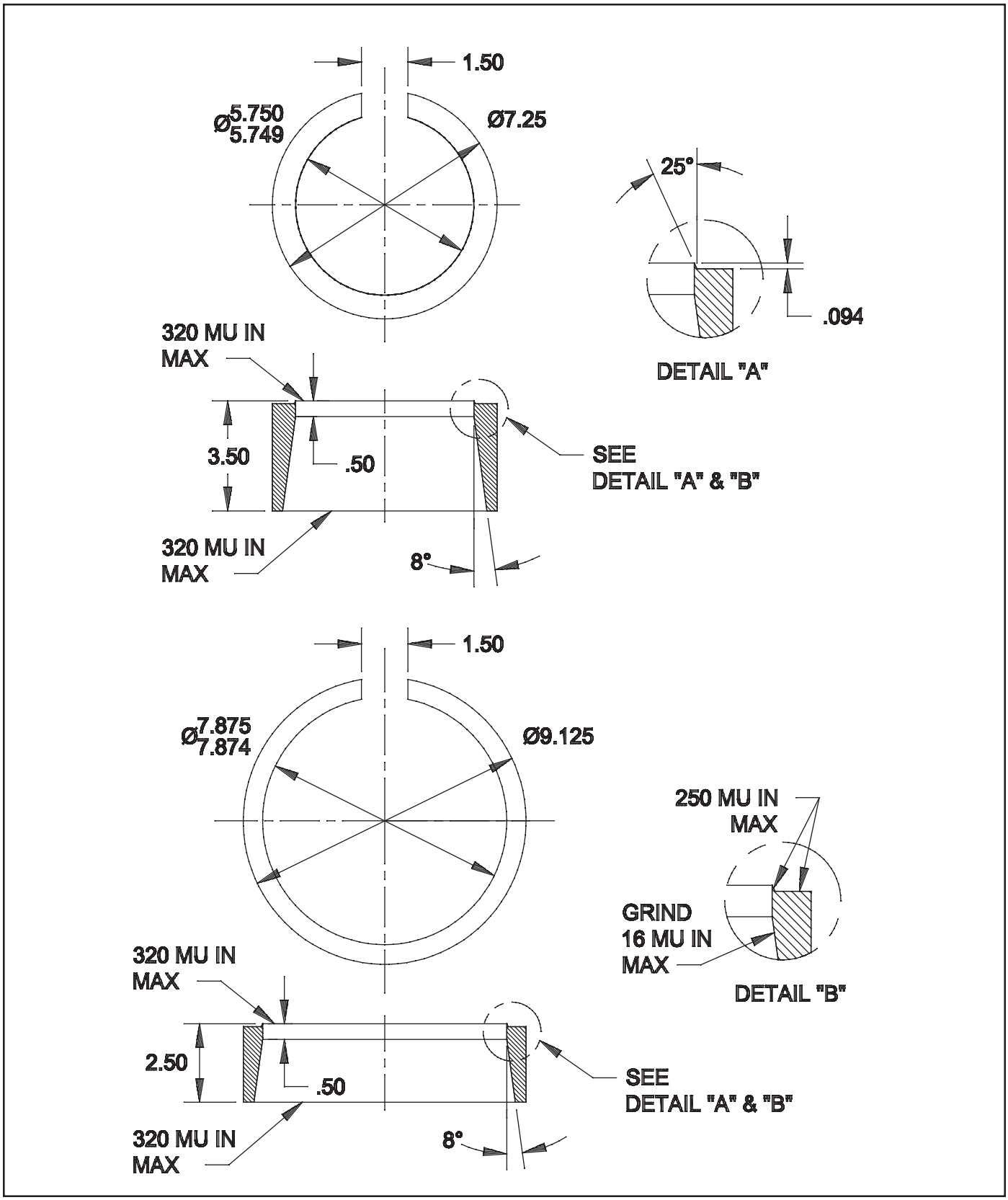



**Figure 16 - Low & High Pressure Piston Rings**

**IMPORTANT:** The connecting rod bolt and nut must be tightened according to the following procedure: Torque the castle nuts evenly to 100 ft.-lbs. (135.1 Nm.); then continue torquing the nuts until a new cotter pin (Part No. 522772), can be inserted through the slot in the nut and the drilled hole in the bolt.

