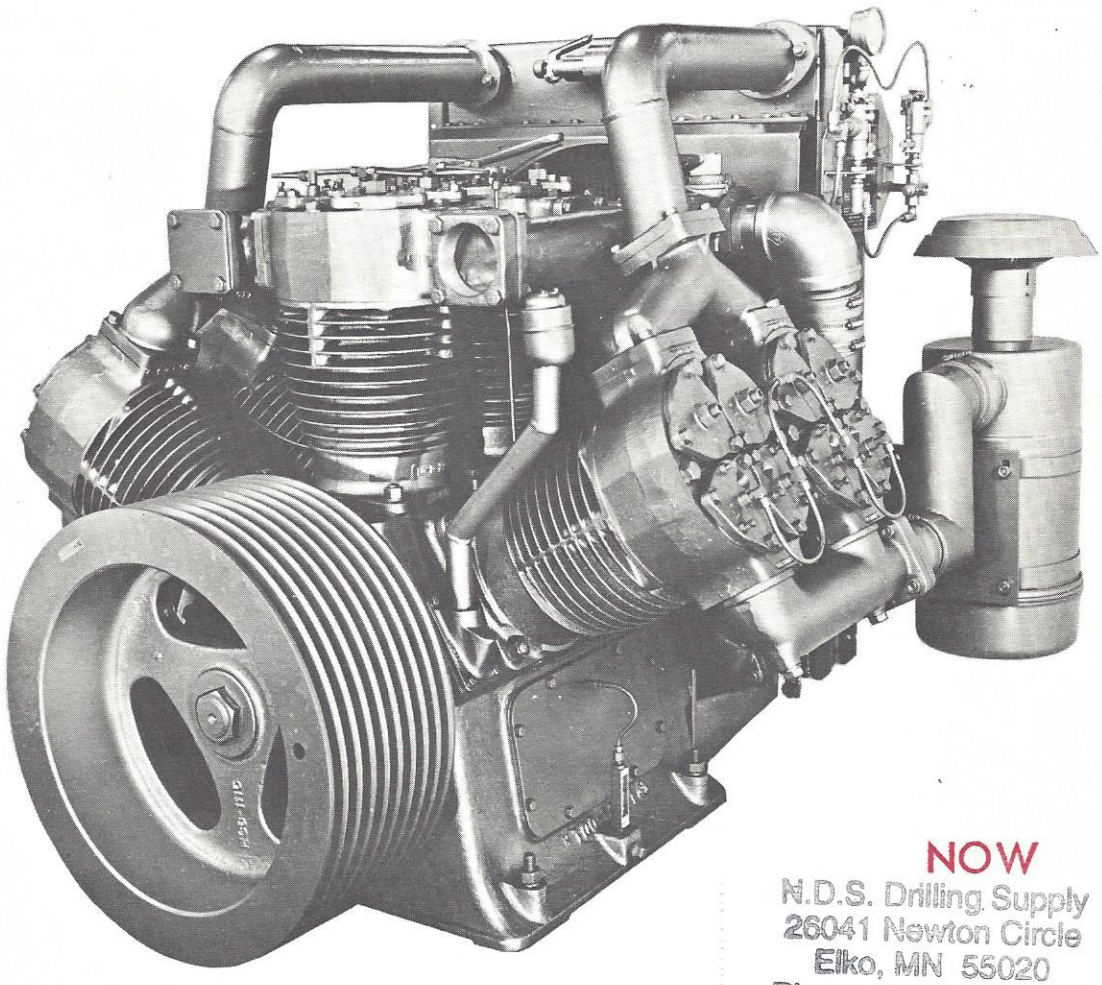
MODELS 50-100-256 SDS

STATIONARY AIR COMPRESSORS

OPERATION AND SERVICE MANUAL WITH PARTS LIST



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NOVEMBER, 1971

WABCO

An American-Standard Company

WESTINGHOUSE AIR BRAKE COMPANY
PNEUMATIC EQUIPMENT DIVISION
SIDNEY, OHIO 45365

Litho in U.S.A.

Chapter 1
COMPRESSOR — GENERAL
INTRODUCTION

1-1. The instructions and information contained in this manual will enable the operator and service personnel to provide the optimum in efficiency and long, trouble-free service from the Models 50SDS, 100SDS and 256SDS WABCO Air Cooled Air Compressors.

1-2. All three model compressors are designed to be powered by an electric motor drive or a power take-off source of driving train. Controls and all components of the units are easily accessible to the operator or service man.

1-3. Always be certain that there is sufficient oil in the crankcase, and that air filters are clean before starting. Always check condition and tension of the belts. Make certain that the compressor is properly connected to its power source.

