ELECTRO-MOTIVE

MAINTENANCE INSTRUCTION

M.I. 1100
*Rev. E

AIR COMPRESSOR-EXHAUSTER MODELS WXOV, ABOV, ADJV-8100 SERIES, ADJV-8400 SERIES

DESCRIPTION

The air compressor-exhauster, Fig. 1, is installed on export locomotives when a vacuum type brake system is used.

The compressor-exhauster is actually two independent machines having a common crankshaft, and mounted on a common crankcase base to simplify installation. One machine functions as an air compressor to supply air under pressure for locomotive brakes and air operated apparatus. The other machine functions as an exhauster, or vacuum pump, to maintain sufficient vacuum for train braking.

Each compressor has its own oil pump and pressure lubricating system.

The air is cleaned before it enters the compressor by passing through either an impingement or oil bath type air filter which is mounted on the air intake manifold.

MODEL WXOV

AIR COMPRESSOR

The air compressor portion of the Model WXOV compressor-exhauster is two-stage, air cooled, having two 200 mm (7-7/8″) diameter low pressure cylinders mounted at an angle, and one 146 mm (5-3/4″) diameter high pressure cylinder mounted vertically. Piston stroke is 127 mm (5″). Compressor displacement is about 2.52 m^3/min (89 cfm) at 315 RPM idling speed, and about 7.19 m^3/min (254 cfm) at 900 RPM.

Individual cylinders are provided with an intake or suction valve and a discharge valve. The intake valves are provided with unloader assemblies, having pistons which hold the valves open when subjected to air from the supply reservoir when at the recommended pressure. This prevents pumping of air even though the compressor is running.

A cast iron intercooler is connected between the low pressure cylinder discharge and the high pressure cylinder intake to cool the air between stages. The intercooler is provided with a safety valve and a gauge to indicate intercooler air pressure.

EXHAUSTER

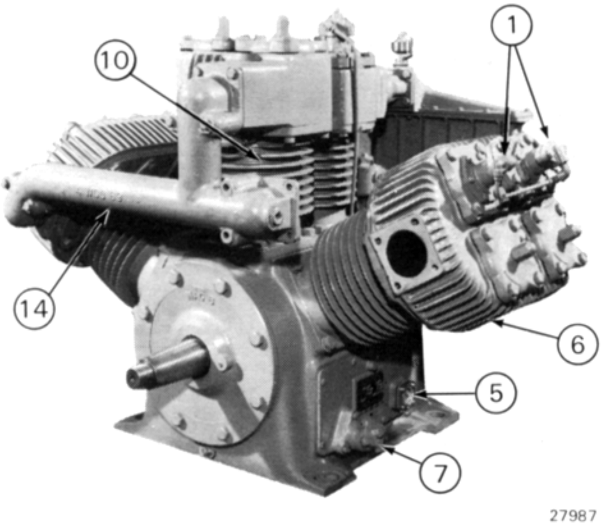
The exhauster, or vacuum pump, employs three 200 mm (7-7/8″) diameter cylinders similar to the air compressor low pressure cylinders. The cylinders form a single-stage unit, with all three cylinders having a common intake and common discharge manifold. No unloading provision is made on the vacuum pump, consequently, it is pulling some vacuum all the time it is being driven by the engine.

Two of the exhauster cylinders are mounted on the crankcase adjacent to each other at an angle, opposite the compressor low pressure cylinders. The third exhauster cylinder is mounted vertically. The exhauster valves are basically the same as the compressor, except no unloaders are used.

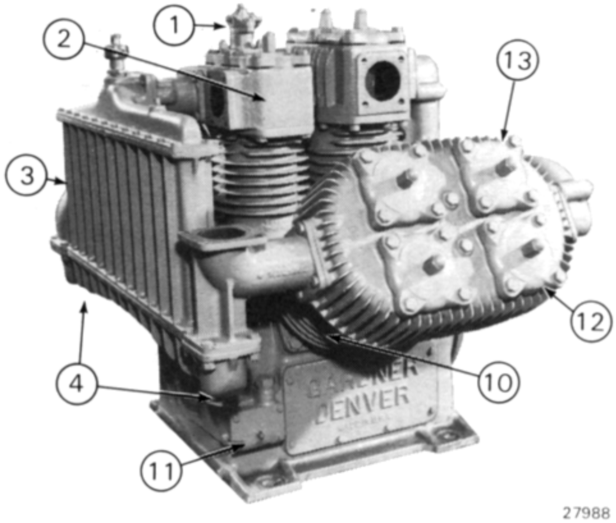
The exhauster is capable of maintaining a vacuum of approximately 686 mm (27″) Hg at sea level.

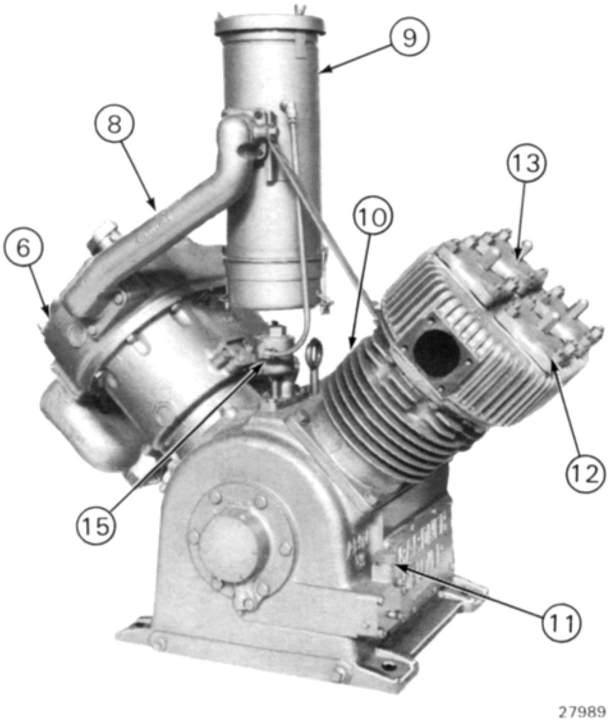
*Information contained herein is applicable to equipment being produced as of the date of issue and does not supersede previous issues.

▌ Areas of change are indicated by vertical bars.



MODEL WXOV





MODEL ABOV

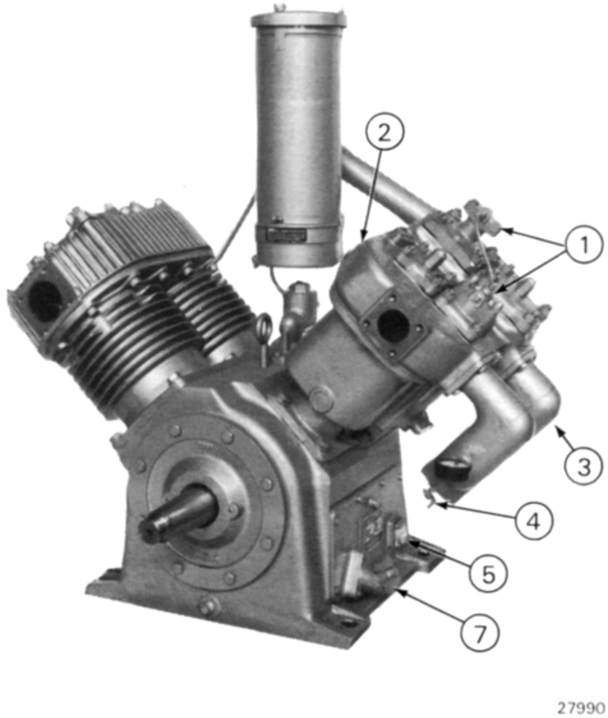
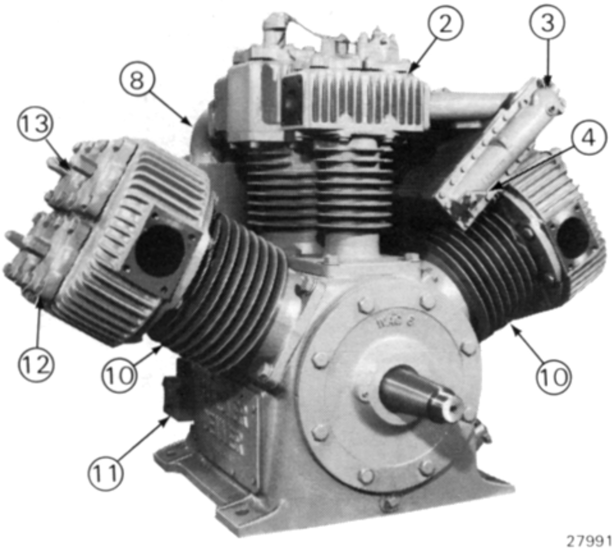


Fig.1 - Air Compressor-Exhauster (Sheet 1 of 2)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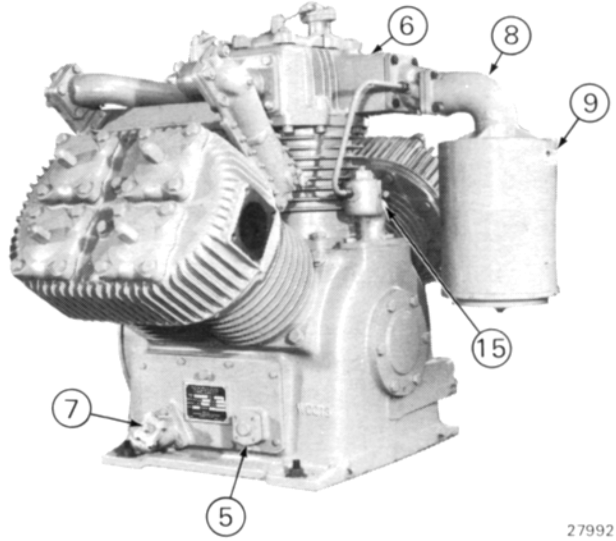
MODEL ADJV 8100 SERIES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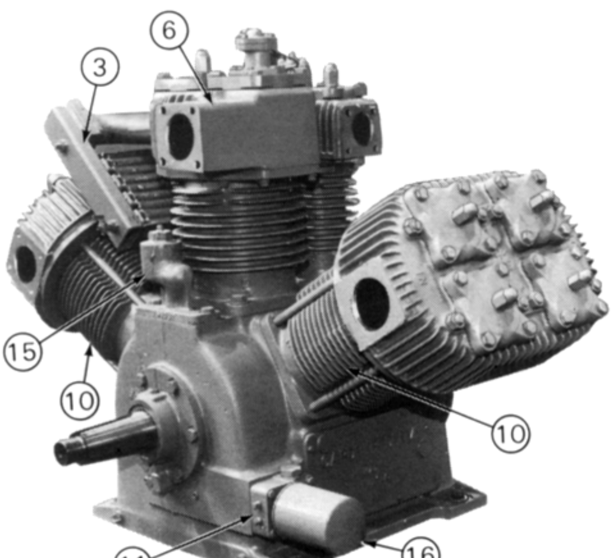
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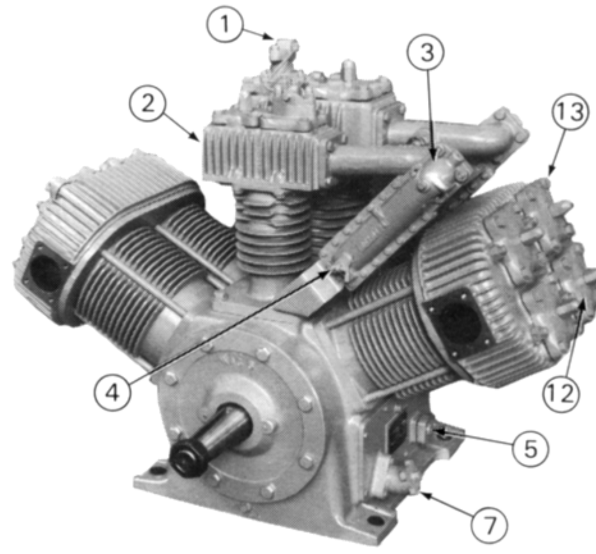
MODEL ADJV 8400 SERIES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1. Unloader Assemblies
2. High Pressure Cylinder Head
3. Intercooler
4. Intercooler Drain
5. Oil Level Gauge
6. Low Pressure Cylinder Head
7. Oil Filler
8. Intake Manifold
9. Air Filter
10. Vacuum Cylinders
11. Oil Pressure Relief Valve
12. Vacuum Suction Valve
13. Vacuum Discharge Valve
14. Vacuum Intake Manifold
15. Crankcase Breather
16. Oil Filter

Fig.1 - Air Compressor-Exhauster (Sheet 2 of 2)

A filter, connected between the vacuum system and the exhauster, protects the working parts by removing foreign particles from the air. A similar filter may also be installed between the exhauster discharge and the inlet line (if so equipped) to engine blower, to remove any oil which may be discharged by the exhauster. Additional filter information is provided under Maintenance.

MODEL ABOV

AIR COMPRESSOR

The air compressor portion of the Model ABOV air compressor-exhauster is two-stage having one 200 mm (7-7/8″) diameter low pressure and one 102 mm (4″) diameter high pressure cylinder, water cooled and mounted at an angle. The piston stroke is 127 mm (5″). The compressor displacement is about 1.25 m^3/min (44 cfm) at 315 RPM idling speed, and about 3.6 m^3/min (127 cfm) at 900 RPM.

The cylinders are provided with suction or intake valves located in the compressor cylinder heads. As with other compressors, the intake valves are provided with an unloader assembly having a piston which holds the valve open when actuated by compressor control. Therefore, the compressor may not be pumping even though the compressor crankshaft is rotating.

Cooling of the compressor portion is provided by water from the engine cooling system. An inlet line is connected between the discharge side of the engine water pump and the compressor cylinder. Water circulates through the cylinder water passages, enters the cylinder head, and is discharged from the cylinder head through connecting piping to the engine.

A manifold type intercooler is connected between the low pressure cylinder discharge and the high pressure cylinder intake to cool the air between stages. A pressure gauge and safety valve are installed on the intercooler for compressor protection.

EXHAUSTER

The single-stage exhauster portion of the Model ABOV compressor-exhauster has two 216 mm (8-1/2″) diameter cylinders similar to the air compressor low pressure cylinders. The cylinders are air cooled and are mounted at an angle opposite the two compressor cylinders. There is no unloading provision on the intake valves; therefore, the exhauster is pumping whenever the compressor crankshaft is rotating.

The exhauster is capable of maintaining a vacuum of approximately 686 mm (27″) Hg at sea level.

MODELS ADJV-8100 SERIES AND ADJV-8400 SERIES

AIR COMPRESSOR

The compressor portion of Model ADJV compressor-exhausters are two-staged and air cooled. They have one 200 mm (7-7/8″) diameter low pressure cylinder mounted vertically, and one 102 mm (4″) high pressure cylinder mounted vertically. The piston stroke is 127 mm (5″). Compressor displacement is about 1.25 m^3/min (44 cfm) at 315 RPM idling speed, and about 3.6 m^3/min (127 cfm) at 900 RPM.

Individual cylinders are provided with an intake or suction valve, and a discharge valve. The intake valves are provided with an unloader assembly having a piston which holds the valve open when subjected to air from the supply reservoir when at the recommended pressure. This prevents pumping of air even though the compressor crankshaft is rotating.

Cooling of the two-stage compressor is provided by atmospheric air circulating around the finned cylinder and head assemblies.

An intercooler with a safety valve and gauge is connected between the low pressure cylinder and the high pressure compressor cylinder to cool the air between stages.

EXHAUSTER - MODELS ADJV-8100 SERIES

The exhauster, or vacuum, portion of this compressor-exhauster employs four 200 mm (7-7/8″) diameter cylinders similar to the air compressor low pressure cylinder. The cylinders form a single-stage unit with all four cylinders having a common intake and discharge manifold. No unloading provision is employed on the exhauster portion; therefore, it is pumping whenever the compressor crankshaft is rotating.

Cooling of the exhauster portion is provided by atmospheric air circulating around the cylinder and head assemblies.

The exhauster is capable of maintaining a vacuum of approximately 686 mm (27″) Hg at sea level.

EXHAUSTER - MODELS ADJV-8400 SERIES

The single-stage exhauster portion of this compressor-exhauster has four 216 mm (8-1/2″) diameter cylinders similar to the air compressor low pressure cylinders. The cylinders are air cooled, and are mounted at an angle to the two vertical compressor cylinders. There is no unloading provision on the intake valves; therefore, the exhauster is pumping whenever the compressor crankshaft is rotating.

The exhauster is capable of maintaining a vacuum of approximately 686 mm (27″) Hg at sea level.

OPERATION

COMPRESSOR

Air at atmospheric pressure is drawn in through the filter and intake valve into the low pressure cylinders during the downward stroke of the piston. As the air is compressed on the upward stroke, the intake valve is closed and the air at higher pressure is forced through the discharge valve into the intercooler. Air leaves the intercooler, entering the high pressure cylinder through the intake valve. As the high pressure piston moves upward, it compresses the air to a higher pressure, forcing it out through the discharge valve and connecting piping to the main air reservoir.

The intercooler removes heat from the compressed air, making it more dense, and thereby improving the efficiency of the high pressure cylinder(s).

Since each compressor is driven by the engine, the compressor is in operation whenever the engine is running, although not continuously pumping air. When main reservoir air reaches the recommended pressure, the compressor control admits air to the unloader assembly, cutting out the compressor action by holding the intake valve open. When reservoir pressure falls, the air operating the unloader is cut off, the intake valve is released, and the compressor resumes normal pumping.