**CAUTION:** DO NOT EXCEED 150 foot-pounds (202 Nm.) torque. Observe that the compressor crankshaft turns freely after all of the connecting rod bolts have been torqued and the piston doesn't extend above the cylinder.

## 15.7 HIGH PRESSURE CYLINDER HEAD ASSEMBLY

**15.7.1** Pre-assemble the high pressure cylinder head per Figure 4 before installing onto cylinder.

**15.7.2** Install the inlet and discharge valves in the heads using new copper valve gaskets (Part No. 592225).

**15.7.3** Apply anti seize compound to both sides of the gasket.

**15.7.4** Assemble the high pressure cylinder head onto the cylinder using a new gasket (Part No. 592249).

**15.7.5** Connect the unloader tubing to the heads to complete the assembly.

## 15.8 LOW PRESSURE CYLINDER HEAD ASSEMBLY

**15.8.1** Pre-assemble the low pressure cylinder head per Figure 1 before installing onto cylinder.

**15.8.2** Install the inlet and discharge valves in the heads using new copper valve gaskets (Part No. 592223). Apply anti seize compound to both sides of the gasket.

**15.8.3** Assemble the low pressure cylinder head onto the cylinder using a new gasket (Part No. 592250).

## 15.9 SIDE COVERS

**15.9.1** Install (3-2) NEW side cover gaskets (Part No. 592248 and 592247). Install the plain side covers using the $^{3}/_{8}$ x $^{7}/_{8}$" hex head cap screw (Part No. 587539). Install the side cover with the oil fill elbow, dipstick or oil level float gage using the $^{3}/_{8}$ x $^{7}/_{8}$" hex head cap screw (Part No. 587539) and $^{3}/_{8}$ x 2" hex head cap screw (Part No. 584542). Take care not to bend the oil level float gage on compressors so equipped.

## 15.10 INTERCOOLER

**NOTE:** Care must be taken when trying to install the intercooler assembly. Use appropriate lifting device when installing the intercooler.

**15.10.1** Install new flange gasket (Part No. 592242) between the low pressure cylinder head and intercooler. Finger tighten $^{1}/_{2}$" x $1^{1}/_{8}$" hex screws (Part No. 592423).

**15.10.2** Install the intercooler assembly via the high pressure head connector using a new flange gasket (Part No. 592243) and $^{1}/_{2}$" x $1^{1}/_{8}$" hex screws (Part No. 0592423). Tighten finger tight.

**15.10.3** Torque all connections to 50 ft.-lbs. (67.9 Nm.) beginning at the high pressure head connector and working towards the low pressure elbows.

**15.10.4** Install relief valve into tapped hole in the center of the intercooler discharge manifold.

## 16.0 WEAR-IN AND TESTS

**16.1** Compressors which have been reconditioned and have undergone major repairs such as covered by the preceding instructions must be subjected to a reasonable wear-in period.

**16.2** The compressor, after being properly and completely assembled with Wabtec Corporation APPROVED AIR INLET FILTERS and with the crankcase filled the appropriate lubricating oil for the anticipated operating conditions, see paragraph 8.2, should be placed on a suitable test stand. This test stand should be equipped with a motor of sufficient horsepower (See General Specifications in Table 2) preferably of the variable speed type, to which the compressor can be mechanically coupled.

**16.3** During the entire breaking-in period, the air filters must be in position to prevent damage due to entrance of foreign particles.

**16.4** With the compressor arranged on the test stand, make the connection from the compressor discharge port to the pressure reservoir. With the globe valve open and the $^{17}/_{64}$" (6.746 mm) orifice disc (Part No. 520439), in the orifice holder, operate the compressor according to the wear in schedule shown in Table 3.

**16.5 WEAR-IN SCHEDULE**
Reference the Wear-In Schedule in Table 3

**16.6** The oil pressure should be checked at frequent intervals during the test run and must never be less than 15 psig (103.42 kPa) at any of the above test speeds. Install a test gage in the tapped hole provided in the oil relief valve body.

**16.7** Remove test gage at completion of tests and replace proper pipe plug.

**16.8** If any parts such as pistons, cylinders, rings, wrist pins, connecting rods or bearings are replaced, all tests must be repeated.

## 17.0 COMPRESSOR CAPACITY TEST

Reference Figure 17

**17.1** After the compressor is completely reassembled, it must be operated again at maximum speed and pressure for a period of not less than one-half hour against 100 psig (689.47 kPa) to regain its normal operating temperature.