1-4. Model 50SDS is a three cylinder air compressor while Models 100SDS and 256SDS are six cylinder machines. All three units may be operated as either single or two stage compressors. When a unit is operating as a single stage compressor, all cylinders function as low stage compressors. Dur-

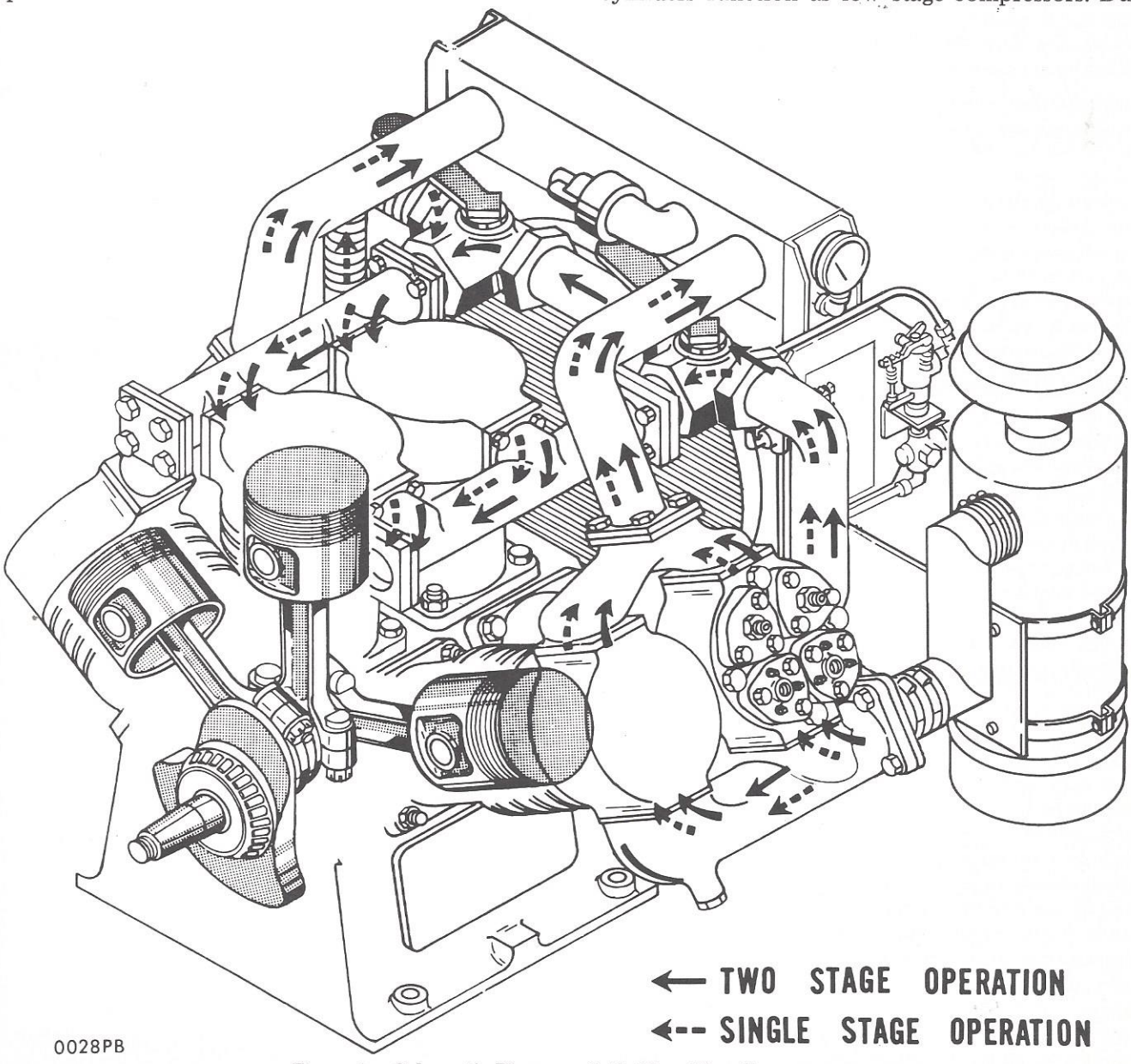


Figure 1 — Schematic Diagram of Air Flow Thru Compressor

ing two stage operation the outer banks of cylinders operate as a single stage compressor while the center bank functions as a second stage of compression. All cylinders incorporate two suction and two discharge valves each, except the center, or high pressure, cylinders of the Model 256SDS which incorporate one each suction and discharge valves.