EXHAUSTER

As the exhauster pistons go down, a pressure difference is created between the air in the cylinders and the trainline. The greater trainline pressure forces the intake valve off the seats to permit air to enter the cylinders. When the piston moves up, the air in the cylinder is compressed, and the air pressure along with spring pressure closes the intake valves. As the cylinder air pressure increases, the cylinder discharge valves are opened. Air is then discharged through the connecting piping and filter to the suction side of the engine blower air intake or to atmosphere on units equipped with turbocharged engines.

All vacuum cylinders are alternately pulling a vacuum on the common manifold, as long as the engine is running. The extent of the vacuum depends on air temperature, altitude, trainline leakage, and driven speed of the exhauster.

CRANKCASE BREATHER

The compressor-exhausters are equipped with a crankcase breather, Fig. 2, which permits a partial

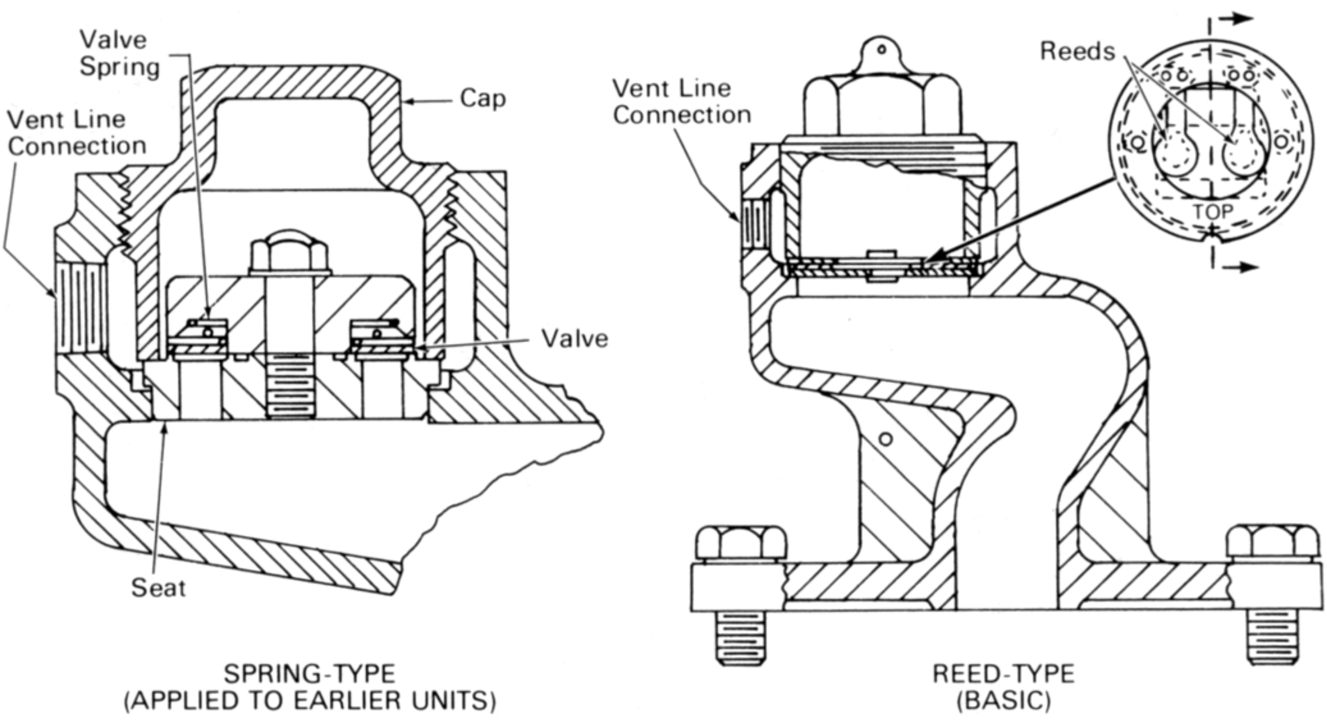


Fig.2 – Crankcase Breathers

vacuum in the compressor crankcase. To accomplish this, the breather acts as a check valve. When pressure builds up in the crankcase as the pistons move down, the breather valve opens. As the pistons start up, the valve closes, preventing the admission of air into the crankcase.

On springbacked valves there should be only a slight tension in the spring. Excess tension will cause abnormal pulsation at the breather as the pistons move up and down, nullifying the purpose of the breather.

The breather is connected to the compressor air intake manifold or to the filter. This prevents the escape of vapors into the air around the compressor.

The breather should be cleaned periodically with petroleum solvent and blown dry with compressed air.

LUBRICATING SYSTEM

The lubricating system is shown in Fig. 3. The crankshaft is rifle drilled for passage of oil to the connecting rod bearings. Oil under pressure from the lubricating oil pump flows through the drilled passages of the crankshaft. The piston pin bearings and crankshaft main bearings are lubricated by oil mist from the connecting rod oil throw-off.

A block mounted on the side of the crankcase houses a relief valve, Fig. 4, that is used to control oil pressure. This valve provides for correct minimum oil pressure at idling speed, and ensures adequate oil pressure at all speeds.

CAUTION

Do not put a locomotive into service with a pressure gauge at the test opening. Failure of the gauge can result in serious compressor and engine damage.

PLUNGER-TYPE OIL PUMP

The plunger- or piston-type oil pump is actuated by a strap riding on an eccentric on the crankshaft. Oil from the pump flows through the drilled pump plunger and eccentric, and into the drilled passages of the crankshaft.

GEAR-TYPE OIL PUMP

The oil pump drive shaft is driven by a mating helical gear that is shrunk on the crankshaft. Oil under pressure is fed to the relief valve block and returned by drilled passages in the crankcase to the oil introducing ring that is housed in the small bearing end plate. A drilled opening in the crankshaft lines up with a circumferential groove in the oil introducing ring I.D. to feed oil to the drilled passages in the crankshaft.

The lube oil filter provided with compressors that are equipped with gear type pumps is a spin-on, full flow design with a built-in relief valve.

LUBRICATION REQUIREMENTS

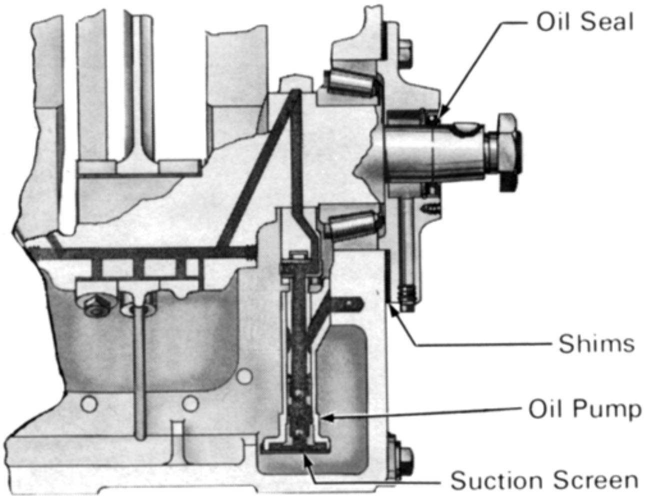
It is important that the compressor oil be changed at intervals given in the applicable Scheduled Maintenance Program. After draining the oil, thoroughly clean the crankcase interior by flushing with petroleum solvent, and wiping clean with lint-free, bound-edge towels. For compressor lubricating oil specifications, refer to the applicable Locomotive Service Manual or Maintenance Instruction 1756. For crankcase oil capacity, see Service Data.

Oil level can be determined at any time, with the compressor running or stopped. When the basic float gauge is applied to the compressor, the gauge needle must be kept in the green "RUN" area. When the compressor is equipped with a dipstick-type oil level gauge, oil should be added as indicated by the dipstick reading. To take an oil level reading from a dipstick, first remove it, wipe it clean, and reinsert it, making certain that it is fully seated. Then remove the dipstick and make the reading. Modernization Recommendation 9521 outlines the procedure to convert earlier model air compressors using a dipstick or sight glass to the float gauge design.

Whenever air compressor lube oil is changed, the oil level float gauge should be checked for proper operation and repaired or replaced if defective. In most cases the defect consists of a stuck dial needle, and can be corrected by replacing the dial which is secured to the gauge assembly by two small screws.

Oil pressure should be checked periodically to ensure that the pump and associated parts are functioning properly. Oil pressure at 315 RPM and 60° C (140° F) oil temperature should be 69-124 kPa (10-18 psi) on the "A" series compressors, and 103-138 kPa (15-20 psi) on the "W" series compressors. A plugged pipe opening is provided in the oil relief valve for application of a pressure gauge to check compressor oil pressure.

An improved relief valve, Fig. 4, with a built-in accumulator is now applied to all compressor exhausters. This relief valve reduces pressure pulses. It is a direct replacement for all existing relief valve assemblies used with direct feed lubrication systems.



PLUNGER-TYPE OIL PUMP

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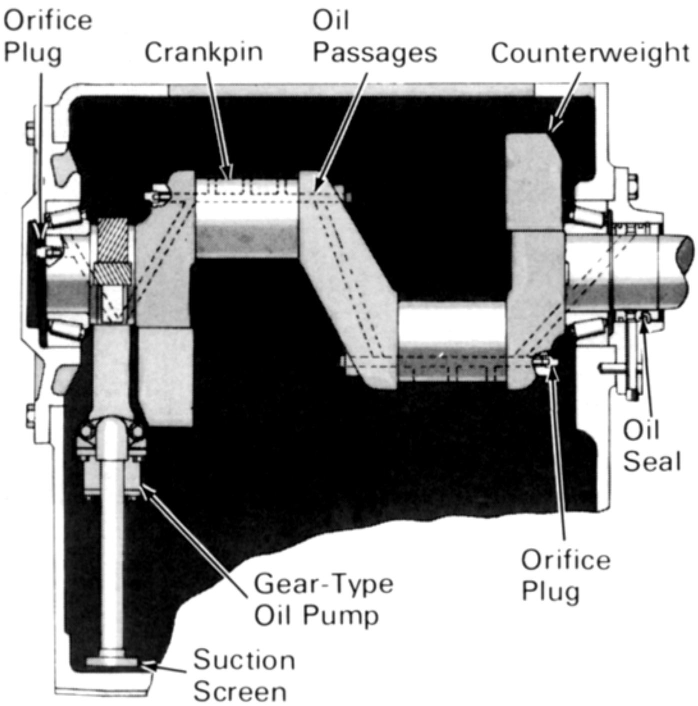

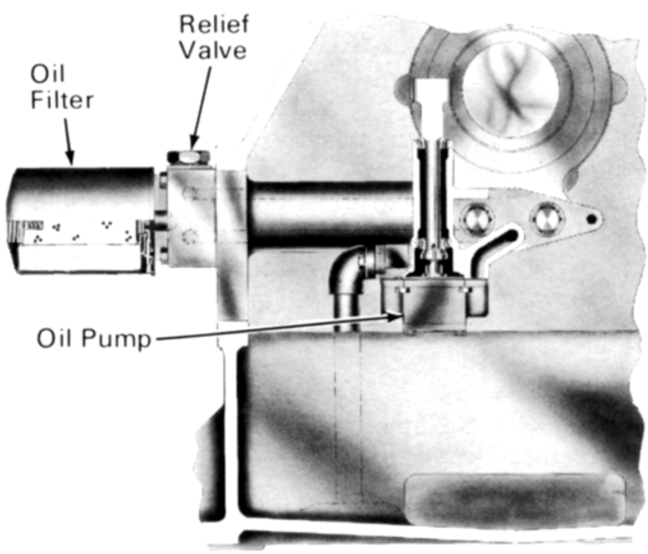

GEAR-TYPE OIL PUMP AND FILTER

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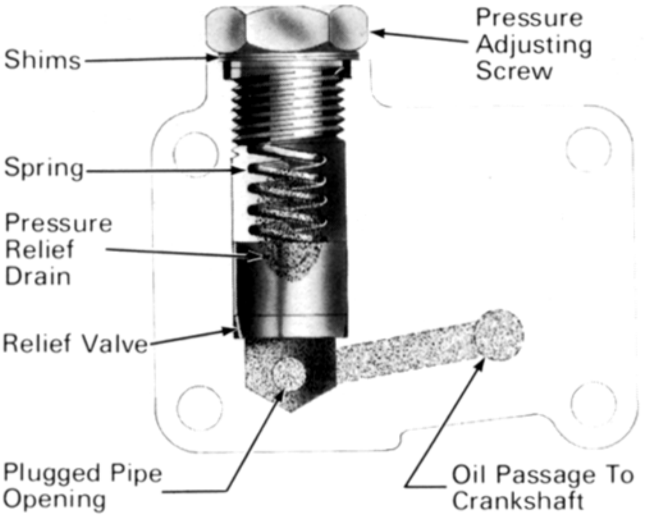
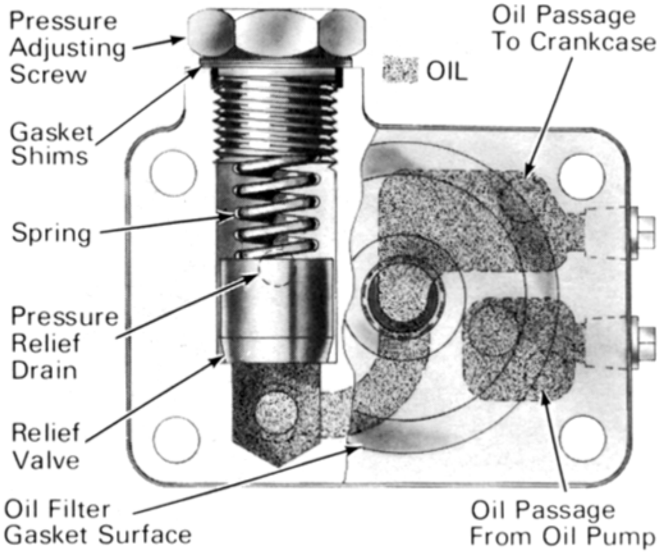
Fig.3 - Lubricating System



ACCUMULATOR-TYPE
(PLUNGER PUMP UNITS)



ACCUMULATOR-TYPE
(GEAR PUMP UNITS)

Fig.4 - Oil Pressure Relief Valve

No crankcase modifications are required. However, for proper operation, the proper gasket and mounting bolts listed in the applicable Parts Catalog should be used.

Although the valve assembly significantly reduces oil pressure pulses, a pressure gauge with an externally mounted pulsation damper should be used whenever oil pressure is measured. After the pressure is checked, the locomotive should be shut down, the gauge removed, and the pipe opening plugged.

Pressure readings should be taken when oil temperature is 60° C (140° F). In the event that oil temperature is lower, the oil pressure versus temperature graph shown in Fig. 5 can be used to determine the corresponding pressure at 60° C (140° F). The graph is applicable to all relief valve assemblies applied to new or rebuilt compressors or supplied as service parts after October 1973. The graph should not be used on earlier relief valve assemblies.

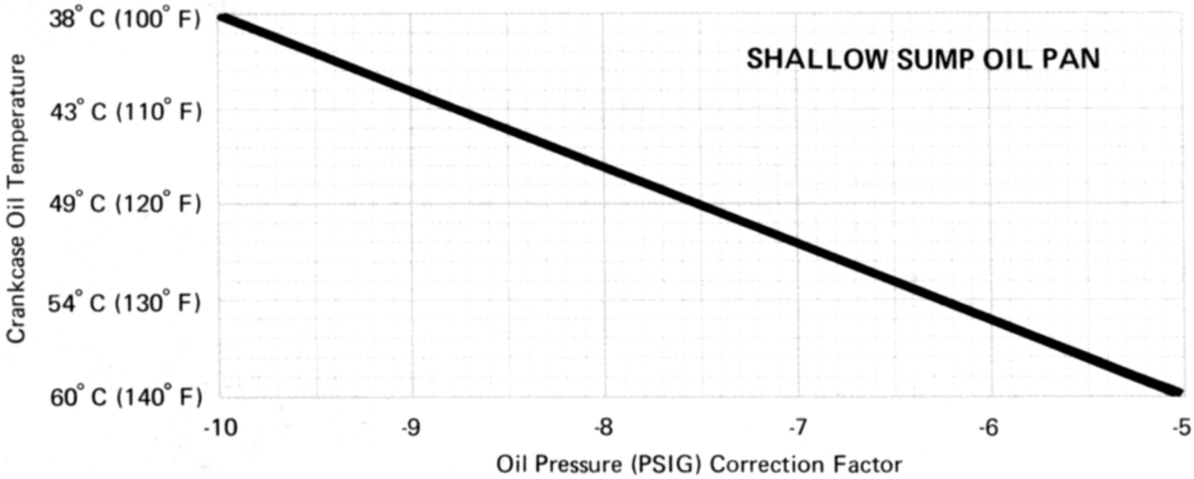
Oil pressure is varied by adding or removing shims under the pressure adjusting screw on the constant pressure relief valve. The recommended clearance between the valve body and the piston is shown in the Service Data. If the clearance is exceeded, and a new piston will not correct the clearance discrepancy, a new valve must be applied. On accumulator-type valves alteration of shims is not normally required.

When checking oil pressure on units that are equipped with lube oil filters, use the upper plugged opening on the side of the relief valve body. The oil pressure relief valve is located between the filter and the crankshaft oil passages. Pressure drop across the filter has no effect on the oil pressure setting.

To check oil pressure drop across the filter, take pressure readings at both the upper and lower openings on the side of the oil pressure relief valve body. Subtraction of the lower reading from the upper reading gives the pressure drop across the filter. If the drop is as much as 10 psi the filter should be replaced even if the replacement schedule does not yet call for it. The old filter gasket must be removed completely in order to obtain a proper seal with the new gasket.

LUBRICATING OIL QUALIFICATION

Since variations in operating conditions such as ambient temperature and length of time a compressor is loaded can influence the performance of



Instructions: When crankcase oil temperature is below 60° C (140° F), subtract graph readings from pressure gauge readings obtained at lower temperatures to determine gauge pressure at 60° C (140° F).