**17.2** The capacity test should then be made in accordance with the arrangement for testing as shown in Wabtec Corporation Test Specification T-4050-D.

## 18.0 INSTALLATION & ALIGNMENT OF COMPRESSOR WITH DIESEL ENGINE

**18.1** Installation of a new compressor or one being installed after overhauling requires careful consideration as regards proper alignment with the diesel engine when direct mechanical drive is involved. Regardless of the effort being made in properly repairing or rebuilding a compressor and the good workmanship applied, it cannot be expected to give satisfactory and reasonably long service life if not properly aligned and coupled to the diesel engine drive shaft. Use proper lifting mechanism capable of handling a minimum of 3000 lbs. (1360.8 kilograms) during this installation.

**18.2** The alignment should be checked with a dial indicator in order to insure proper coupling.

**18.3** For detailed procedure and installation values when installing the coupling, reference should be made to the locomotive builder's instruction manual for the compressor drive system.

## 19.0 PREPARATION OF COMPRESSORS FOR DEAD STORAGE

**19.1** To prepare compressor for dead storage, the following procedure is recommended.

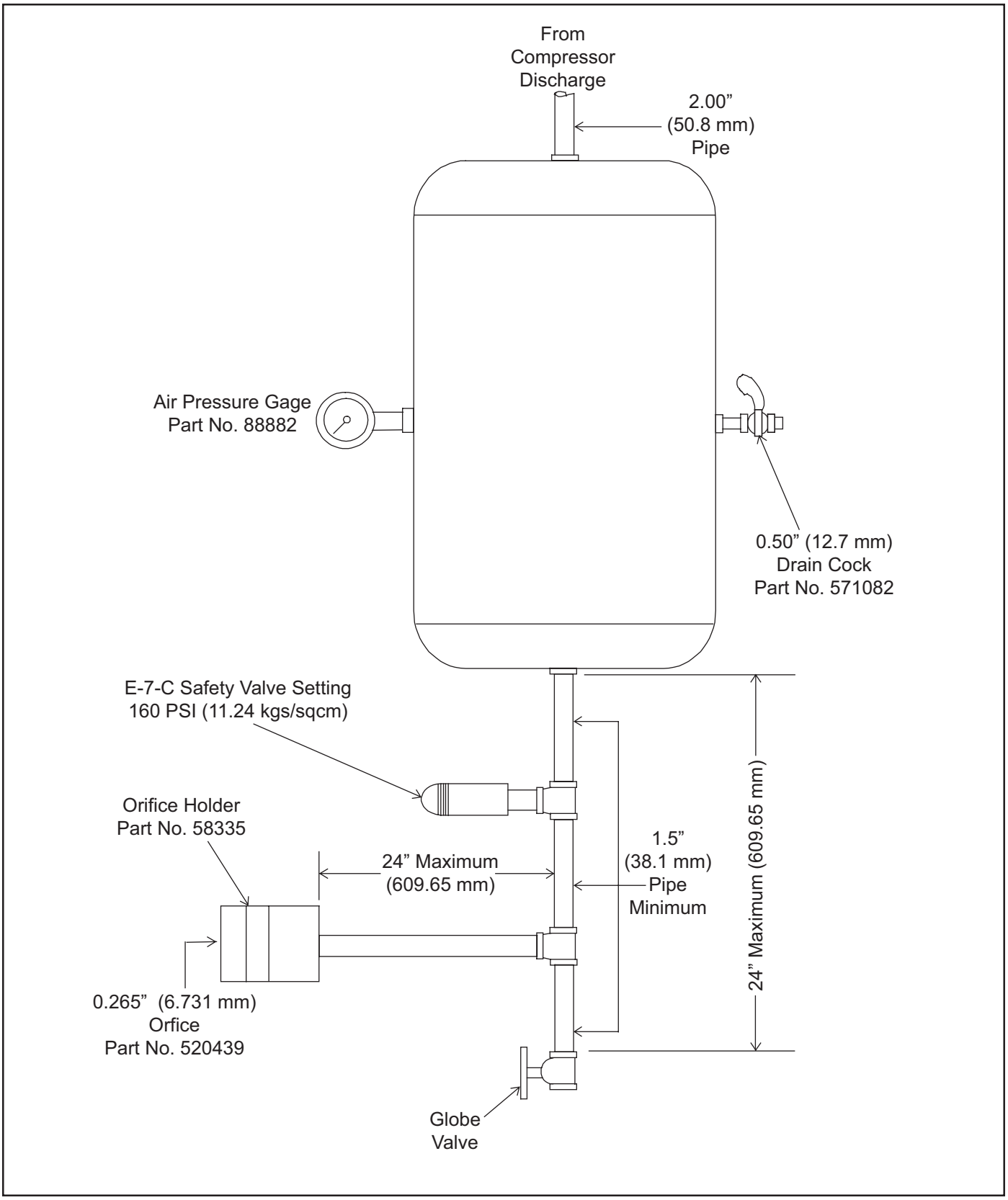



**Figure 17 - Compressor Capacity Test**

| 3-CWDL Type Air Compressors | | |
|---|---|---|
| | Condemning Limit | |
| | INCHES | MILLIMETERS |
| **Low Pressure Cylinder:** | | |
| Diameter | 7.8795 Max | 200.139 Max |
| Length | 11.340 Min | 288.04 Min |
| **High Pressure Cylinder:** | | |
| Diameter | 5.7545 Max | 146.164 Max |
| Length | 11.715 Min | 297.56 Min |
| **Low Pressure Pistons:** | | |
| Diameter | 7.8665 Min | 199.809 Min |
| Compressor Ring Groove Width | 0.1900 Max | 4.826 Max |
| Oil Control Ring Groove Width | 0.2531 Max | 6.429 Max |