1-5. Low pressure and high pressure pistons are made of aluminum alloy on the 50 and 100SDS while the low pressure pistons of the 256SDS are aluminum alloy, the high pressure pistons of 256SDS are cast iron. All connecting rods are either cast iron or forged steel. Connecting rod bearings are steel backed, babbit lined, shell type construction. The crankshaft is dynamically balanced, counter-weighted and rides on two tapered roller bearings. A suction fan draws air through the intercooler and provides a flow of cooling air over the entire compressor. Refer to "General Specifications" Chart for capacities and general specs of the three different models.

1-6. AIR FLOW. (See Figure 1).

1-7. Single Stage Operation. In single stage operation all cylinders draw in air through the air cleaners. The outside bank of cylinders discharge their compressed air into the intercooler (which functions as an aftercooler in this operation) while the center bank of cylinders discharges into a manifold as does air from the intercooler. Compressed air from this manifold is piped to an air receiver for storage and use.

1-8. Two Stage Operation. When the machines are used as two stage compressors, the outer banks of cylinders draw atmospheric air into them through the air cleaners and compress it. From the outer banks, or low pressure cylinders, the air is passed to the intercooler where much of the heat build-up of compression is dissipated. The air from the intercooler is then fed into the center bank, or high pressure cylinders. Here the air is compressed to the rated pressure of the machine and then piped to the air receiver tank and stored for use.

1-9. Oil Flow. Oil is stored in the crankcase sump from which it is drawn by a plunger type oil pump. This oil pump is located on the front of the compressor adjacent to the intercooler. The oil pump (Figure 2) is driven off an integral cam of the compressor crankshaft. Normal operating oil pressure is 10 to 20PSI. The oil is drawn through a screen located in the crankcase sump, through a check valve and passes through the oil pump plunger to the oil pressure chamber. From this point the oil is under pressure and is fed through drilled passages in the crankshaft to the connecting rod and main bearings. The pistons, piston rings, and cylinders are splash lubricated by throw-off from the connecting rod bearings. The oil pump body is bolted and doweled to the compressor front retainer and

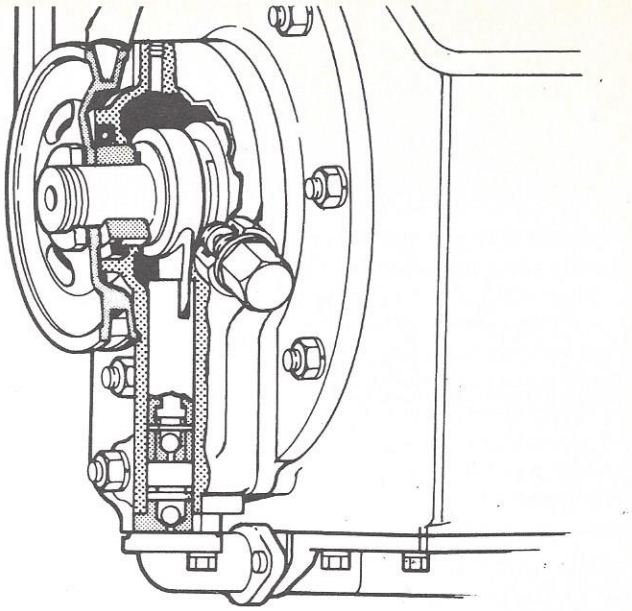


Figure 2 — Lubricating Oil Pump

carries a non-adjustable pressure relief valve that serves to by-pass excess oil to the crankcase sump.

1-10. Pressure Control System. (See Figure 3.) These "SDS" type compressors use a continuous running, load-unload pressure control. The system utilizes two unloader pilot valves. One valve is adjusted for single stage operation and the other for two stage operation. The two valves are separated by a shut-off valve and a double check valve.

1-11. When receiver air pressure reaches the unloader pilot valve pressure setting, the receiver air flows to the suction valve unloaders. When receiver pressure drops below the pressure setting of the unloader valve, the valve actuates to eliminate pressure to the unloader portion of the suction valves in the compressor cylinder heads allowing the compressor to resume its compressing function.

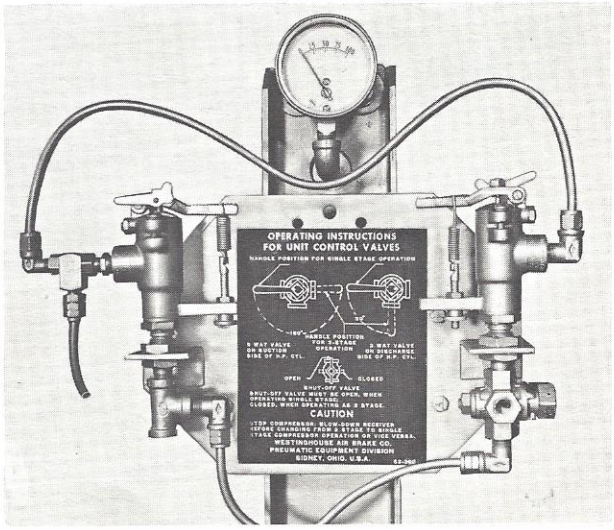


Figure 3 — Pressure Control System

Chapter 2
COMPRESSOR INSTALLATION

2-1. Location.