Conditions:
1. 315 to 900 rpm.
2. S.A.E. No. 30 weight lubricating oil.
3. Compressor loaded or unloaded.
4. Relief valve 8493807 or later.

21387

Fig.5 – Correction Factor Graph – Oil Pressure Versus Oil Temperature

individual compressor oils, the final decision on a particular brand to be used is best made by testing under actual operating conditions. The oil should be tested for at least three months, and preferably six months, to be sure the variables of operation are encountered. A compressor in new condition in respect to cylinders, rings, heads, and bearings should be selected for the test.

At the end of the test period, the compressor and the air system of the locomotive should be inspected. In the compressor, the piston pin bushings, piston rings, cylinder walls and pistons should be inspected for lacquer deposits. Discharge valves should also be inspected for lacquer and hard or soft carbon deposits. The locomotive air system can be qualified for lacquer and hard or soft carbon deposits. The locomotive air system can be qualified for lacquer accumulation by examination of the magnet valves, brake valves, and feed valves. The presence of any lacquer, or hard carbon, or excessive deposits of soft carbon indicates an unsuitable lubricant.

The presence of any oily substance in a feed valve does not necessarily mean an oil pumping air compressor, but may mean an unsuitable oil is being used. There are unstable ends in some oils which will distill off and deposit as an oil formation at expansion areas such as feed valves. Generally speaking, the substance will lacquer a shiny surface rapidly.

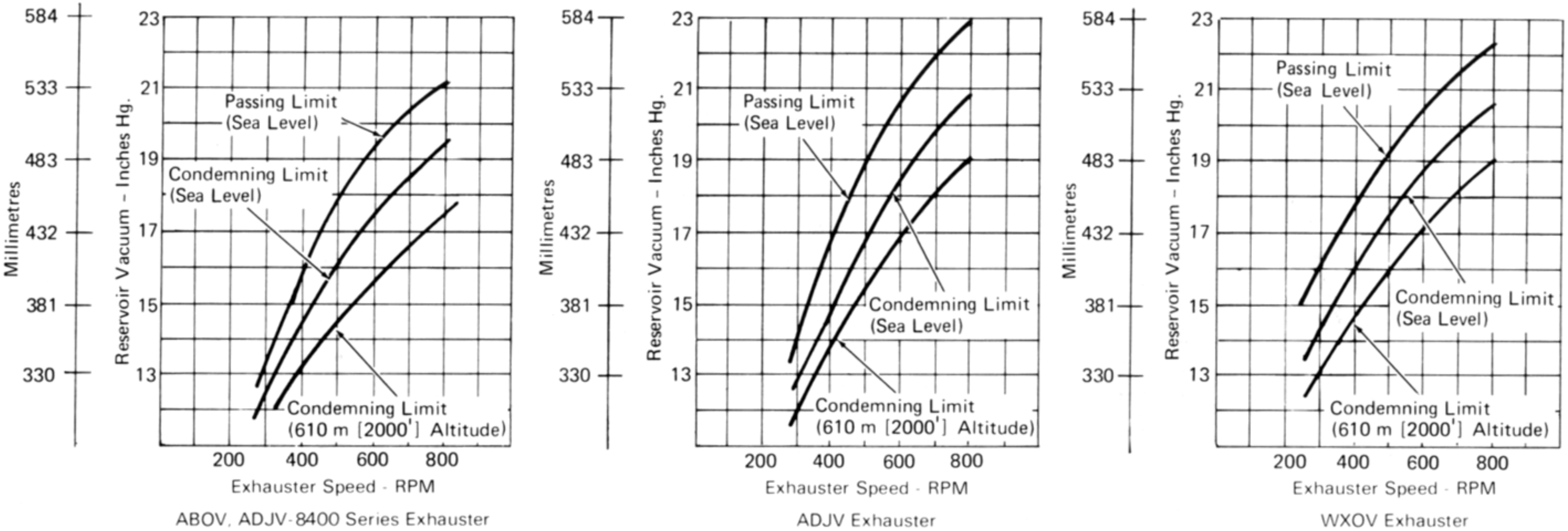
Heavy detergent oils will form hard lacquer deposits in the cylinder heads and on the cylinder walls, which will result in oil carryover in the system. Heavy weight oils will cause excessive wear in the piston pin bearings. Detergent or high film strength oils would probably improve piston pin bearing life, but cannot be used because ring seating is affected and carryover into the air system has a detrimental effect on air brake equipment.

Extensive experience has demonstrated that heavy detergent oils or mineral oils with unstable ends will not satisfactorily lubricate compressors. In several instances of compressor failure, examination of failed parts has shown that failure resulted from use of unsuitable oils. This has been confirmed by the fact that upon changing to an oil suited to the application, compressor failure has not recurred.

ORIFICE TESTING

The compressor-exhauster should be given an orifice test, as a measure of its condition, at intervals as outlined in the applicable Scheduled Maintenance Program.

The graphs shown in Fig. 6 indicate the recommended limits for the compressors and exhausters included in this instruction. For part numbers of various size orifices and adapters for these tests, refer to the Service Tools Catalog.



EXHAUSTERS

Vacuum should be maintained with orifice at end of 51 mm (2") pipe 3 m (10') from intake manifold.

For ABOV and WXOV use orifice 8245758 12.7 mm (1/2") in adapter 8245757.

For ADJV use orifice 8336669 15.9 mm (5/8") in adapter 8245757.

- For ADJV-8400 Series, use orifice 8245758 12.7 mm (1/2") in adapter 8245757.

COMPRESSORS

All curves shown are for sea level only. For each 305 m (1000') altitude, reduce the curve 4%.

Orifice tests should be made at the discharge side of the main reservoir.

For ABOV and ADJV use orifice 8058885 5.2 mm (13/64") in adapter 8024101.

For WXOV use orifice 8062165 7.1 mm (9/32") in adapter 8024101.

- Some units using ADJV-8400 Series have excessive vacuum piping. Use vacuum reading at exhauster instead of at reservoir.

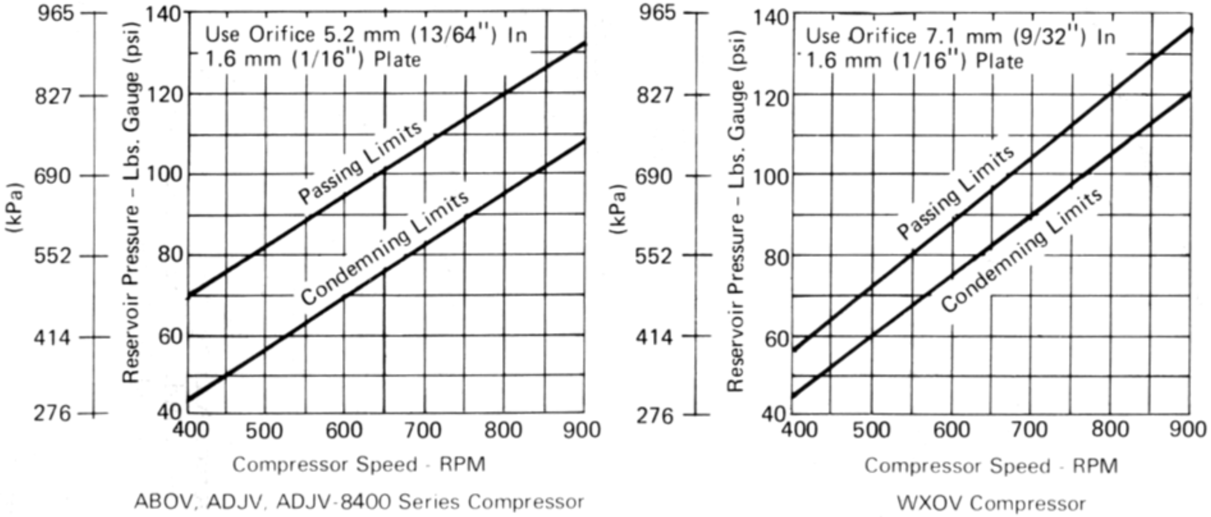


Fig.6 – Compressor-Exhauster Orifice Test Limits

AIR FILTERS

The filters outlined in the following paragraphs should be cleaned or replaced at intervals given in the applicable Scheduled Maintenance Program, or more frequently if operating conditions require.

COMPRESSOR FILTERS

Three different filters are available, Fig. 7. The cylindrical impingement-type filter is considered standard. The rectangular impingement-type and oil bath-type filters are optional.

REPLACEABLE ELEMENT IMPINGEMENT-TYPE

The replaceable element impingement-type filters are available in rectangular or cylindrical models, Fig. 7. The rectangular filter contains a paper element molded with a plastisol flange.

To remove the element from the rectangular filter, remove the nut, lockwasher, and retainer hook at the top and bottom of the filter. The impingement screen can then be removed, and the element pulled out of the housing.

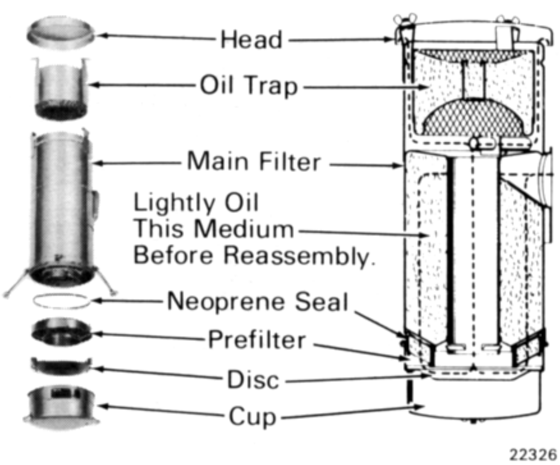
The basic cylindrical filter, since March 1977, has a pleated paper element. Earlier cylindrical filters were equipped with a resin impregnated fiberglass element. Both cylindrical elements are interchangeable in either housing.

To remove the element from the cylindrical filter, remove the elastic stop nut and the retainer at the bottom of the filter. The element is then free to drop out of the filter body so a new element can be installed.

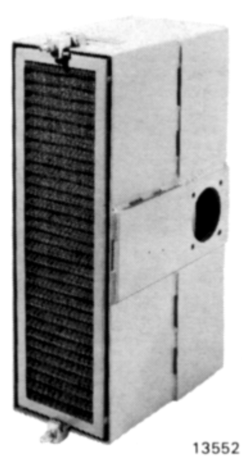
VORTOX OIL BATH-TYPE

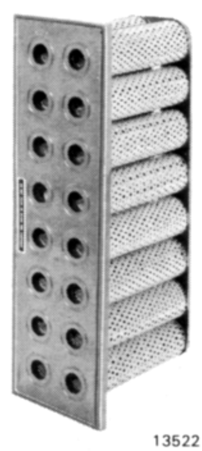
This type of air filter, Fig. 7, was specifically designed for use on air compressors unloading through the air inlet. When a compressor unloads through the air inlet, severe pulsations occur in the intake system with the possibility of fumes and oil vapor being ejected from the filter inlet. To eliminate this, an oil trap is located in the head of the filter. The trap is for the sole purpose of preventing the ejection of oil laden vapors from the inlet.

Improper service can result in excessive wear on the exhauster valves and/or vacuum brake control valves. Although recommended filter maintenance



Oil Bath Filter





Rectangular Filter

Cylindrical Filter

Fig.7 – Compressor Air Inlet Filter

intervals are contained in the applicable Scheduled Maintenance Program, an unusual environment can necessitate more frequent maintenance. The required maintenance intervals should be determined by close observation of the filter under these conditions. Once the time period is established, regardless of frequency, it should be strictly adhered to.

Service the air filter whenever the oil reservoir is 1/4 full of sediment, or the oil thickens to the consistency of an SAE 60 oil at 21.1° C (70° F). With proper maintenance of the cup and prefilter, the body should never need servicing. If the body shows evidence of plugging or accumulation of dirt, increase service frequency.

Basically, the air filter consists of the body assembly and the removable cup and disc assembly. Remove the cup, lift out the disc, and empty the oil. Thoroughly wash the cup and disc in solvent. After drying, replace the disc in the cup.

Before replacing the cup, remove the prefilter by pressing upward, while turning in a counterclockwise direction until the locking tabs align with the vertical slots. Then pull downward. Wash, dry, and replace prefilter. Reinstall the cup making sure the disc is in place. Refill cup to the indicated level with clean oil of the proper viscosity.

Since the oil is used primarily to carry the dust extracted from the air stream into the reservoir, use an inexpensive lightweight lubricating oil. For specific recommendations, see Service Data.

When servicing the oil trap, remove the head and examine the filter element in the trap. If the element has a heavy coating of lint or dust, remove the assembly, wash in solvent, dry, and replace. To prevent rust, lightly oil the trap element after cleaning.

Lightly prelube the main filter medium after cleaning, prior to reassembly. This will ensure adequate temporary filtering capability until wetting down by oil drawn up from the cup can occur.

NOTE

Inspect all filter and manifold connections to make sure they are airtight. This applies to all filters.

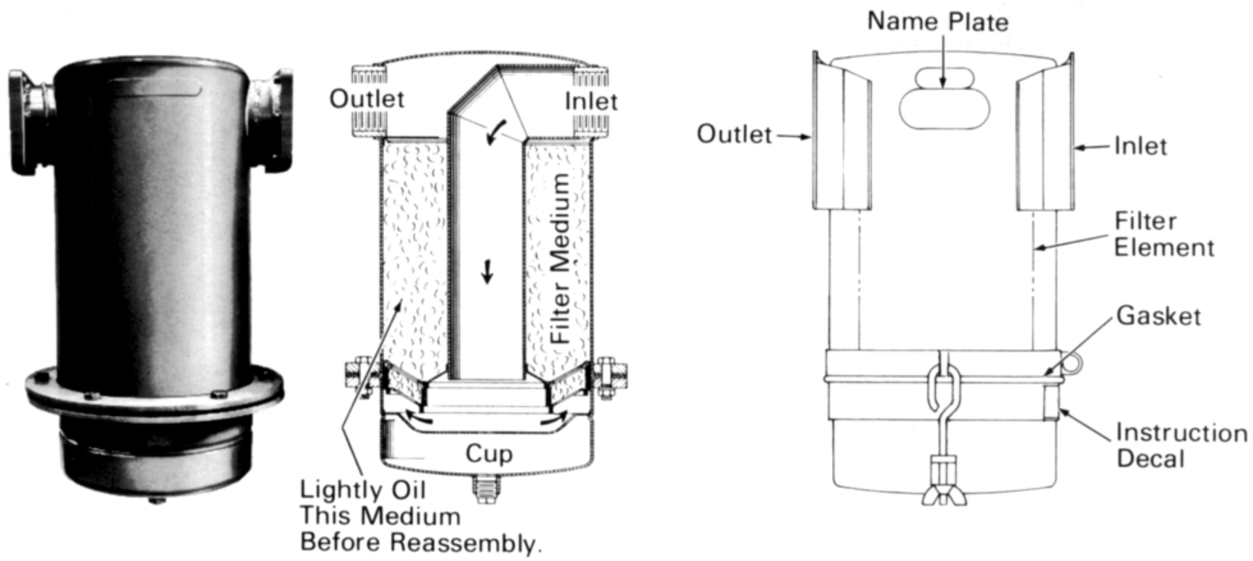
When installing the cup, the wing nuts should be sufficiently tightened so the cup seals on the gasket. Improper wing nut tension may cause damage to the oil cup baffle, prefilter positioning pads, and the oil cup gasket surface.

EXHAUSTER FILTERS

Two filters are used with the exhauster. One is used at the intake to the exhauster from the trainline; the other is used as an oil separator at the discharge.

INTAKE FILTER

The exhauster intake filter, Fig. 8, may be an oil bath filter or it may be a pleated paper filter. Air enters the filter from the trainline. In the oil bath filter, the air flows down the center tube of the filter. Upon changing direction at the bottom of the tube, any foreign material is thrown off. Any remaining material is caught in the prefilter.



OIL BATH FILTER

PLEATED PAPER FILTER

28002

Fig.8 – Exhauster Filter

OIL SEPARATOR OR DISCHARGE FILTER

The oil separator or discharge filter, Fig. 8, is an oil bath filter. Any oil entrained in the air is thrown out when the air changes direction or is caught in the prefilter. This oil collects and drains down into the cup. Oil collected in the cup is piped back to the crankcase of the compressor-exhauster. Normally, a 3 mm (1/8″) orifice is located at the inlet to the crankcase to prevent air pressure buildup in the air compressor crankcase. However, on certain models where the oil separator is mounted almost at crankcase level, the 3 mm (1/8″) orifice is provided in the line from the oil separator to the crankcase at the connection in the bottom of the oil separator.

Maintenance of the oil bath filter at either the intake or discharge consists of removing the bottom cup and prefilter, cleaning them of any accumulated dirt, and drying the parts. Lightly prelube the filter medium. Fill the intake filter cup with the same oil as that previously recommended for the compressor filter. No oil is used in the cup of the oil separator. There should be no accumulation of oil in the cup of the oil separator. If any accumulation is evident, check that the 3 mm (1/8″) orifice in the oil drain line at the crankcase is open. Schedule replacement of the pleated paper filter element according to experience with specific operating conditions.

DISASSEMBLY

Before the compressor-exhauster is disassembled, the exterior of the unit should be thoroughly cleaned. Mark the parts for identification purposes, and return to original locations upon reapplication. Care should be taken when handling parts to ensure against damage to reusable parts. When cleaning the parts, do not put main bearings, crankshaft, connecting rods, valves, pistons, or piston pins in same basket with other parts.