| Wrist Pin Bushing Diameter | 1.3880 Max | 35.255 Max |
| | 1.3848 Min | 35.174 Min |
| Wrist Pin Diameter | 1.3820 Min | 35.103 Min |
| **High Pressure Piston:** | | |
| Diameter | 5.7425 Min | 145.860 Min |
| Compressor Ring Groove Width | 0.1275 Max | 3.239 Max |
| Oil Control Ring Groove Width | 0.2529 Max | 6.424 Max |
| Wrist Pin Diameter | 1.498 Min | 38.070 Min |
| **Oil Control Ring:** | | |
| Bore Diameter | 3.253 Max | 82.63 Max |
| **Bearing End Plate:** | | |
| Bore Diameter | 6.378 Max | 162.00 Max |
| **Crankshaft:** | | |
| Main Bearing Journal | 3.375 Min | 85.73 Min |
| Crankpin Diameter | 3.496 Min | 88.80 Min |
| **Oil Relief Valve:** | | |
| Oil Relief Valve Bore Diameter | 1.189 Max | 30.20 Max |
| Oil Relief Valve Plunger Diameter | 1.185 Min | 30.10 Min |
| **Crankcase:** | | |
| Bore Diameter | 6.378 Max | 162.00 Max |

**Table 1 - 3-CWDL Type Air Compessor Condemning Limits**

| GENERAL SPECIFICATIONS<br>3CWDL Type Air Compressor | |
|---|---|
| **Rated Speed** | 1050 RPM |
| **Displacement at Rated Speed** | 296 CFM<br>(8382.7 liters/min) |
| **Low Pressure Cylinder, Number & Diameter** | (2)--7.88”<br>(200.2 mm) |
| **High Pressure Cylinder, Number & Diameter** | (1)--5.75”<br>(146.1 mm) |
| **Number of Compression Rings per Piston** | (3) |
| **Number of Oil Rings per Piston** | (1) |
| **Stroke** | 5”<br>(127 mm) |
| **Number of Main Bearings** | (2) |
| **Type of Main Bearings** | Tapered Roller |
| **Crankpin Journal Lubrication** | Pressure |
| **Wrist Pin Lubrication** | Pressure |
| **Oil Pump Type** | Gear Driven |
| **Oil Capacity- Quarts (Liters)** | 42 Quarts<br>(39.7 liters) |
| **Compressor BHP @ Maximum Rated Speed & 140 psig (20.305 kPa)** | 68 |
| **Cooling** | Water |
| **Oil Pressure (minimum)** | 15 psig<br>(2.175 kPa) |
| **Valve Type** | Disc-Spring Loaded |
| **Dry Weight** | 1590 Lbs<br>(721.2 Kgs.) |