2-2. The compressor must be located on the rig in a position that is a minimum of two feet from any bulkhead. Since these SDS compressors are air cooled, there must be room for air to circulate around, over, and through the compressor, cylinders, and intercooler. If sufficient room for air circulation around the compressor is not provided the compressor will run too hot which in turn could cause premature valve failure within the compressor. Every effort should be made to ascertain that ambient air around the compressor does not exceed 120°F. Also, engine exhaust gases and piping should be routed away from the compressor installation.

2-3. Piping.

2-4. Piping from the compressor to the air receiver must be at least three inches in diameter. The receiver should be located as near the compressor as practicable with a maximum of a fifteen foot run from compressor discharge to receiver inlet connections. Never reduce pipe size in discharge line from compressor. Minimize bends and fittings in discharge line but do include a flexible coupling in the line and attempt to run discharge line down hill from compressor to receiver in order to drain any condensate that may occur in this line. Some bends and expansion joints are desireable in the discharge line to relieve stresses of expansion and contraction inherent in metal that is subject to temperature variations. For a typical rig installation see figure 4. As will be noted in figure 4, an auxiliary sump is often added to the intercooler on rig applications of SDS compressors. Due to moisture build-up in the bottom of the air receiver, the compressor piping should be connected to the upper end of the air receiver to prevent moisture feed back to the compressor.

2-5. Safety Valves.

2-6. The air receiver compressor must be protected by a safety valve. This valve must be sized to handle the full compressor output while maintaining the receiver pressure below the rated pressure of the receiver. The safety valve should be set to release at 10 PSI above the compressor's maximum rated operating pressure. This will provide additional protection against overloading the compressor.