Cylinder heads, cylinders, crankcases, end plates, handhole covers, suction and discharge elbows, manifolds, and cast iron intercoolers should be placed in a cleaning solution and left there a sufficient length of time to ensure proper cleaning. After removal from the cleaning solution, these parts should be wire brushed and magnetic-particle inspected for defects.

The main bearings, pistons, crankshaft, and connecting rods should be thoroughly cleaned (DO NOT WIRE BRUSH), and magnetic-particle inspected for defects.

After magnetic-particle inspection all parts should be rewashed and de-magnetized before reassembly.

1. Remove pipe plug at bottom of crankcase to drain lube oil. Drain compressor cooling water (if applicable) by draining locomotive system.
2. Remove all tubing assemblies and both crankcase inspection covers.
3. Remove air filter, air intake manifold, crankcase breather, oil pressure relief valve, safety valve, and suction and discharge elbows.
4. Remove intercooler assembly.
5. Remove cylinder heads and cylinder assemblies.
6. Remove connecting rod cap bolts, and pull piston and connecting rod assemblies off of crankshaft.
7. Remove the oil pump and oil pump eccentric (if applicable) from crankcase.
8. Remove end plate bolts, and pull end plates off the crankshaft.
9. Remove crankshaft from crankcase.
10. Individual assemblies can now be disassembled by following instructions covering the particular assembly.

INTERCOOLER

CLEANING

The intercooler should be removed at overhaul time, and cleaned inside and out. Oil film inside the intercooler, or an accumulation of dirt, will materially reduce its efficiency, with the possibility of excess moisture being carried into the locomotive air system.

The intercooler should be cleaned using an inhibited alkaline or solvent cleaner and water. After cleaning, flush thoroughly with hot water, and blow dry.

SAFETY VALVE TEST AND ADJUSTMENT

A safety valve, Fig. 9, is provided to relieve excessive pressure buildup in the intercooler. This valve is tested and adjusted as follows.

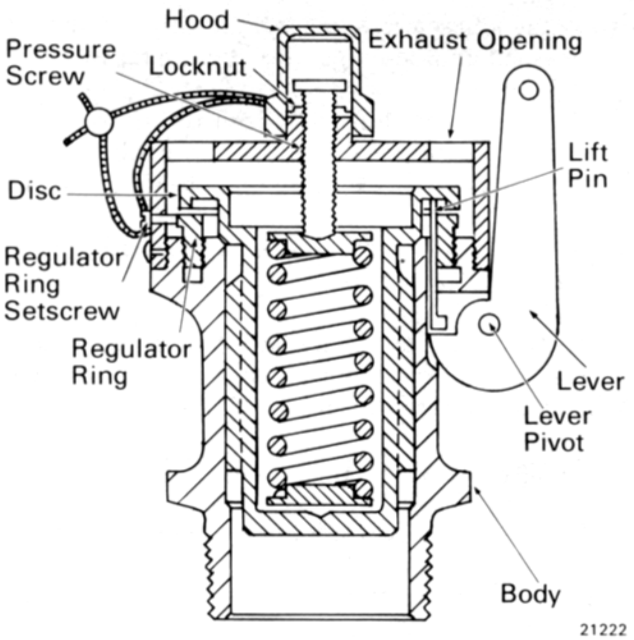


Fig.9 – Intercooler Safety Valve

TEST PROCEDURE

In testing the safety valve, it is essential that the air supply be adequate (at least .328 m^3 [20,000 cu. in.] reservoir) with piping to the valve not less than the size of the pipe thread fitting on the end of the valve. If restricted feed is used, the restriction must not be less than 11 mm (7/16″) in diameter. If air supply is not adequate, the valve cannot be set properly.

The valve must not lift before the specified lift pressure, and the blowdown of the valve must not exceed 69 kPa (10 psi). The valve must be fully assembled when the test is made.

The valve should lift at a static air pressure between 441 and 455 kPa (64 and 66 psi).

ADJUSTMENT

A valve which does not lift or reseat within the specified pressure ranges should be disassembled and thoroughly cleaned with a solvent or caustic cleaner. (DO NOT USE A WIRE BRUSH.) Replace any damaged parts.

Reassemble the valve with a small amount of light oil between the valve disc and the valve body. Apply a mixture of light oil and graphite on the lever pivot and lift pin.

Adjust the lift and reseating pressures of the valve to those given under Test Procedure. Adjust the lift pressure by adjusting the pressure screw to change spring tension on the disc. Adjust the reseating pressure by loosening the regulator ring set screw and adjusting the regulator ring. After the adjustments have been made, the setscrew and the hood should be lockwired and sealed.

UNLOADER VALVES

The piston-type unloader valves, Fig. 10, are used on the compressor to hold the intake or suction valves off the seats to stop compressor action when the main reservoir air is at the proper pressure.

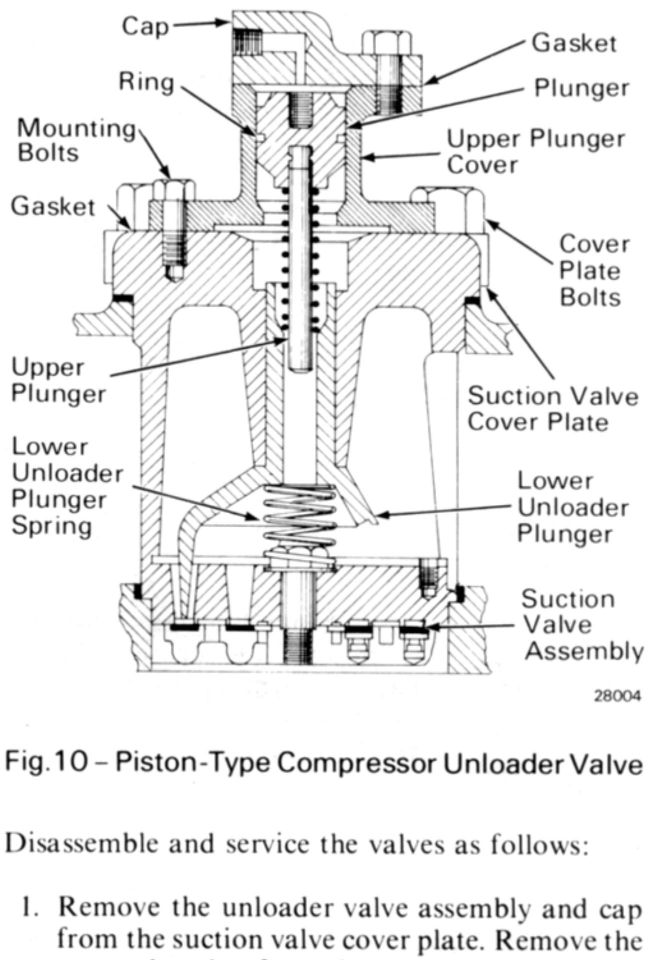


Fig.10 – Piston-Type Compressor Unloader Valve

Disassemble and service the valves as follows:

1. Remove the unloader valve assembly and cap from the suction valve cover plate. Remove the cap and gasket from the upper plunger cover.

2. Remove the plunger assembly from the upper plunger cover.

3. Clean the plunger and ring. Check to ensure freedom of ring operation in groove.

4. Clean and inspect the interior of the upper plunger cover.

5. Apply a small amount of fine lapping compound to the angle seat on the plunger. Insert the plunger in the cover, and lap the angle seats of the plunger and cover.

6. After lapping the seats, remove the plunger and clean both the plunger and cover. Remove all compound.

7. Apply light grease comparable to petroleum jelly to the cover, plunger, and ring. Reassemble the parts, using new gaskets under the cover cap and the upper plunger cover.

DISCHARGE AND SUCTION VALVES

Each cylinder has one discharge valve, Fig. 11, and one suction valve, Fig. 12. Each valve is a cage-like assembly consisting of a bumper, a seat, springs, and two concentric discs. The discs are installed between the bumper and seat and are held against the seat by springs that fit into recesses in the bumper. The assembly is held together by a single centrally located bolt.

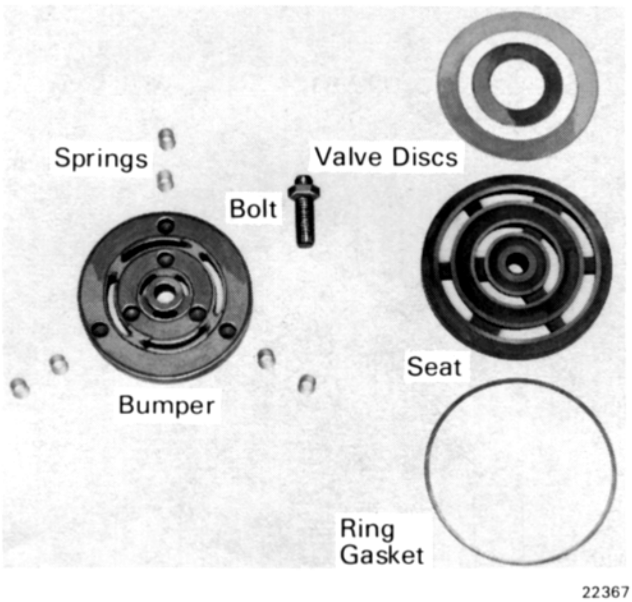


Fig. 11 – Discharge Valve Assembly

In a discharge valve assembly, the springs are above the discs and hold them down against the seat. In a suction valve assembly, the springs are below the discs and hold them up against the seat. Discharge and suction valves both contain six springs, three for each disc. However, since May 1, 1975 a nine-spring valve assembly is available as a replacement part. The nine-spring discharge valve with spring 9098117 can be used in any water cooled air

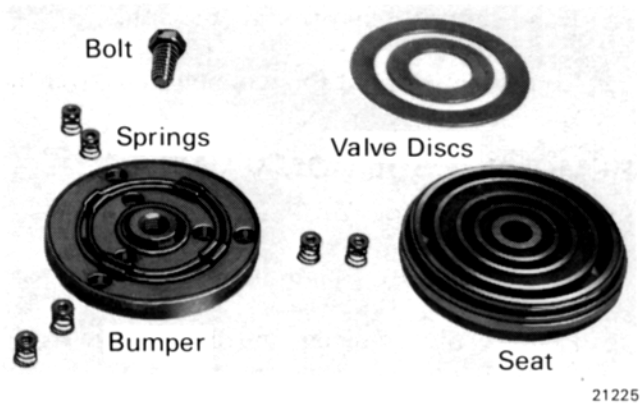


Fig. 12 – Suction Valve Assembly

compressor, but due to the higher operating temperatures involved, must be adapted for use in air cooled machines by substituting standard spring 8246382. See Valve Usage Table in Service Data.

Special valve holders that facilitate air compressor valve maintenance are available. These valve holders ensure proper rigidity, and minimize the possibility of damage while work is being done on the valves. For holder part numbers, see Service Data at the back of this instruction.

REMOVING DISCHARGE VALVES

1. Back off the crown and setscrew, Fig. 13, at the center of the cover plate.

2. Remove the cover plate bolts, and remove the cover plate.

3. Remove the valve clamp.

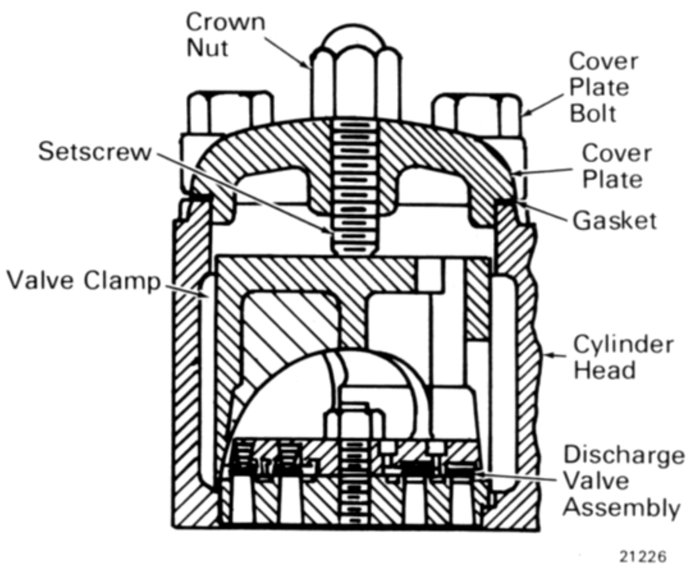


Fig. 13 – Discharge Valve Removal

4. Remove the discharge valve assembly.

5. To prevent entry of foreign material, cover the valve openings.

REMOVING SUCTION VALVES

LOW PRESSURE

1. Remove the cover plate bolts, Fig. 10.

2. Remove the unloader and cover plate as an assembly.

3. Remove the suction valve assembly, then cover the valve opening.

HIGH PRESSURE

1. Loosen the crown nuts, Fig. 14, approximately two turns.

2. Remove the cover plate bolts, and remove the cover plate and unloader as an assembly.

3. Make certain that the clamp setscrews have been loosened sufficiently to provide clearance between the screws and the valve clamp upon reassembly.

4. Remove the clamp.

5. Remove the suction valve assembly, then cover the valve opening.

SUCTION AND DISCHARGE VALVE DISASSEMBLY

Valves can be taken apart to remove the springs and valve discs, by removing the nut and lockwasher or the cap bolt. The valve parts should then be cleaned thoroughly.

VALVE RECONDITIONING

VALVE DISCS

The valve discs should be replaced if a wear step has formed. The following information is provided to qualify a disc for reuse.

A valve disc that shows no defects requires only cleaning, and should not be lapped or ground.

If a disc must be lapped to remove some minor defects, even pressure should be placed on the disc. Finger pressure should not be applied to the valve disc to ensure against concentrated pressure areas.

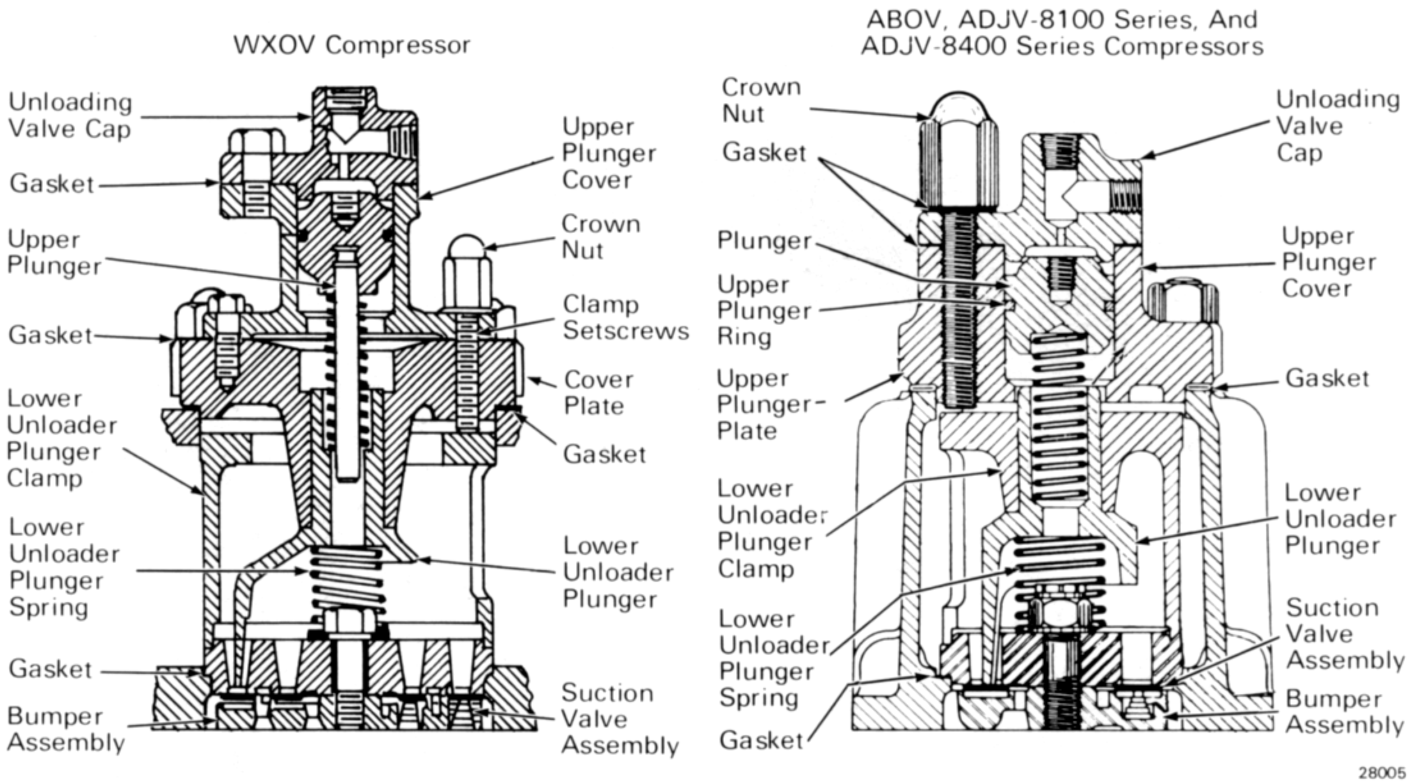


Fig. 14 – Suction Valve Removal

A disc can be sprung badly enough using finger pressure to cause a wavy finish that will allow the valve to leak.

The disc should be placed in a holder that will distribute the pressure evenly while lapping. A simple holder can be made from a flat steel plate cut out to a depth of about 2/3 the thickness of a disc.

The disc should not be lapped to the seat. If the disc is not perfectly flat, the seat will be given a wavy surface. The disc should be lapped on a perfectly flat lapping plate. To bring the disc finish to a near-mirror condition, very fine lapping compound should be used.