**Table 2 - General Specifications**

| WEAR IN SCHEDULE | | | |
|---|---|---|---|
| **RPM** | **TIME (HOURS)** | **PRESSURE (PSI)** | **REMARKS** |
| **500** | **-** | **Atmosphere** | |
| **500** | **1 ½** | **140 (965.51 kPa)** | **Soap flanges & Intercooler** |
| **1000** | **½** | **140 to 125 (965.51 to 862.06 kPa)** | **Check to see is compressor loads & unloads** |
| **1000** | **1 ½** | **140 (965.51 kPa)** | **Continuous duty – volumetric efficiency test conducted in last half hour** |

**⚠ WARNING: STATED MINIMUM AND MAXIMUM ARE NOT TO BE EXCEEDED OR COMPRESSOR DAMAGE AND PERSONAL INJURY MAY RESULT!**

**Table 3 - Wear in Schedule**

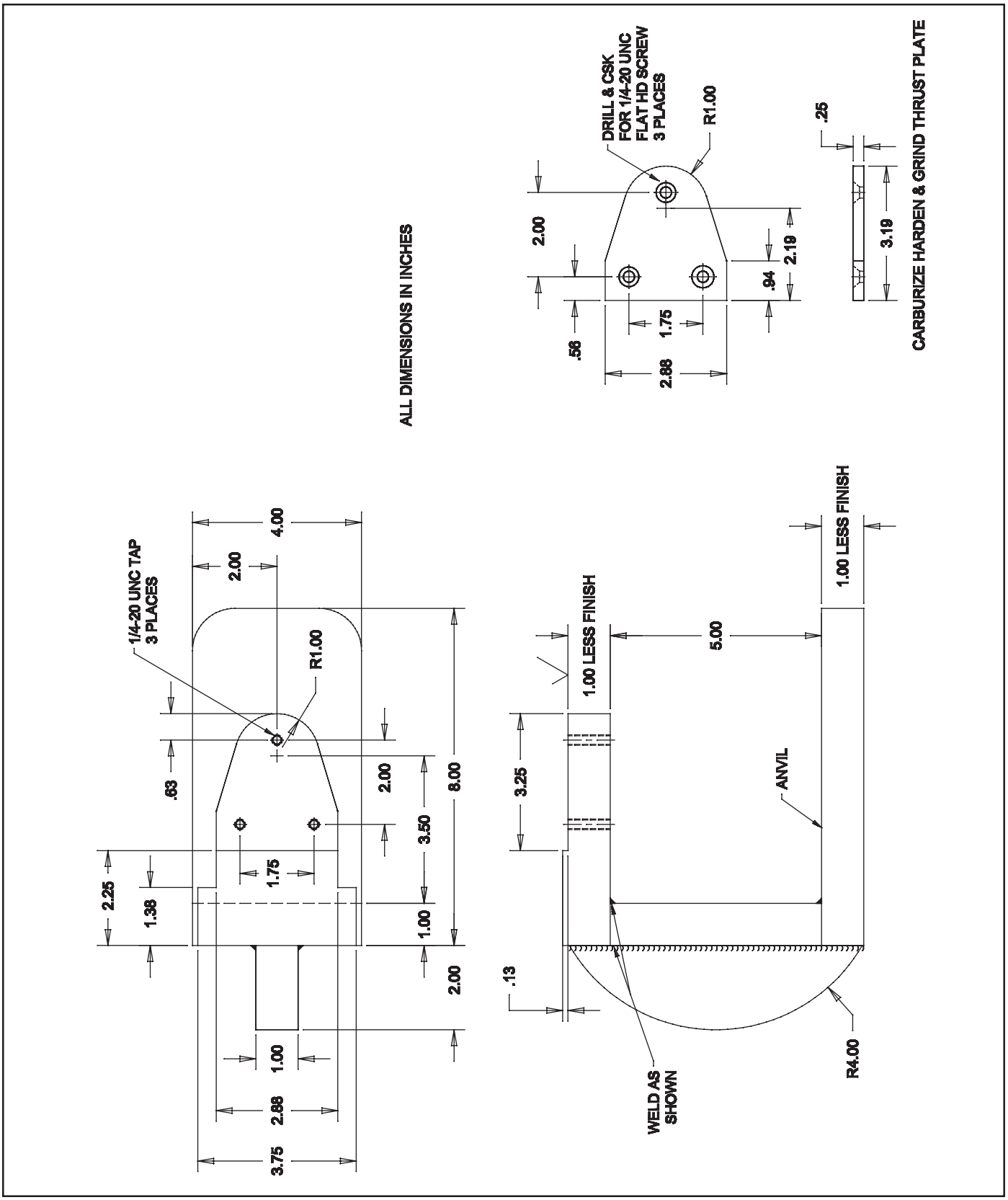
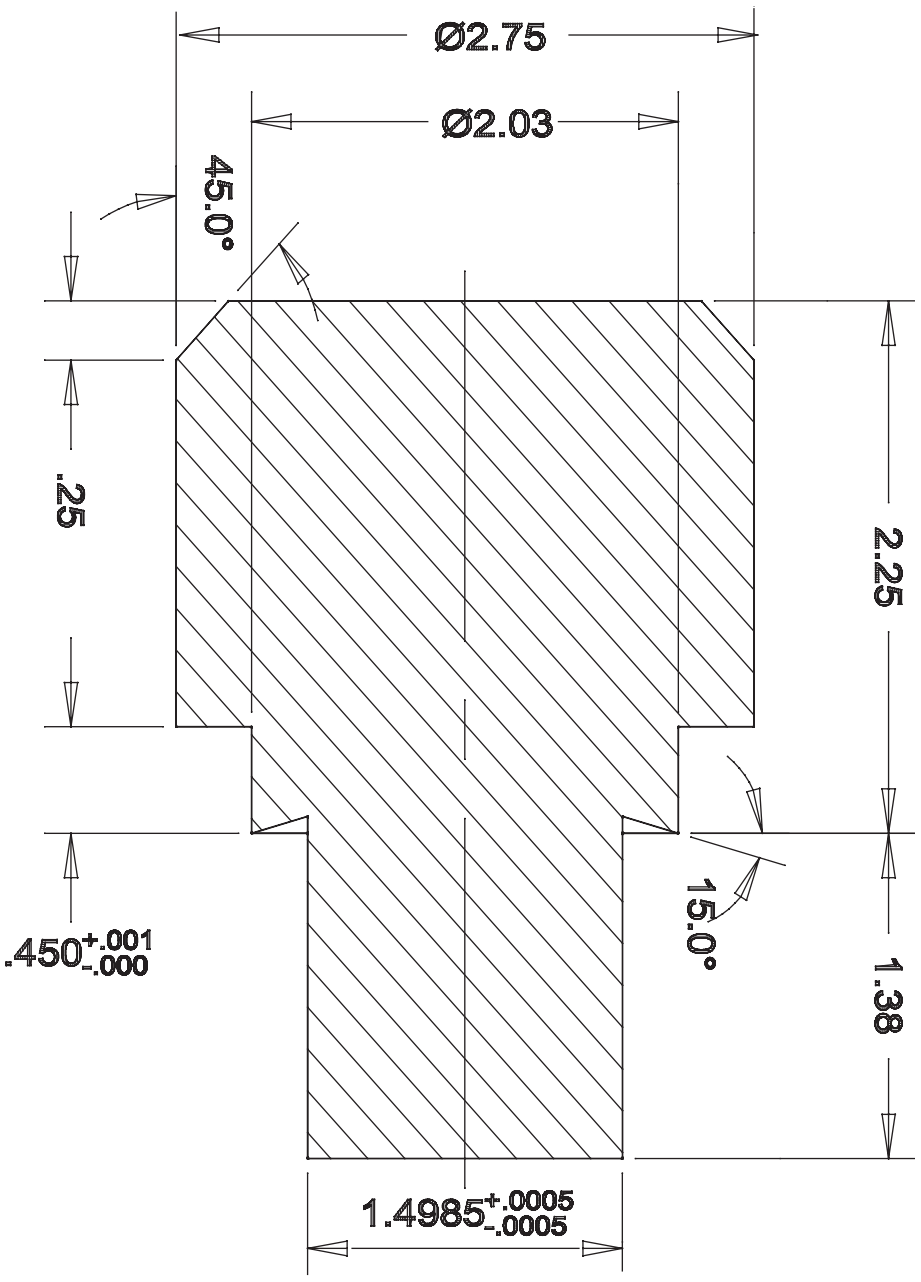



**Figure 18 - Anvil forRemoval of Piston Roller Bearings**




Driving Tool
(All dimensions shown in inches)

**Figure 19 - Driving Tool**

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