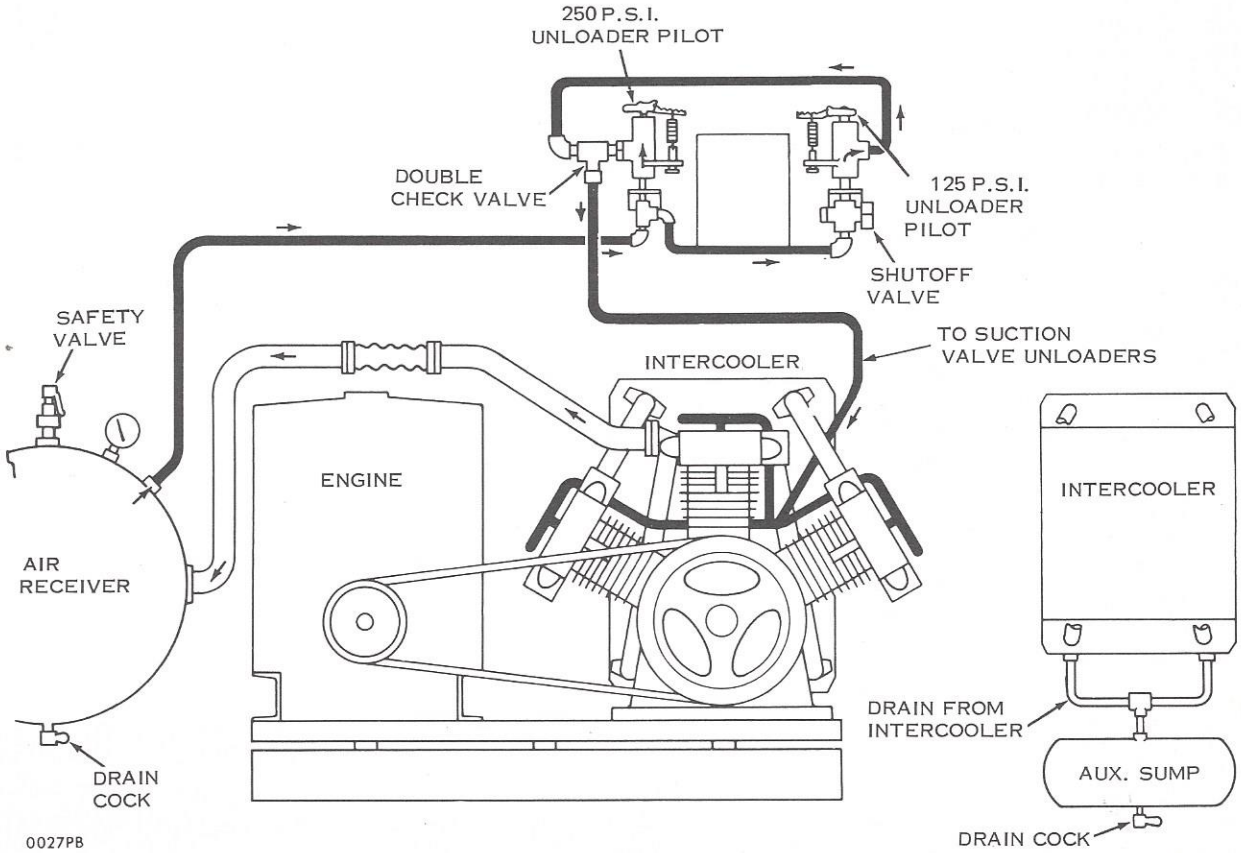


Figure 4 — Typical Piping Diagram (Engine Driven) Rig Application

Chapter 3
OPERATION

3-1. Lubrication.

3-2. Prior to initial operation, the crankcase of the compressor must be filled with a single viscosity, non-detergent, super refined oil with rust and oxidation inhibitors. Oil should be either a napthenic base or a specially compounded type to minimize carbon formation and to produce carbon residue of a soft, fluffy nature. Oils having animal fat compounding are NOT recommended. Use the following weight oils for the ambient temperature ranges indicated: above 60°F. Use SAE 30; 32 to 60°F use SAE 20; below 32°F use SAE 10W. It is important to use oil from a known, reputable source. Use of inferior quality oil will likely create service problems with valves, bearings, oil pump, etc. that will be costly to repair. The type of service required of an air compressor on rig applications is heavy duty under less than ideal conditions. Therefore, be sure to use only the proper lubricants.

3-3. Starting.

3-4. Prior to starting the compressor, perform all scheduled maintenance as outlined in Chapter IV. Always be certain that there is sufficient oil in the crankcase. If a shut-off valve has been incorporated in the compressor discharge pipe to receiver, make certain that this valve is open before starting.

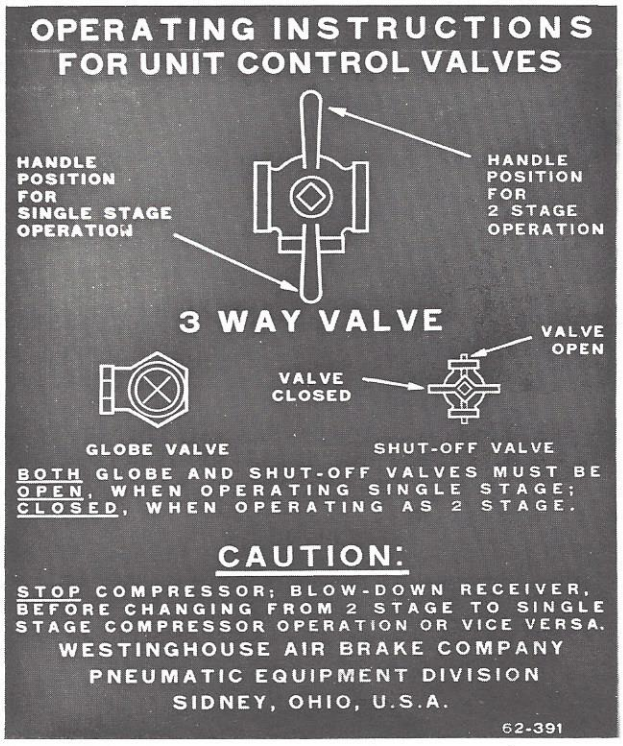


Figure 5 — Safety Valves

WARNING

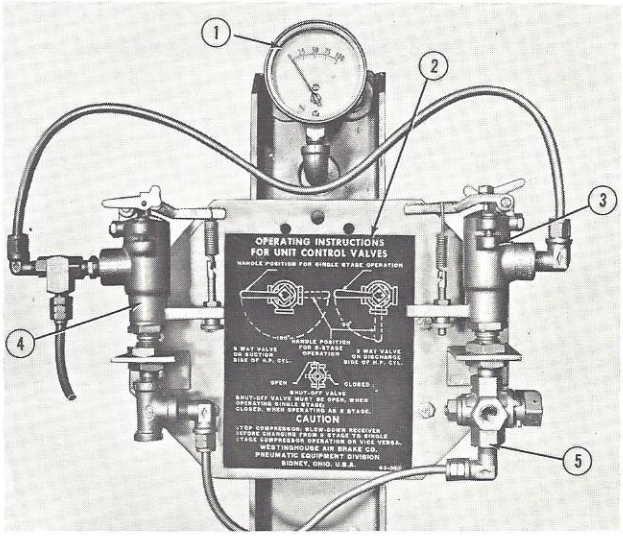
A shut-off valve should never be used in the compressor to receiver air line. However, should a shut-off valve be installed in this line, the operator should make certain that this valve is open before starting the compressor. In addition, if a shut-off valve is incorporated, a relief valve must also be included in the line between compressor and shut-off valve.