Occasionally, a valve disc which has had a long period of service will stop rotating. If the disc remains in one position long enough, the valve springs will wear rings in the disc. Discs in this condition should be discarded. The wear rings, if deep enough, are weak spots that can develop into cracks. Also, a valve disc which has had considerable service may have a wear step in it. A disc in this condition should be discarded.

Minimum valve disc thickness should not be less than that given in the Service Data.

VALVE SEATS

Valve seats must be completely free of any nicks, and the edges should be square and sharp. If a valve seat requires lapping, it should be lapped to a master plate using a fine compound that will give a shiny, scratch-free surface.

While inspecting valve seats, refer to dimensions in the Service Data.

VALVE BUMPER

Inspect valve bumper for cracks or excessively worn areas. See Service Data for dimensions.

VALVE SPRINGS

New valve springs should be used when reconditioning valves. The springs should have a slip fit in the bumper holes. A spring that fits loosely in the bumper hole will wear rapidly on the bottom coil, promoting spring and disc breakage. If the spring is not set squarely in the bottom of the hole, it will bind and cause wear on the O.D. of the upper coils. This can be avoided by using a rod that is slightly smaller than the 11 mm (7/16″) diameter of the spring hole, and square on the end for compressing the spring solid on the bottom. Springs that are too tight will also bind in the holes and cause wear on the upper coils. Springs should be compresed after installation to check for freedom of movement.

CLEANING

After reconditioning and inspection, all valve parts should be thoroughly cleaned for reassembly.

VALVE REASSEMBLY

DISCHARGE VALVE

Any discharge valves held in place with a stud and nut should have the stud replaced with a cap bolt. This will eliminate removing the stud each time a valve is lapped.

1. Hold bumper assembly in one hand with spring pockets facing up.
2. Place springs in place, with large diameter inserted into spring pocket, and place inner and outer valve discs on their respective springs.
3. Invert the seat assembly and position it on the discs.
4. Hold this assembly together, apply the cap bolt, and tighten to 115-129 N·m (85-95 ft-lbs) torque.

SUCTION VALVE

1. Hold the bumper assembly, spring pockets up, and place the inner and outer valve disc springs in the pockets.
2. Place the respective discs on the springs.
3. Carefully place the seat assembly over the discs.
4. Apply the cap bolt and tighten to 115-129 N·m (85-95 ft-lbs) torque.

Using a blunt-nosed piece of wood inserted through the valve opening, check that the valve discs move freely. Check for leaks by filling valve pockets with fuel oil.

If valve assemblies are not to be used immediately, they should be oiled and wrapped to keep them clean. If the valves are to be stored, they should be protected against rust.

CRANKSHAFT

CLEANING

If the crankshaft is removed for any reason, it should be given a thorough cleaning with solvent, particularly during any overhaul work, since metallic particles may lodge in the oil passages. All rifle drillings must be cleaned thoroughly.

The main drilling of the crankshaft consists of two intersecting passages. One of these passages is parallel to the crankpin and is plugged at both ends. These plugs are provided to aid in cleaning and must be removed. A long-handled bristle brush having slightly over an 8 mm (5/16″) diameter is recommended for cleaning passages. During scrubbing, solvent should be directed into the passages under approximately 170 kPa (25 psi) pressure. Washing and brushing must be repeated until the oil passages and crankshaft are absolutely clean. After cleaning, be sure to replace the passage plugs which were removed.

In compressor-exhausters the plug in the crankpin oil passage (near the main bearing) is orificed for feeding oil to the main bearing, Fig. 15. Other oil passage plugs may also be orificed. Make sure that orifices are absolutely clean. Plugs orificed for feeding oil to the pump end of the crankshaft from the nearby end of the crankpin oil passage should be installed with the orifice aimed toward the center line of the crankshaft. All other orificed plugs should be installed with the orifice aimed away from the center line of the crankshaft. Take care when tightening that the wrench does not pinch the orifice shut. Check after tightening by running a wire through the orifice or by feeding a solvent under pressure into the crankshaft lube oil inlet opening.

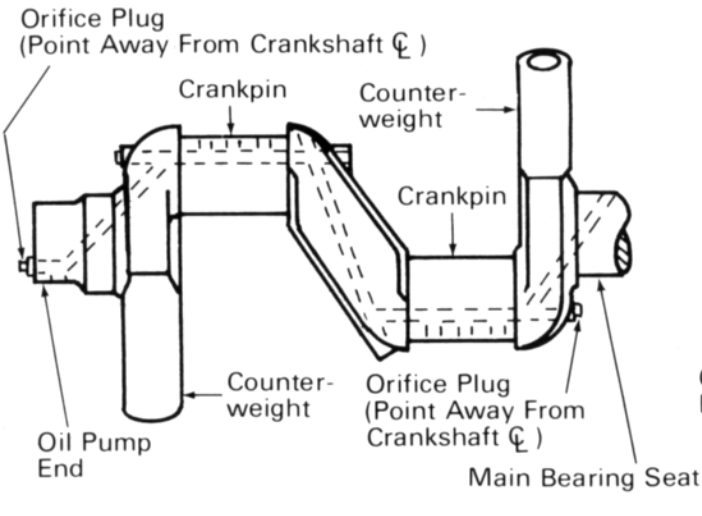
INSPECTION

The main bearing surfaces of the crankshaft should not receive any wear, and should not be less than 85.75 mm (3.376″) diameter. On units equipped with a plunger-type oil pump, the oil pump eccentric surface should not be scored, tapered, or out-of-round in excess of 0.013 mm (.0005″). The runout of the crankshaft should not exceed 0.25 mm (.010″) at the main bearing journal, with the crankshaft located in centers.

The crankpin on the crankshaft should not be more than 0.038 mm (.0015″) out-of-round, or worn to less than 88.80 mm (3.496″) diameter.

If it is damaged, or worn beyond above limits, it can be reconditioned by grinding, provided the surface will clean up to 0.76 mm (.030″) undersize.

If the crankshaft has grooved seal surfaces, use synthetic oil seal kit 8367712 at the oil pump end and kit 8367711 at the opposite end. These kits include a renewable wear sleeve which is to be pressed over the crankshaft to provide an optimum seal riding surface on the crankshaft. Also included is a synthetic oil seal to operate with the 3 mm (1/8″) oversize shaft, provided by the wear sleeve.



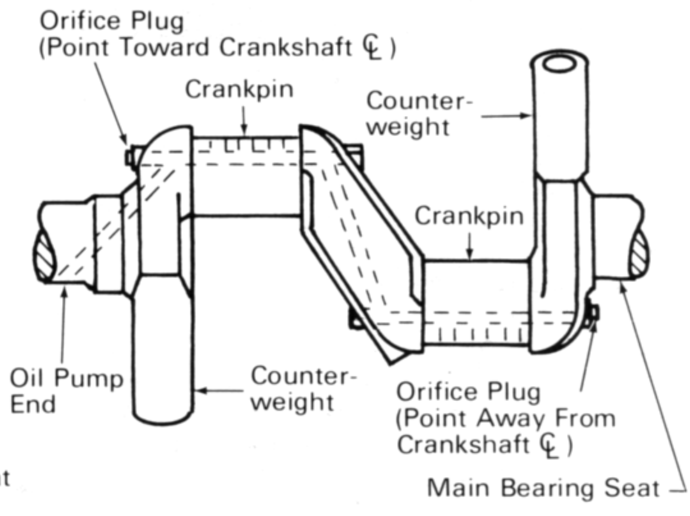


Fig.15 – Typical Orifice Plug Applications

1. To apply wear sleeve, the shaft must be clean and seating surface must measure 82.55 mm ± 0.038 mm (3.250″ ± .0015″).

2. Shaft surface must be coated with a liquid sealant or gasket cement.

3. Wear sleeve must be pressed into correct position with arbor or flat plate against sleeve end. Do not hammer on thin edge of sleeve or wear sleeve may become warped or out-of-round.

4. Remove excess sealant. None should be left on finished working surface.

5. Fill the cavity between the two seal lips with a good quality grease.

6. Install the seal with the name and number side or the lip side facing the outside of the compressor.

All used crankshafts will have some damage in the seal area. Crankshaft rework is not required in the seal area if kit is used.

RECONDITIONING

1. To regrind the crankpin, remove the crankshaft from the crankcase and position in an engine lathe. Throw blocks for regrinding a crankshaft can be made, and must hold the centerline of the throw at 63.5 mm ± 0.13 mm (2.5″ ± 0.005″) from the centerline of the crankshaft. The crankpin must be ground to 88.074 mm ± 0.013 mm - 0.000 mm (3.4675″ ± .0005″ - .0000″).

2. After grinding crankpin to size, the radius at the intersection of the radial oil holes and the outside diameter of the crankpin must be rounded. This can be done by attaching a small piece of No. 320 abrasive to a rubber tip driven by a high speed drill motor.

3. To polish the crankpin, perform the following steps:

   a. Use a 1″ wide strip of No. 240 emery cloth to remove grinder marks. Buff and oil until 80% of the marks are gone.

   b. Use No. 320 emery cloth to remove the remaining grinder marks. Continue to buff and oil until surface smoothness is a maximum of 0.31 microns (12 microinches), when measured with profilometer.

Extreme care must be used when polishing to ensure even and continuous motion of emery cloth from one crank cheek to the other while the shaft is rotating. Polishing must be uniformly even, or an uneven diameter will result.

4. When oil seal surfaces are grooved, they may be ground to 81.79 mm (3.220″) diameter, and still use standard seals when rebuilding. The surfaces should then be finished to 0.25-0.51 microns (10-20 microinches) with no machine lead. The radius must be retained at shoulder to bearing diameter.

5. Before reinstallation of the crankshaft, it must be thoroughly cleaned by following the procedure under Cleaning.

6. A new set of crankpin bearing inserts 0.76 mm (.030″) undersize must be used in the connecting rods upon reassembly. For part numbers of undersize inserts, refer to the Parts Catalog.

CONNECTING RODS

Connecting rods used in the compressors are equipped with precision bearing inserts. The bearing inserts should be replaced at the time of overhaul or any time condition warrants replacement.

The connecting rods and bearing shells should be fitted to the crankshaft before the crankshaft is installed in the crankcase. Clearance limits are given in the Service Data at the end of this publication. The connecting rod bearing to crankshaft journal clearance can be checked by the use of Plastigage strips.

CAUTION

Connecting rod insert bearing 8083586 must not be used in compressors that have gear-type lube oil pumps; that is, units that have crankshafts with a radius between the crankpin and web. Narrower bearing 8496981 must be used in gear pump equipped compressors in order to clear the radii that are at the crankpin shoulders.

CYLINDERS

CLEANING AND INSPECTION

The cylinder should be thoroughly cleaned after removal, prior to any inspection or reconditioning. Examine the cylinder for score marks or ridges at the end of the ring travel surface. Inspect cylinders for a maximum out-of-round condition of 0.03 mm (.001"). Also check cylinder diameter to ensure correct clearances may be obtained with the correct size piston.

Accumulated cylinder and piston wear will increase piston to cylinder clearance which is a limiting factor at the time of reapplication. No cylinder should be matched with a new or used piston with a piston to cylinder clearance exceeding the limit given in the Service Data at the rear of this instruction.

For example, with a WXOV low pressure cylinder worn to a maximum diameter of 200.114 mm (7.8785"), a piston not less than 199.923 mm (7.8710") diameter must be used. Obviously, with a cylinder worn to this diameter the minimum diameter shown in the specifications for a rebuild piston cannot be used since the maximum clearance of 0.190 mm (.0075") would be exceeded. If cylinders are worn excessively, they should be rebored to oversize increments of 0.25 mm (.010"). It has been found to be more economical to rebore them to 0.25 mm (.010"), 0.51 mm (.020"), or 0.76 mm (.030") oversize. If cylinders are worn to the extent that they would require more than 0.76 mm (.030") reboring, it is far more satisfactory and economical to replace them with new cylinders or those rebored to the regular oversizes.

REBORING

When reboring is necessary the cylinders should not be rebored to their final size. They should be rebored to 0.05 mm to 0.08 mm (.002" to .003") under their final size to allow enough stock for proper honing. If less stock is left, the boring marks will not be completely removed when the cylinder is honed to size.

HONING

After reboring, the cylinders should be honed for the final finish. A honed finished of 0.64 to 1.01 microns (25-40 microinches) is desired, with a crosshatch of 25° to 35°. The proper microinch finish can be obtained from stones ranging from 180 to 280 grit. See the Equipment List at the rear of this publication for the proper cylinder bore honing set.

Fig. 16 shows a cylinder wall at various stages of the cylinder reconditioning operation. Figs. 16a and 16b are views of a cylinder after boring and before honing. Notice the rough finish left by the boring tool. New piston rings installed in a cylinder with this finish would be ineffective. Oil consumption and blow-by would remain high because the rings could not form a good seal. Fig. 16c is the same cylinder after 25 strokes with a spring loaded hone. Although honing marks are visible, the boring marks can also be seen. This finish is still too rough for piston ring seating. Fig. 16d is the cylinder wall after the cylinder was honed to size with a rigid hone. The boring marks have been cleaned up, and the crosshatch pattern left by the hone is all that is visible. This surface is ideal for early piston ring seating.

The tolerance allowed on finishing oversize rebored cylinders is + 0.03 mm - 0.00 mm (+ .001" - .000"). This tolerance is added to the amount that the cylinder is rebored. For example, if a standard 177.80 mm (7.000") cylinder is rebored 0.25 mm (.010") oversize, the finished diameter after honing should be 178.05 mm - 178.08 mm (7.010" - 7.011").

Honing of cylinders at regular maintenance periods should be avoided, except when used to remove scoring. A better practice is to remove any ridge at the top of the ring travel by scraping, and then rough the cylinder by hand using a No. 180 emery cloth to produce a crosshatch pattern at an angle of 25°-35° to the bore.

CLEANING AFTER HONING

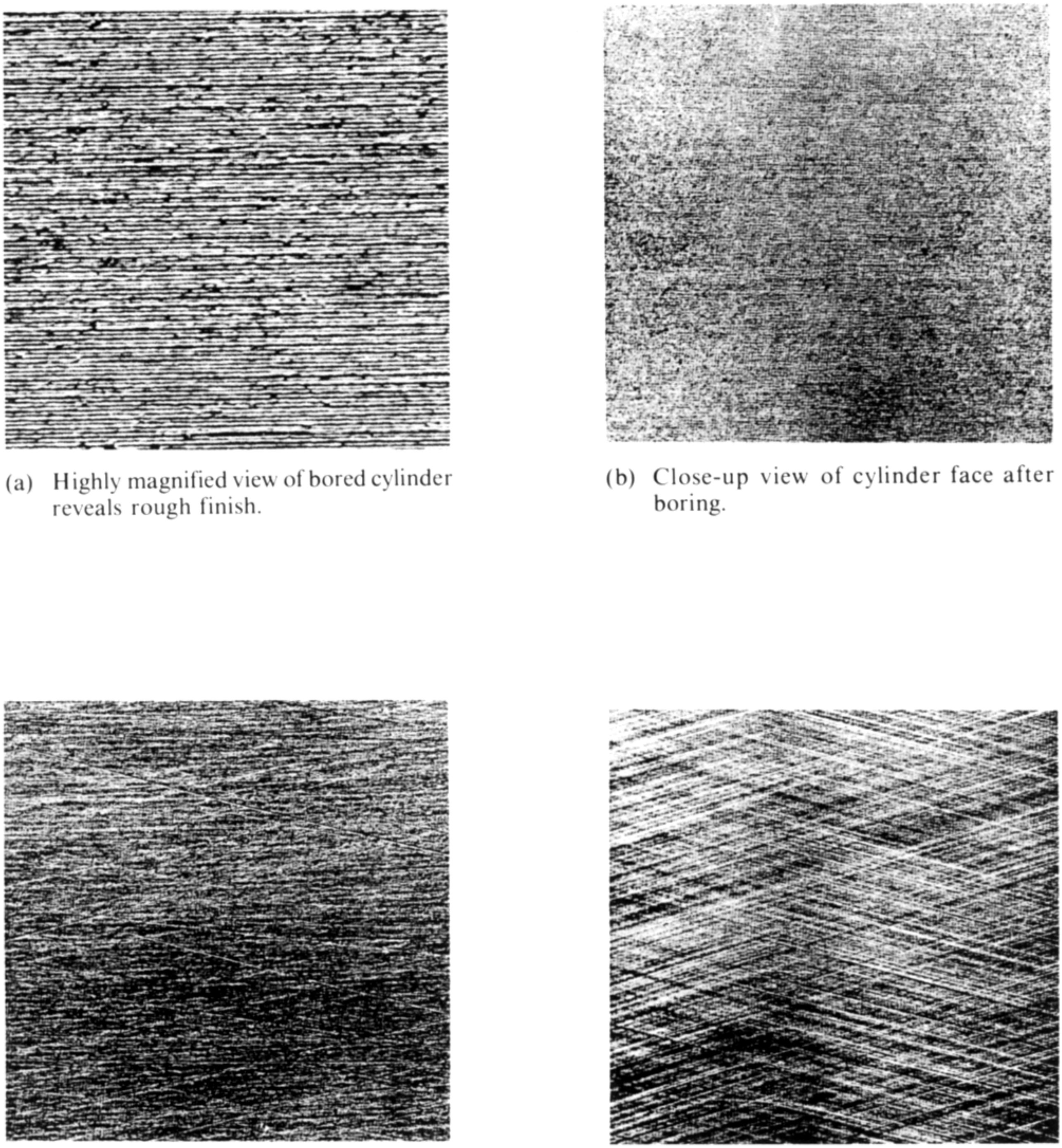
Of all the operations in repairing an air compressor, cleaning the cylinders may be the most costly one to forget. If the cylinders are not properly cleaned after they are honed, the compresor will wear out in an alarmingly short time. The tiny particles left by the hone will attack the rings, cylinders, and any other moving parts in the compressor. Thus, the omission of one procedure can eliminate all the good accomplished by hours of labor and valuable replacement parts. To make certain that the overhaul will last, the following cleaning procedure must be used:

1. Wash cylinder with soap and hot water using stiff fiber brush to clean cylinder bore and flanges thoroughly.

2. Swab each cylinder thoroughly with a clean rag dipped in 10W engine oil.

3. Wipe out cylinder with dry, clean cloth.

4. Repeat Steps 2 and 3 until clean white cloth can be rubbed on cylinder wall without staining cloth. It is important to use oil for this cleaning procedure because the oil pulls the abrasive particles out of the tiny pores and crevices in the cylinder wall. Solvents will not remove all abrasive particles.



(a) Highly magnified view of bored cylinder reveals rough finish.

(b) Close-up view of cylinder face after boring.

(c) Cylinder wall after 25 strokes with flexible hone. Note boring marks.

(d) Proper honing leaves crosshatch pattern.

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Fig.16 - Cylinder Wall Honing

PISTONS

At the time of the compressor overhaul, the pistons should be removed, cleaned, and inspected for excess wear. Match the pistons with a new or used cylinder so the diameters result in a piston-to-cylinder clearance which does not exceed the limit given in the Service Data at the rear of this publication.

Paragraph deleted.

Piston ring grooves must be square and free from wear ridges. Clearance between the ring side and groove should not exceed 0.10 mm (.004″), where applicable. Minor scuff marks or scratches can be smoothed or rounded with a file. (Do not use a stone or emery cloth.) All pistons that are to be used again should be given a phosphate treatment as outlined in Maintenance Instruction 1758.

PISTON PIN BEARING REPLACEMENT

Current model compressors are equipped with a prefinished bushing in the low pressure and vacuum piston assembly and roller bearings, Fig. 17, in the high pressure piston assembly. The roller bearing type piston assembly requires a different piston pin and connecting rod than piston assemblies using other types of bushings or bearings.

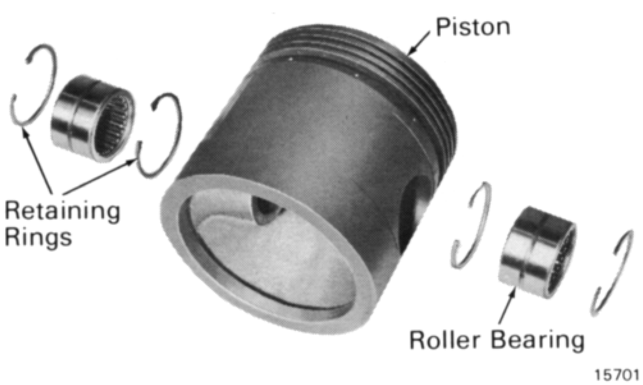

Fig.17 - Piston Pin Roller Bearing Application

LOW PRESSURE PISTON

When reconditioning machines, replace the low pressure piston pin bushings with the type removed.

The old bushings or bearings should be pressed out using driving tool 8231757, Fig. 18. Alternate methods tend to gouge the inside of piston bosses, and destroy the piston for further use.

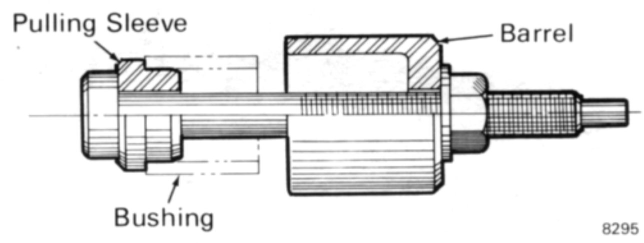

Fig.18 - Piston Bushing Removal Tool

Before attempting to replace the piston bushings, check the piston to see that it is sound and free from excessive scuff marks or wear at the following points:

1. Piston ring grooves must be square and free from wear ridges. Clearances between ring side and groove should not exceed maximum indicated in Service Data.

2. Piston-to-cylinder clearance must be within limits indicated in Service Data.

3. Minor scuff marks or scratches can be smoothed or rounded with a file. (Do not use stone or emery cloth.)

New bushings should be applied by shrinking the bushing with dry ice or liquid nitrogen, and heating the piston. The use of liquid nitrogen will permit dropping bushing into piston at room temperature. The use of dry ice will require heating piston to 90° to 150° C (200° to 300° F). Bushing should be dropped into outside opening of piston boss with inner end of boss squarely seated on piston bushing anvil 8231756, Fig. 19.

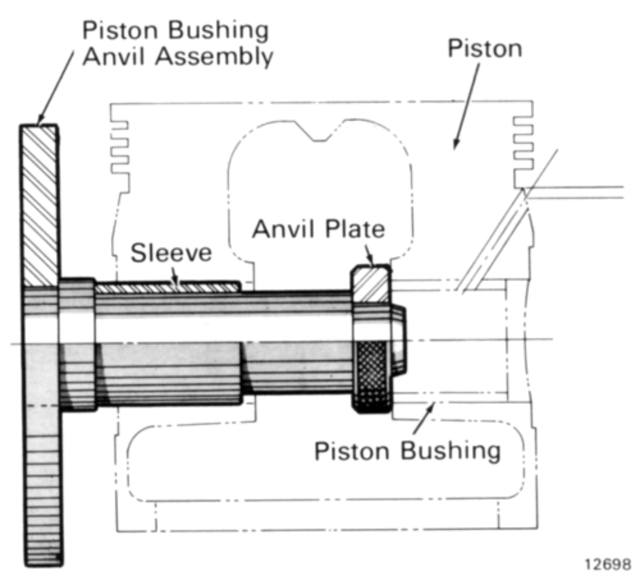

Fig.19 – Piston Pin Bushing Installed

HIGH PRESSURE PISTON

When replacing high pressure piston pin bearings, use roller bearing assemblies, Fig. 17. Those machines which did not previously have roller bearing assemblies will require a different piston, piston pin, and connecting rod.

The old bearings should be removed by pressing to the center of the piston with a 51 mm (2-1/32") diameter driving tool. Use care not to gouge the inside of the piston bosses with the driving tool.

A piston boss support anvil and plug for pressing in the roller bearings can be made as shown in Fig. 20.

Before attempting to replace the piston bearings, check the piston to see that it is sound and free from excessive scuff marks or wear at the following points:

1. Piston ring grooves must be square and free from wear ridges. Clearance between ring side and groove should not exceed the maximum indicated in Service Data.
2. Piston to cylinder clearance must be within limits indicated in Service Data.
3. Minor scuff marks or scratches can be smoothed or rounded with a file. (Do not use stone or emery cloth.)
4. Wash piston thoroughly to remove any foreign material, then blow it dry with clean, dry air.
5. Install inner retainer rings in piston pin boss using internal pliers.
6. Place piston over anvil, Fig. 21, locating piston pin boss approximately in the center of the three countersunk screws in the top of the anvil.

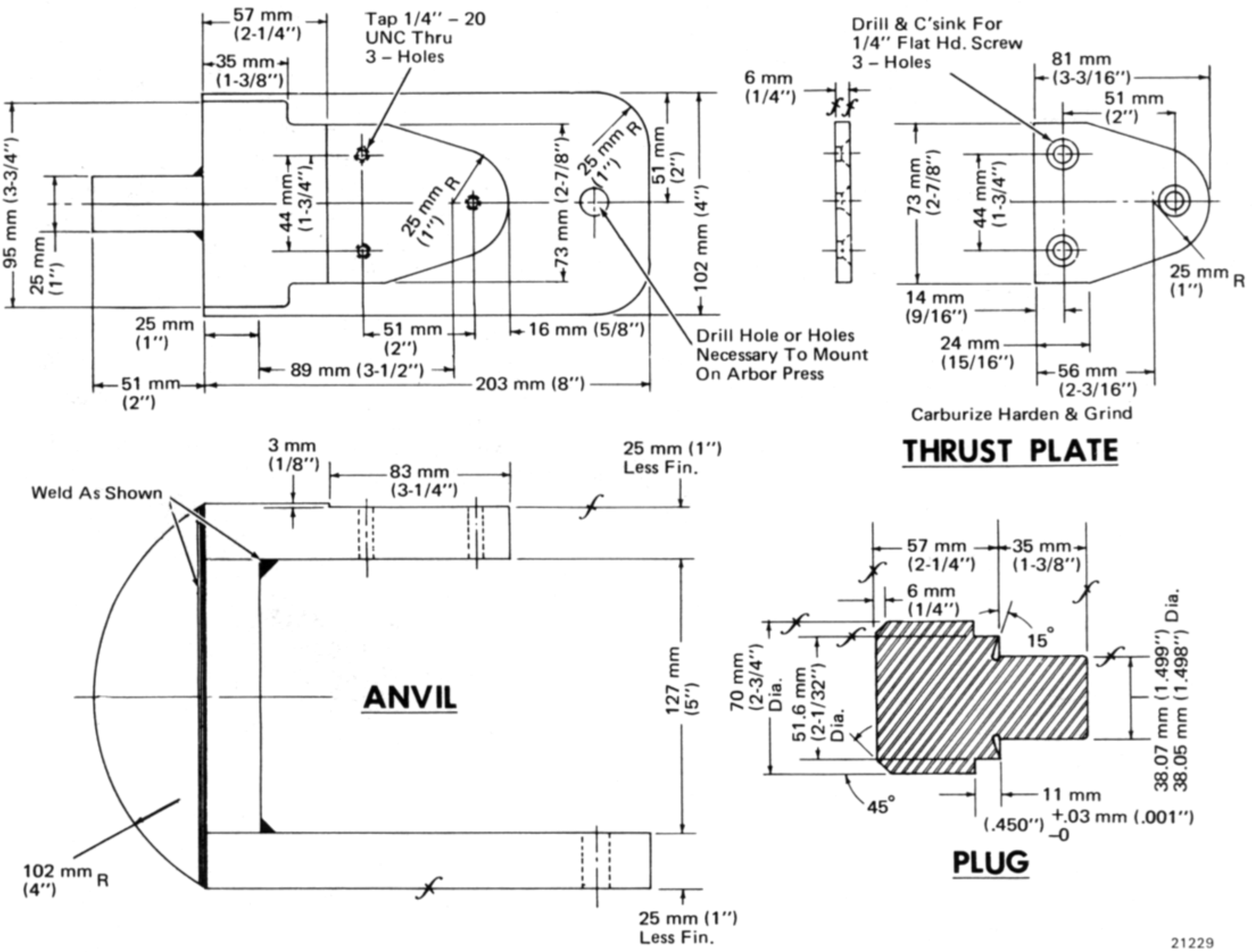

Fig.20 – Piston Boss Support Anvil

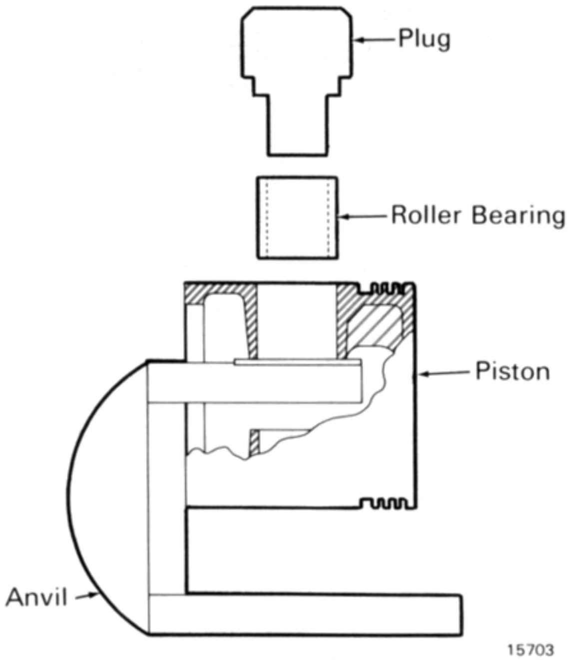

Fig.21 – Roller Bearing Installation

7. Place roller bearing on plug and start bearing into piston pin bore, being sure bearing is parallel with pin bore.

8. Press bearing into piston until plug bottoms on the O.D. of the piston. Do not overpress plug.

9. Remove plug, rotate piston 180° and relocate the other piston pin boss on the anvil. Repeat Steps 7 and 8.

10. After both bearings have been installed, remove the piston from anvil and install the two outer retainer rings.

11. Cover both ends of the piston pin bore to keep foreign material out of the bearings until the piston pin is installed.

PISTON PIN REPLACEMENT

The piston pin must be replaced if it is scored, damaged, or exceeds clearance limits given in the Service Data. A special tool is available for piston pin and connecting rod assembly, Fig. 22. This assembly fixture 8213878 ensures proper alignment of the piston pin and connecting rod, and prevents twisting the connecting rod when torquing the retaining bolt to the recommended 108-136 N·m (80-100 ft-lbs). It also positions the rod eye with the slot machined in the wrist pin for application of the retaining bolt.

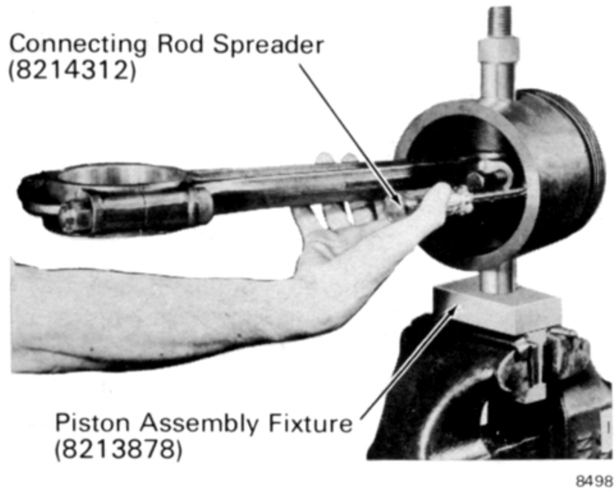

Fig.22 – Piston Assembly Fixture And Rod Spreader

Connecting rod spreader 8214312, also shown in Fig. 22, is used to expand the wrist pin bore of the connecting rod so it may be aligned in the piston assembly fixture without the use of force, which might damage the assembly.

PISTON RINGS

To aid in piston ring identification and location, the various ring combinations for the compressor and exhauster are shown in Fig. 23. Compression rings are marked on top with a pip or dimple to ensure proper application. Oil control rings are not marked as they may be applied with either side up.

As illustrated, there is a difference in ring usage in the water cooled and air cooled air compressor. Particular notice should be made of the ring and spring combination used in the low pressure cylinder of the water cooled compressor. This spring and ring combination is applied to the top and No. 2 ring grooves of the piston, with the spring above the ring. See chart in Service Data for proper piston ring application.

NOTE

Ring side clearance limits given in the specifications do not apply to the spring and ring combination. Oil control rings are used in the bottom piston ring groove of all compressor pistons.

The exhauster pistons use a similar spring and ring combination as used in the water-cooled cylinder piston. It should be noted, however, that the exhauster piston application differs, inasmuch as the spring is below the ring. Application of the spring and ring combination is made to the top and No. 2 piston ring grooves.

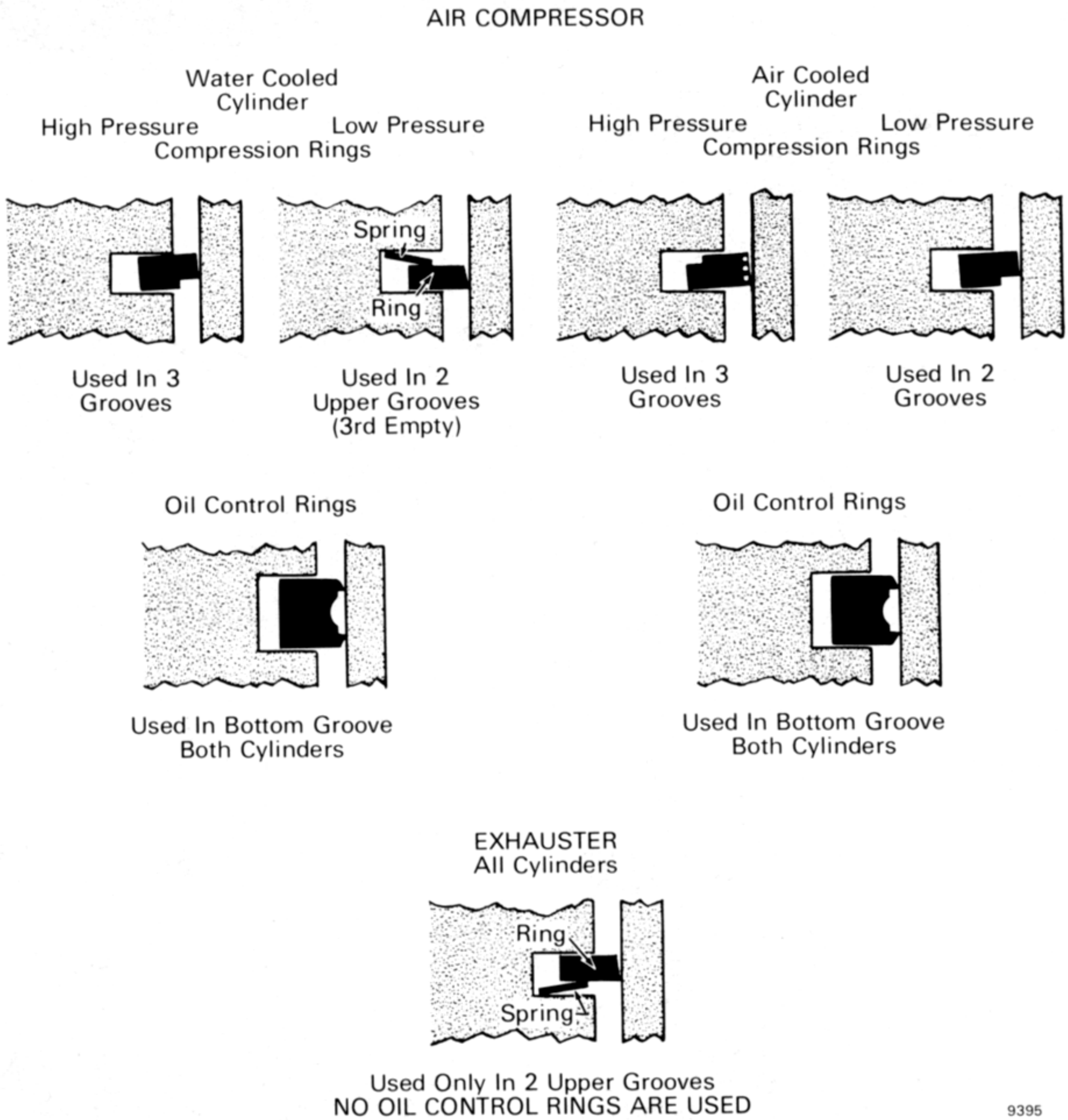

Fig.23 – Piston Ring Installation Details

NOTE

Ring side clearance limits given in the specifications do not apply to the spring and ring combination. Oil control rings are not used with the exhauster pistons.