3-5. Refer to figures 5, 6, and 7 and set the controls for the mode of operation (single stage or two stage) desired. Start the power unit that drives the compressor.

3-6. Operation. After the compressor starts, check the direction of rotation. Rotation should be counterclockwise as viewed looking at the flywheel. Also check to see that the suction fan is drawing air through the intercooler and across the cylinders to provide proper heat dissipation.

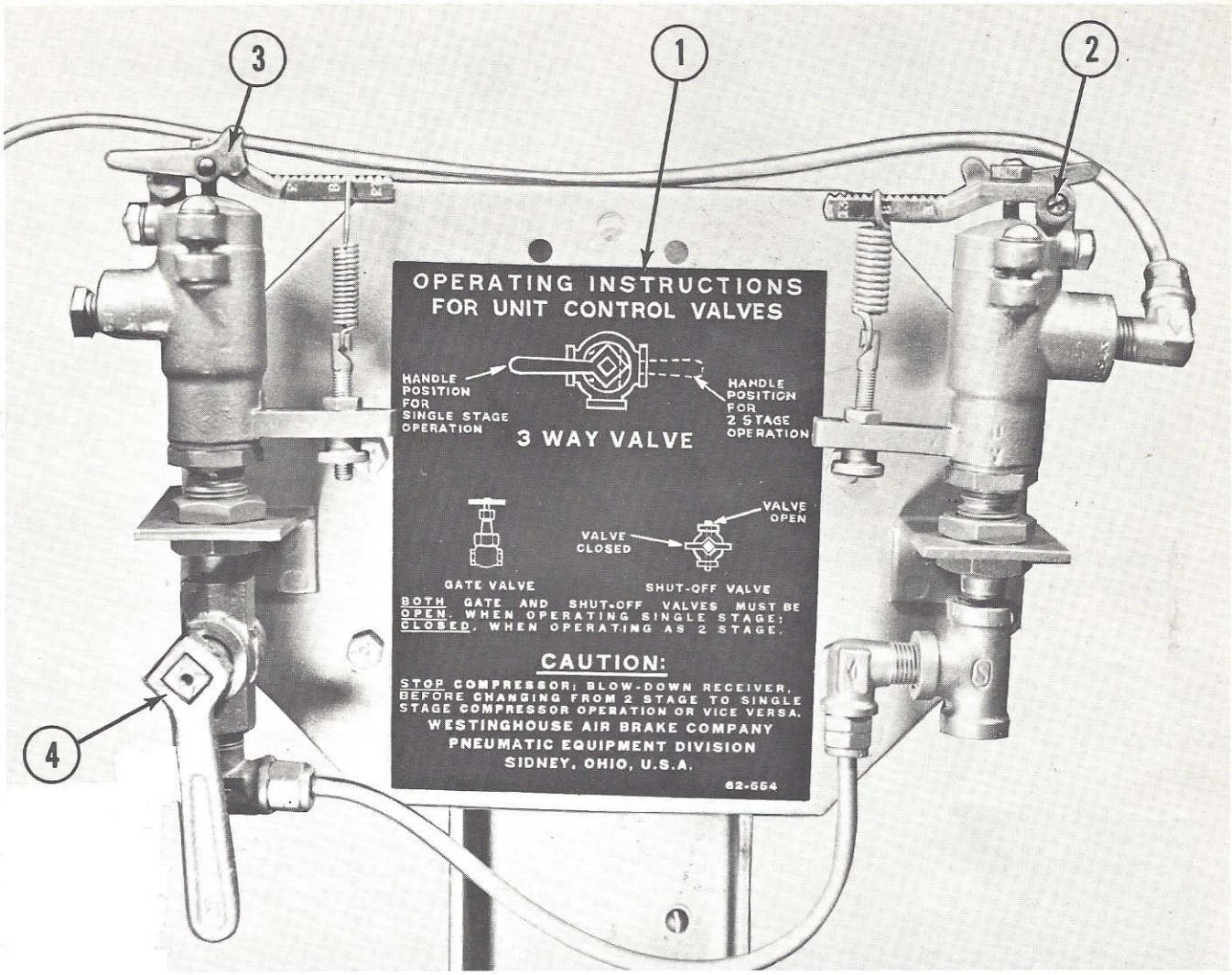
3-7. After the compressor is started, it will continue to run in the mode of operation selected until it is stopped.