To properly apply the piston rings, use the correct ring expanding installing tool according to the piston diameter. See Equipment List in Service Data for the correct ring expanders.

Standard size rings should be used on all standard pistons for all bore sizes up to where a 0.25 mm (.010″) oversize piston can be used. Piston rings should be fitted through the bottom of the cylinders rather than through the top, because the bottom of the cylinder is chamfered to prevent damage to the ring on entry, and this end wears less than the top. There, rings must have at least a minimum clearance at the lower end of the cylinders. Piston rings should never be filed to obtain end clearance.

OIL PUMP

PLUNGER-TYPE PUMP

The oil pump should fit the crankshaft to the limits listed in the Service Data. If the clearance limit is exceeded, a new oil pump eccentric will be required. The oil pump plunger should be inspected for scoring and excessive wear. If the clearance limit is exceeded as given in the Service Data, a new pump assembly should be installed.

GEAR-TYPE PUMP

The backlash in the oil pump drive is fixed by dowel pins in the oil pump mounting flange. The endplay in the oil pump drive shaft should not be less than 0.03 mm (.001″) or more than 0.10 mm (.004″). It is obtained by pulling up on the adjusting nut until this endplay is 0.05 mm (.002″) to 0.13 mm (.005″), then advancing the nut to the nearest locking position. If the clearance limits are exceeded as given in the Service Data, a new pump should be installed.

When converting a unit from plunger-type pump to gear-type pump, the oil pump mounting flange will have no dowel pins to fix the oil pump backlash. The backlash between the oil pump gears should be between .002″ to .004″.

OIL PRESSURE RELIEF VALVE

The oil pressure relief valve should be completely disassembled and thoroughly cleaned. All passages should be blown out, using compressed air. The valve should then be reassembled and reset as described in the Lubricating System section.

PRESSURE GAUGES

The orifice screw should be removed, and the air and oil pressure gauges tested on a dead weight tester. After testing, an orifice screw having an orifice diameter not greater than 0.38 mm (.015″) must be installed in the gauge, and staked securely in place.

REASSEMBLY

The compressor-exhauster should be assembled with new gaskets and oil seals. The bearing surfaces of the crankshaft, main bearings, connecting rod bearings, wrist pins, and cylinders should be adequately lubricated with approved air compressor oil as recommended in Maintenance Instruction 1756.

The area of the crankshaft that the lip of the synthetic rubber seal touches should be well oiled or greased.

1. On compressor-exhausters equipped with plunger-type oil pump, install the oil seals in the end plates as explained in the "Crankshaft" section of this publication. On models equipped with gear-type oil pumps, Fig. 24, first install the oil introducing ring, piston rings, and retainer ring in the end plate, making sure that the retainer ring snaps firmly in place. Then install the oil seals.

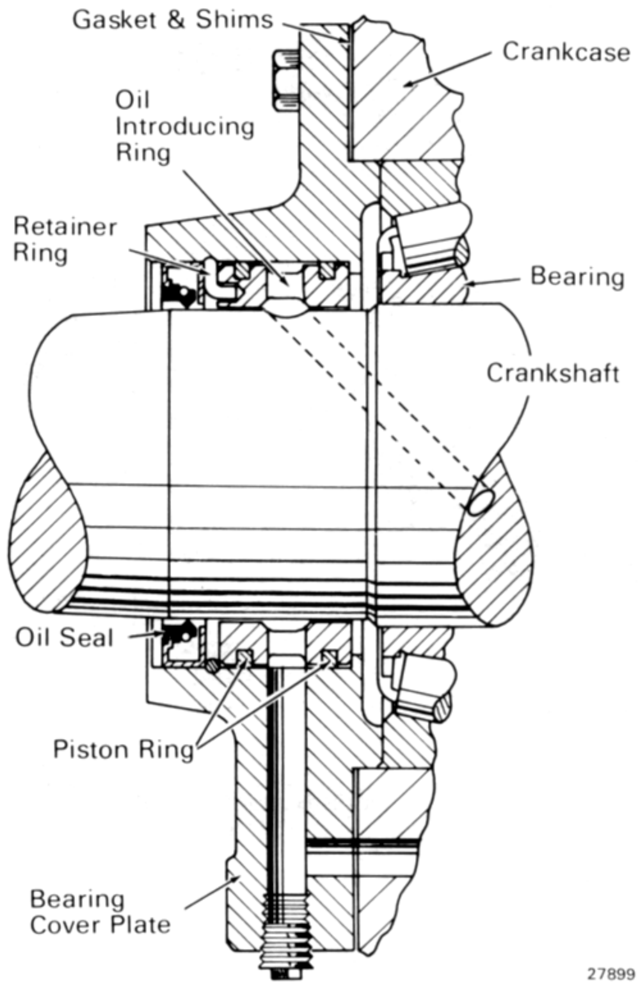

Fig.24 – Gear-Pump Compressor-Exhauster Oil Introducing Assembly

2. Mount the main bearing inner races on the crankshaft, and the outer races in the crankcase (oil pump end) or the end plate (opposite oil pump end). The races must be flat against the locating shoulder within 0.05 mm (.002″).

3. Install the crankshaft in the crankcase with a gasket behind the end plate opposite the intercooler and shims at the intercooler so the oil pocket and passage is up, providing gravity feed lubrication to the main bearings.

NOTE

If leather type oil seals are used, oil seal guide 8219901 should be employed when sliding the leather type oil seals over the shaft keyway and shoulder on the shaft. Any burr will destroy the feather edge of the oil seal.

4. Check the end thrust of the crankshaft by exerting 1724 kPa (250 psi) pressure alternately at each end of the shaft, and checking shaft movement with a dial indicator. Thrust clearance

should not exceed the limits given in the Service Data. If necessary, the end thrust may be adjusted by the addition or removal of shims between the end plate and crankcase.

5. Install the plunger-type oil pump and oil pump eccentric in the crankcase. Torque the eccentric strap bolts to 47-61 N·m (35-45 ft-lbs). Install cotter pins in the strap bolts, and lockwire the oil pump mounting bolts.

   Install the gear-type oil pump. Torque the mounting flange bolts to 62-74 N·m (45-55 ft-lbs).

NOTE

Identifying or matching marks on the connecting rods, connecting rod caps, and both halves of the oil pump eccentric (plunger-type pump only) must all be on the same side.

6. Install the previously assembled piston and connecting rod assembly on crankshaft. Torque connecting rod bolts to 197-210 N·m (145-155 ft-lbs). Install locknut hand tight against connecting rod nut, and tighten 1/3 to 1/2 turn.

NOTE

When installing the cylinders, cylinder heads, and intercooler to the compressor, be sure to use the proper gaskets and initially tighten the bolts hand tight. To limit the cylinder distortion to a minimum, the mounting bolts should be tightened to the proper torque value as specified in the Service Data in the following order:

Intercooler to cylinder head.
Cylinder head to cylinder.
Cylinder to crankcase.

7. Using a piston ring compressor, mount the cylinders on the crankcase.

8. The following steps should be taken before installing the cylinder heads to the cylinders to ensure maximum operating performance of the cylinder head gaskets.

   a. Gasket surfaces on cylinder and heads must be free of deep scratches and foreign material. The faces of the water cooled heads must be flat within 0.05 mm (.002″).

   b. Gaskets should be dipped or coated with light motor oil prior to application, to permit flow of gasket and complete sealing. Use of heavy grease, gasket cements, or graphite coatings should be avoided because they impair gasket performance and life. Proper positioning of gasket should be attained by using short studs inserted in head before application.

9. The valve covers on the discharge valves, and the unloader on the high pressure suction valves should be installed with the valve clamp screws released. After the covers are installed, the valve clamp screws should be tightened and locked in place with the clamp screw crown nut. On the low pressure unloader assemblies, care should be taken to ensure compression of the suction valve cover gasket.

   If the gasket does not compress, two gaskets should be applied. Do not remove the valve seat gasket.

10. Mount the cylinder head assemblies containing the suction and discharge valves onto the cylinders.

11. Install the intercooler, then tighten the intercooler, cylinder head, and cylinder mounting bolts as explained in Step 6.

12. Insert all cylinder head bolts, and tighten finger tight. Torque as indicated:

    ABOV (Water cooled)

    Tighten bolts to 163-176 N·m (120-130 ft-lbs) following pattern in Fig. 25.

    WXOV; ADJV-8100 Series

    Tighten bolts to 122 N·m (90 ft-lbs). Recheck the torque by going through the sequence a second time.

    ADJV-8400 Series

    Tighten bolts to 258-285 N·m (190-210 ft-lbs). Recheck the torque by going through the sequence a second time.

NOTE

Because tightening of heads on air cooled models is not as critical as tightening a water cooled machine, no specific pattern need be followed.

13. Install the safety valve, suction and discharge elbows, air filter, crankcase breather, oil pressure relief valve, and oil filter (if applicable) in proper locations.

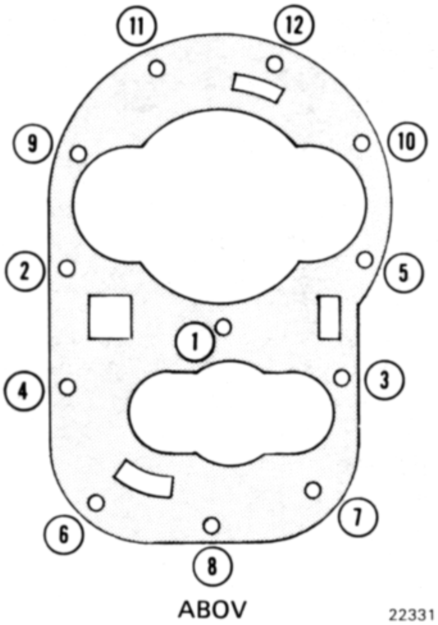

Fig.25 - Cylinder Head Tightening Pattern

14. If the unloader piping is in good condition, it should be reused. If new unloader piping is required, the latest type should be used. The piping should be soap tested for leaks at 620 kPa (90 psi).

15. Wipe the crankcase clean with lint-free, bound-edge cloths, and install the inspection covers. If the oil gauge and oil filter were removed from the inspection cover, replace them in the proper position.

BREAK-IN AND TESTING AFTER OVERHAUL

A customer having many compressor-exhausters to break-in and test is advised to set up a test stand. Drawings covering such an installation will be furnished on request. File Drawing No. 343 covers a schematic piping diagram for an air compressor test stand, and File Drawing No. 603, an air compressor test stand arrangement. If access to a compressor test stand is not possible, the compressor may be tested on the locomotive.

PRELIMINARY TEST PROCEDURES

Whether the compressor is to be mounted on a test stand, Fig. 26, or tested in the locomotive, the following steps should be taken before starting test: Insert a temperature gauge in the pipe plug hole in the crankcase to check temperature rise of lube oil. A 10° to 150° C (50° to 300° F) gauge can be used.

To provide means of relieving air pressure while testing compressor on locomotive, the discharge relief valve (if so equipped) should be removed, and a globe valve installed. Flexible tubing or armored hose can be attached to the valve and placed to allow air and vapors to discharge outside the engineroom.

As soon as the compressor is started, either on the test stand or in the locomotive, the lube oil pressure should be approximately 310 kPa (45 psi) with cold oil. As the oil temperature increases, the pressure will drop. The oil pressure at 315 RPM should be adjusted to 60-124 kPa (10-18 psi) on "A" series, and 103-138 kPa (15-20 psi) on "W" series with oil temperature at about 60° C (140° F).

COMPRESSOR TEST BREAK-IN RUN

Before the final test runs, the compressor should be given a break-in run for 30 minutes at 425 RPM pumping against a maximum of 69 kPa (10 psi) air pressure. On the test stand, a 50.8 mm (2") globe valve is used to exhaust the air being pumped, and on the locomotive the newly installed globe valve and other air drains can be used. If this does not exhaust sufficient air to keep the pressure at 69 kPa (10 psi), the automatic brake valve can be moved to the full release position.

After the half hour break-in, close drain valve(s) and let main reservoir air pressure build up to normal cutout setting of the unloader governor or compressor control switch. Repeat several times to make sure suction unloading valve parts and unloader governor or compressor control switch are operating correctly. If any valve or valves fail to unload properly, shut down the compressor and repair the defect.

FINAL TEST RUNS

Set unloader governor or compressor control switch to cut out at 689 kPa (100 psi), and cut in at approximately 620 kPa (90 psi). Open drain sufficiently so compressor operates at 50% load factor (i.e., unload for the same amount of time that it is loaded), and run for 2 hours at 425 RPM.

Following the first 2 hour final run, reset unloaded governor to cut out at normal operating pressure. Operate at 50% load factor under these normal pressures for an additional 2 hours at a compressor speed of 425 RPM.

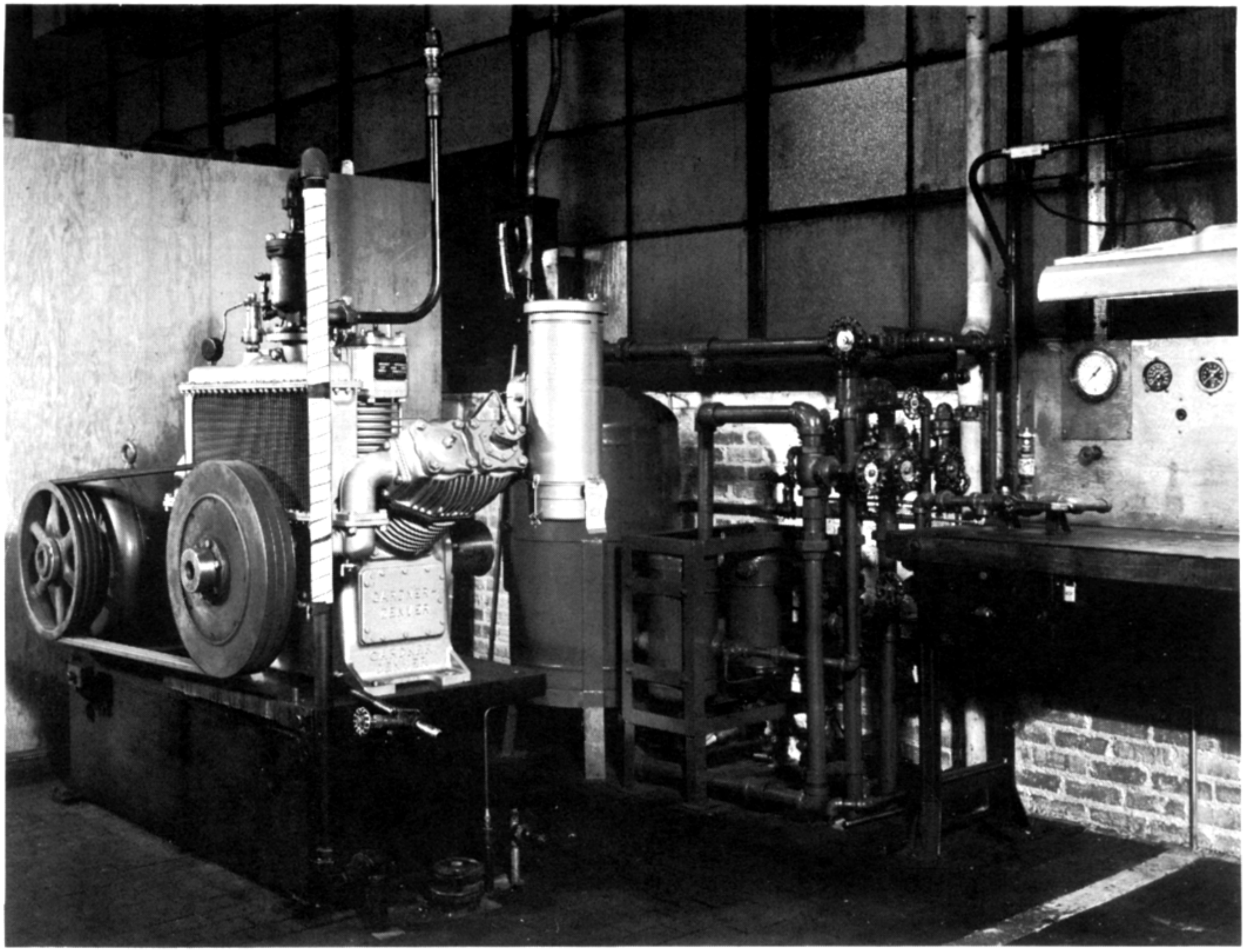

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Fig. 26 – Typical Test Stand Installation

OPERATING TESTS

Audio inspections of moving parts should be made at regular intervals during the break-in period. If any noise (other than the normal valve click) is apparent, or a regularly occurring thump can be felt by placing hand on compressor, the cause of the noise or vibration should be corrected before attempting any further testing.

The intercooler pressure, observed during a test run while under load, should be near 380 kPa (55 psi), as this pressure is an indicator of the valve efficiency. The pressure may vary slightly due to change in air temperature or barometric pressure, but any variation of more than 20 kPa (3 psi) above or below normal intercooler pressure is an indication of a defective valve(s), the location of which can be found as follows:

1. If intercooler pressure is abnormally high only when pumping, the high pressure suction valve should be inspected.
2. If the intercooler pressure climbs slowly when the compressor is unloaded, the high pressure discharge valve should be inspected.
3. If the intercooler pressure is abnormally low when pumping and drops to zero pressure in less than 3 minutes when unloaded, the low pressure discharge valves should be inspected.
4. If the intercooler pressure is abnormally low when pumping, but drops only a few pounds after being unloaded 3 minutes, the low pressure suction valves should be inspected.

The low pressure discharge valves or low pressure suction valves at fault will usually be indicated by a weak or erratic suction sound, abnormal blowback from air filter, or an excessively hot low pressure discharge valve cover plate.

After the compressor has completed the recommended running time and appears to be working satisfactorily, all valves should be removed and the cylinders inspected for scoring or scratches that might have occurred during assembly or break-in. Brown streaks in the cylinder should not be confused with scratches or scoring as this is not an abnormal condition, and these streaks disappear after the rings and the cylinders have had sufficient running to properly polish themselves together.

The valves may then be replaced, and with the compressor running under load, all gasket joints should be tested for air leaks. This testing may be done with water applied to all gasket joints with an oil can.

After making sure that all valves are again working properly and that all joints are tight and free from leaks, the machine should be given an orifice test. See Fig. 6 for orifice test limits.

COMPRESSOR STORAGE

If the place of storage is near a sea coast or in a damp climate, it is recommended that the compressor be given a 1 hour 50% load factor test run every 20-90 days during the high humidity season to prevent minute rust areas forming on cylinders and valves. The experience obtained from other similar machinery in the same climate area will assist materially in establishing the optimum interval between storage period retest.

If the tested compressor is to be kept in storage for an indefinite length of time, it should be protected against rust. After slushing with anti-rust oil, wrap the breather cap and all safety valves with MIL-B-131 barrier material and seal with pressure sensitive tape.

If the compressor is to be immediately installed in a locomotive, the slushing with anti-rust oil will not be required.

SERVICE DATA

SPECIFICATIONS

LUBE OIL CAPACITY . . . . . 13.25 Liters (14 Quarts)

	Millimeters Min.	Millimeters Max.	Inches Min.	Inches Max.
VALVE REWORK LIMITS				
Valve Seats				
Difference Between Center Boss And Valve Disc Seat	—	0.25	—	0.010
Gasket Surface Flat Within	—	0.13	—	0.005
Gasket Seat Width	3.18	—	0.125	—
Valve Bumper				
Distance Disc Seat Surface Below Center Boss Surface	3.56	3.96	0.140	0.156
Guide Finger Height Must Not Be Greater Than Center Boss Height.				
Valve Disc				
Thickness	1.32	—	0.052	—
Lift	1.98	2.59	0.078	0.102

DIMENSIONS FOR REBUILD – LOW PRESSURE CYLINDER

	WXOV Millimeters Min.	WXOV Millimeters Max.	WXOV Inches Min.	WXOV Inches Max.
Cylinder Inside Diameter				
New	200.000	200.038	7.8740	7.8755
*Maximum	—	200.114	—	7.8785
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	199.809	—	7.8665	—
Clearances				
Piston To Cylinder				
New	0.076	0.140	0.0030	0.0055
Rebuild	0.076	0.191	0.0030	0.0075
Piston Pin	0.033	0.10	0.0013	0.004
Side Of Oil Ring Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.18	—	0.007	—

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

DIMENSIONS FOR REBUILD – HIGH PRESSURE CYLINDER

	WXOV (Cont'd)			
	Millimeters		Millimeters	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	146.025	146.063	5.7490	5.7505
*Maximum	———	146.139	———	5.7535
Piston Diameter				
New	145.948	145.974	5.7460	5.7470
**Minimum	146.111	———	5.7524	———
Clearances				
Piston To Cylinder				
New	0.051	0.114	0.0020	0.0045
Rebuild	0.051	0.165	0.0020	0.0065
Piston Pin	0.033	0.152	0.0013	0.006
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.15	———	0.006	———

DIMENSIONS FOR REBUILD – VACUUM CYLINDER

	WXOV (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	200.000	200.038	7.8740	7.8755
*Maximum	———	200.114	———	7.8785
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	199.809	———	7.8665	———
Clearances				
Piston To Cylinder				
New	0.076	0.140	0.0030	0.0055
Rebuild	0.076	0.191	0.0030	0.0075
General Clearance Data				
†Main Bearing End (Cold)	0.20	0.33	0.008	0.013
††Connecting Rod Bearing	0.030	0.10	0.0012	0.004
†††Connecting Rod Side	0.33	1.65	0.013	0.065
Oil Pump Eccentric	0.02	0.10	0.001	0.004
Oil Pump Plunger To Body	0.013	0.08	0.0005	0.003

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

†If end clearance is more than maximum limit, remove one 0.13 mm (.005″) shim and recheck.
††Do not file cap or rod or use shim stock to tighten. When maximum clearance is reached, install new inserts.
†††Total clearance for all rods on one crankpin.

DIMENSIONS FOR REBUILD – LOW PRESSURE CYLINDER

	ABOV			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	200.025	200.063	7.8750	7.8765
*Maximum	———	200.139	———	7.8795
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	199.809	———	7.8665	———
Clearances				
Piston To Cylinder				
New	0.102	0.165	0.0040	0.0065
Rebuild	0.102	0.216	0.0040	0.0085
Piston Pin	0.033	0.10	0.0013	0.004
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.20	———	0.008	———

DIMENSIONS FOR REBUILD – HIGH PRESSURE CYLINDER

	ABOV (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	101.600	101.638	4.0000	4.0015
*Maximum	———	101.714	———	4.0045
Piston Diameter				
New	101.536	101.536	3.9975	3.9985
**Minimum	101.448	———	3.9940	———
Clearances				
Piston To Cylinder				
New	0.038	0.102	0.0015	0.0040
Rebuild	0.038	0.152	0.0015	0.0060
Piston Pin	0.033	0.15	0.0013	0.006
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.10	———	0.004	———

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

DIMENSIONS FOR REBUILD – VACUUM CYLINDER

	ABOV (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	215.875	215.900	8.4990	8.5005
*Maximum	———	215.989	———	8.5035
Piston Diameter				
New	215.519	215.544	8.4850	8.4860
**Minimum	215.430	———	8.4815	———
Clearances				
Piston To Cylinder				
New	0.330	0.381	0.0130	0.0150
Rebuild	0.330	0.444	0.0130	0.0175
General Clearance Data				
†Main Bearing End (Cold)	0.25	0.38	0.010	0.015
††Connecting Rod Bearing	0.030	0.10	0.0012	0.004
†††Connecting Rod Side	0.33	1.65	0.013	0.065
Oil Pump Eccentric	0.02	0.10	0.001	0.004
Oil Pump Plunger To Body	0.13	0.08	0.0005	0.003

DIMENSIONS FOR REBUILD – LOW PRESSURE CYLINDER

	ADJV-8100 Series			
	Milimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Daimeter				
New	200.000	200.038	7.8740	7.8755
*Maximum	———	200.114	———	7.8785
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	100.809	———	7.8665	———
Clearances				
Piston To Cylinder				
New	0.076	0.140	0.0030	0.0055
Rebuild	0.076	0.191	0.0030	0.0075
Piston Pin	0.033	0.10	0.0013	0.004
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.20	———	0.008	———

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necesary to remove rings from piston or cylinder.

†If end clearance is more than maximum limit, remove one 0.13 mm (.005″) shim and recheck.
††Do not file cap or rod or use shim stock to tighten. When maximum clearance is reached, install new inserts.
†††Total clearance for all rods on one crankpin.

DIMENSIONS FOR REBUILD – HIGH PRESSURE CYLINDER

	ADJV-8100 Series (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	101.600	101.638	4.0000	4.0015
*Maximum	——	101.714	——	4.0045
Piston Diameter				
New	101.536	101.562	3.9975	3.9985
**Minimum	101.448	——	3.9940	——
Clearances				
Piston To Cylinder				
New	0.038	0.102	0.0015	0.0040
Rebuild	0.038	0.152	0.0015	0.0060
Piston Pin	0.033	0.15	0.0013	0.006
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.10	——	0.004	——

DIMENSIONS FOR REBUILD – VACUUM CYLINDER

	ADJV-8100 Series (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	200.000	200.038	7.8740	7.8755
*Maximum	——	200.114	——	7.8785
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	199.809	——	7.8665	——
Clearances				
Piston To Cylinder				
New	0.076	0.140	0.0030	0.0055
Rebuild	0.076	0.191	0.0030	0.0075
General Clearance Data				
†Main Bearing End (Cold)	0.20	0.33	0.008	0.013
††Connecting Rod Bearing	0.030	0.10	0.0012	0.004
†††Connecting Rod Side	0.33	1.65	0.013	0.065
Oil Pump Eccentric	0.02	0.10	0.001	0.004
Oil Pump Plunger To Body	0.013	0.08	0.0005	0.003

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

†If end clearance is more than maximum limit, remove one 0.13 mm (.005″) shim and recheck.
††Do not file cap or rod or use shim stock to tighten. When maximum clearance is reached, install new inserts.
†††Total clearance for all rods on one crankpin.

DIMENSIONS FOR REBUILD – LOW PRESSURE CYLINDER

	ADJV-8400 Series			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	200.000	200.038	7.8740	7.8755
*Maximum	———	200.114	———	7.8785
Piston Diameter				
New	199.898	199.923	7.8700	7.8710
**Minimum	199.809	———	7.8665	———
Clearances				
Piston To Cylinder				
New	0.076	0.140	0.0030	0.0055
Rebuild	0.076	0.191	0.0030	0.0075
Piston Pin	0.033	0.10	0.0013	0.004
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.20	———	0.008	———

DIMENSIONS FOR REBUILD – HIGH PRESSURE CYLINDER

	ADJV-8400 Series (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside Diameter				
New	101.600	101.638	4.0000	4.0015
*Maximum	———	101.714	———	4.0045
Piston Diameter				
New	101.536	101.562	3.9975	3.9985
**Minimum	101.448	———	3.9940	———
Clearances				
Piston To Cylinder				
New	0.038	0.102	0.0015	0.0040
Rebuild	0.038	0.152	0.0015	0.0060
Piston Pin	0.033	0.15	0.0013	0.006
Side Of Oil Ring To Groove	0.05	0.10	0.002	0.004
***Ring Gap	0.10	———	0.004	———

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

DIMENSIONS FOR REBUILD – VACUUM CYLINDER

	ADJV-8400 Series (Cont'd)			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
Cylinder Inside diameter				
New	215.875	215.900	8.4990	8.5000
*Maximum	———	215.989	———	8.5035
Piston Diameter				
New	215.519	215.544	8.4850	8.4860
**Minimum	215.430	———	8.4815	———
Clearances				
Piston To Cylinder				
New	0.330	0.381	0.0130	0.0150
Rebuild	0.330	0.444	0.0130	0.0175
General Clearance Data				
†Main Bearing End (Cold)	0.25	0.38	0.010	0.015
††Connecting Rod Bearing	0.030	0.10	0.0012	0.004
†††Connecting Rod Side	0.33	1.65	0.013	0.065
Oil Pump Eccentric	0.02	0.10	0.001	0.004
Oil Pump Plunger To Body	0.13	0.08	0.0005	0.003

*Using new piston at maximum diameter.
**Using new cylinder at minimum diameter.
***Install new rings whenever it is necessary to remove rings from piston or cylinder.

†If end clearance is more than maximum limit, remove one 0.13 mm (.005″) shim and recheck.
††Do not file cap or rod or use shim stock to tighten. When maximum clearance is reached, install new inserts.
†††Total clearance for all rods on one crankpin.

VORTOX COMPRESSOR FILTER

OIL USAGE TABLE

Ambient Air Temperature		Viscosity
37.7° C	(Above 100° F)	SAE 30
10° to 37.7° C	(50° to 100° F)	SAE 20
-3.8° to 10° C	(25° to 50° F)	SAE 10
-17.7° to -3.8° C	(0° to 25° F)	3 parts SAE 10 plus 1 part kerosene
-34.4° to -17.7° C	(-30° to 0° F)	2 parts SAE 10 plus 1 part kerosene

For temperatures below -34.4° C (-30° F), further oil dilution is required. Maintain a mixture having a viscosity, at operating temperature, equivalent to an SAE 20 oil at 21.1° C (70° F).

NOTE

Kerosene dilution is considered an emergency measure. If operating temperature rises, the kerosene may evaporate leaving a low oil level. consult a petroleum distributor to obtain an oil having a severe low temperature characteristic.

PISTON AND RING APPLICATION CHART

COMPRESSOR MODEL		PISTON						STANDARD PISTON RINGS (Quantity Per Piston)								
		HIGH PRESSURE			LOW PRESSURE	VACUUM										
		8345952 102 mm (4")	*8343422 146 mm (5-3/4")	**8430937 146 mm (5-3/4")	8338021 200 mm (7-7/8")	8338021 200 mm (7-7/8")	8430941 216 mm (8-1/2")	8215109	8215113	8219291	8219292	8215101	8215093	8267599	8238311	8297166
HIGH PRESSURE CYLINDERS	ABOV & ADJV	X							1	3						
	WXOV		X (shaded)	X				1			3					
LOW PRESSURE CYLINDERS	ADJV				X							1	3			
	WXOV				X (shaded)							1 (shaded)	3 (shaded)			
	ABOV				X							1		2		
VACUUM CYLINDERS	ADJV -8100 Series & WXOV					X									2	
	ADJV-8400 Series & ABOV						X									2

*Piston with bronze bushing. Requires connecting rod 8033545 and piston pin 8083618.
**Piston with caged roller bearings. Requires connecting rod 8421998 and piston pin 8422001.

Shaded blocks indicate application only as replacement parts. Marked blocks without shading indicate application to new equipment and as replacement parts.

VALVE USAGE TABLE

	LOW PRESSURE CYLINDERS					HIGH PRESSURE CYLINDERS					VACUUM CYLINDER	
	DISCHARGE VALVE			SUCT. VALVE		DISCHARGE VALVE			SUCT. VALVE		DIS.	SUCT.
	Six-Spring Valve 8033548	Nine-Spring Valve 8424968	8424968 With Spring 8246382	9319947	8067160	Six-Spring Valve 8033552	8424969 With Spring 8246382	8038999	8067161	8038986	8497567	8497566
WXOV	1		1 (shaded)		1	1	1 (shaded)		1		4	4
ADJV	1		1 (shaded)		1			1		1	4	4
ABOV	1	1 (shaded)		1 (shaded)	1			1		1	2	2

Shaded blocks indicate optional valve.

NOTE: Machines capable of using either the nine-spring valve or the six-spring valve should not have the valves mixed.

TORQUE VALUES

The following torque values are recommended for fasteners on all air compressors. These torque values are based on threads that are clean and free of burrs and grit. The cleaning solvent (if used) should have a trace of lubricant.

Fastener Size	Torque Values		
And Thread	N·m	Ft-Lbs	Specific Applications
5/16″-18	11-24	8-18	All
3/8″-16	27-41	20-30	All
1/2″-13	41-54	30-40	All
1/2″-20	54-81	40-60	All except piston pin clamp
1/2″-20	108-136	80-100	Piston pin clamp screw
5/8″-11	82-94	60-70	All except cylinder head bolt
5/8″-11	95-122	70-90	Cylinder head bolts - WXOV, ADJV-8100 Series
5/8″-11	136-162	100-120	Cylinder head bolts - ABOV
3/4″-10	258-285	190-210	Cylinder head bolts - ADJV-8400 Series
5/8″-11	197-210	145-155	Connecting rod cap bolts
3/4″-10	176-203	130-150	All

EQUIPMENT LIST

Hone Set	8039177
Holder - Stone	
(Used with 8039177 hone set on high pressure cylinders)	8102249
Ring Expanders	
(101.600 mm [4″] cylinders)	8205283
(146.025 mm [5-3/4″] cylinder)	8205284
(200.000 mm and 200.025 mm [7-7/8″] cylinder(s))	8205286
(215.875 mm [8-1/2″] cylinder)	8194036
Piston Ring Guide	
(101.600 mm [4″] cylinder)	8205490
(146.025 mm [5-3/4″] cylinder)	8205491
(200.000 mm and 200.025 mm [7-7/8″] cylinder(s))	8205493
(215.875 mm [8-1/2″] cylinder)	8034087
Piston Assembly Fixture	8213878
Connecting Rod Spreader	8214312
Valve Holder	
(Used with "W" series machines and low pressure cylinder valves of "A" series compressors)	8214755
(Used on high pressure cylinder valves of "A" series compressors)	8214756
Oil Seal Guide	8219901
Piston Bushing Anvil	8231756
Piston Bushing Puller	8231757
Piston Bushing Groove Scraper	8231758
Replacer Scraper Blade	8231765
Replacement Blade Guard	8231766
Bearing Arbor	8338226

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