3-8. Stopping. To stop the compressor, shut down the power unit. After compressor has stopped, open the receiver outlet valve to release all pressure in the receiver.



1. Gage
2. Instruction Plate
3. Pilot Valve
4. Pilot Valve
5. Shut Off Valve

Figure 6 — Pressure Control System



1. Instruction Plate
2. Pilot Valve
3. Pilot Valve
4. Shut Off Valve

Figure 7 — Pressure Control System

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Chapter 4
MAINTENANCE

4-1. General. Regulate inspections along with proper corrections of any faults found will prolong the useful life of your compressor. A regular inspection and service schedule is outlined in the following paragraphs. Please bear in mind that this schedule is flexible and, depending on the type of service, location, weather condition etc., it may be changed to suit individual conditions.

4-2. Daily Inspection and Maintenance. (Before Starting.)

a. Check oil level (with rig level). Fill to full mark, if oil level is low. Oil level must be kept between high and low level marks on the oil level sight gage (See Figure 8).

b. Drain condensate from air receiver and intercooler by opening drain cocks to each. (See Figure 4).

c. Manually trip the safety valves after receiver pressure exceeds 70 PSI.

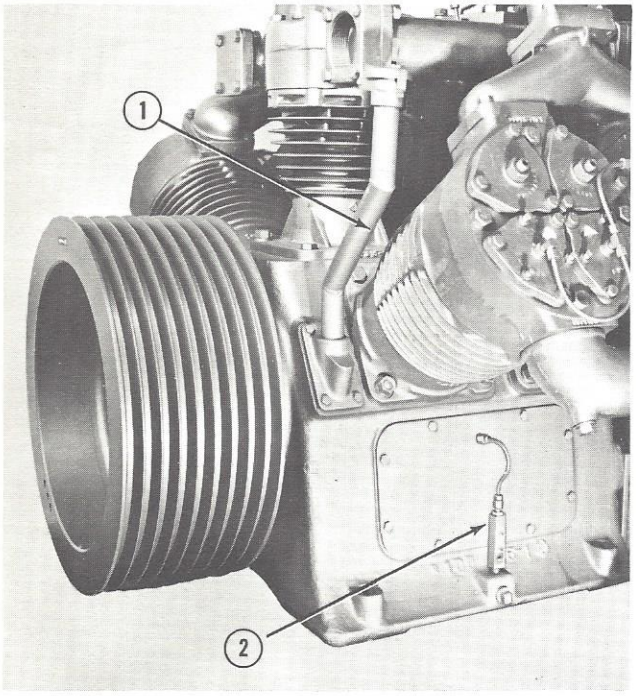
WARNING

Compressed air is very dangerous. It must be treated with respect and handled with care. Since these SDS com-

pressors are capable of delivering air compressed up to 250 PSI (when operated as a two stage machine) the utmost caution should be observed when opening any valve after the air has been compressed. Make certain that no person or object, that could be moved or damaged, is located in the path of the compressed air discharge from a valve. This air travels at an extremely high velocity and should be considered as dangerous as a gun.

NEVER PLAY WITH COMPRESSED AIR! NEVER POINT AN AIR HOSE AT SOMEONE! NEVER TREAT COMPRESSED AIR LIGHTLY!

d. The dust cups on the bottom of the air cleaners must be emptied every 4 to 12 hours. The frequency depends on operating conditions. Where conditions of extreme dust, dirt or grit are prevalent, more frequent service is essential.



1. Oil Filler Tube
2. Oil Sight Gage

Figure 8 — Oil Level Sight Gage

4-3. Weekly Inspection and Maintenance. (Before Starting).

a. Repeat all daily checks.

b. Check condition and tension of fan belt and drive belts. Any indication of excessive wear, cracking, etc., of these belts indicates that they should be replaced. See paragraphs 5-7 and 5-8 to replace belts. To check for *proper tension* of the fan belt see if belt can be slipped by hand. If belt can be *slipped, it is too loose;* if it *cannot be moved,* it is *too tight.* See paragraph 5-7, for details on fan belt tension and adjustment. Drive belt tension should equal one inch deflection at mid span with a ten pound weight. See paragraph 5-8 for drive belt adjustment and replacement.

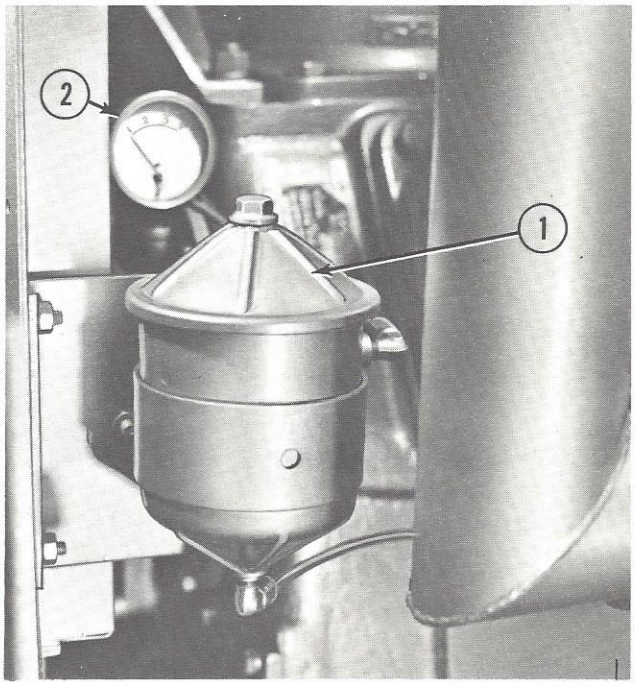
c. Clean intercooler and cylinder fins. If compressed air is used for cleaning, exercise extreme caution. Protect the eyes of all personnel in the vicinity of the compressor and make sure that the air hose is not directed at anyone or anywhere other than the area to be cleaned.

4-4. Monthly or 200 Hour Inspection and Maintenance.

a. Repeat all WEEKLY inspections and maintenance procedures.

b. While compressor is warm, drain and replace lubricating oil (See figure 9.) Remove side cover from crankcase, inspect and clean the strainer screen. Remove and replace the oil filter element.

c. Remove air cleaner dust cups and then remove air cleaner element by removing wing headed screw securing element. Follow



1. Compressor Oil Filter
2. Pressure Gage

Figure 9 — Oil Filter

the cleaning directions on the element. Either use a maximum of 100 PSI compressed air to blow dirt out of filter element from the inside or *wash in* approved solvent and allow to dry. Inspect clean element by placing a light inside element, rotating element by hand and viewing from exterior. If element indicates damage upon inspection, replace with new element.

NOTE: If paper element is used it must be dry before use or it will plug in a short time.

d. Check and make certain that all air connections are tight and secure.

e. Lubricate suction valve unloader felts and "O" ring on the unloader plungers. Refer to 5-18-E. Use new valve seat and valve cover gasket when reassembling.

4-5. 6 Month or 1,000 Hour Inspection and Maintenance. (See Figure 10.)

a. Repeat all MONTHLY inspections and maintenance procedures.

b. Refer to paragraph 5-11 and remove, clean and inspect all compressor intake and exhaust valves. Repair or replace as necessary. Refer to paragraph 5-12 for valve replacement instructions.

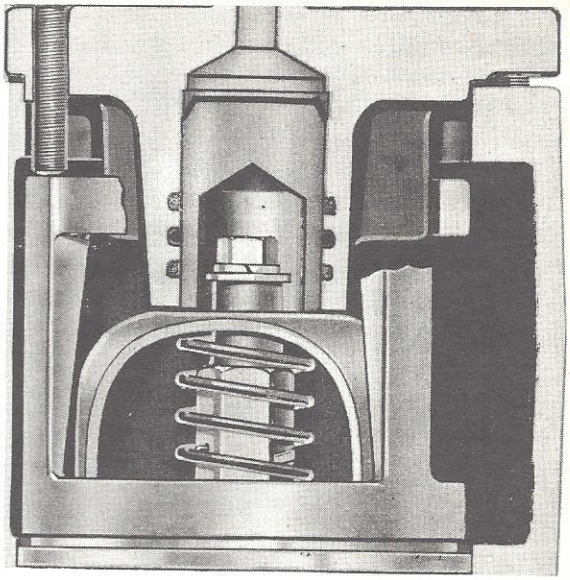


Figure 10 — Inspection and Maintenance

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Chapter 5

SERVICE PROCEDURES, ADJUSTMENTS, AND REPAIR

5-1. General. This chapter is devoted to certain service procedures, adjustments, and repair or replacement instructions for the equipment involved. As noted in the previous chapter, the elapsed time between service, adjustment, and repair of the equipment is dependent upon the nature of service to which the equipment is subjected and environment in which it is working. The more severe the conditions, the more frequent will be the need for service. High concentrations of sand or dust, high humidity, extreme cold or heat all have a bearing on how frequently your compressor will need to be serviced.

5-2. Service Procedures.

5-3. Air Cleaners. To service the air cleaners refer to paragraphs 4-2,d and 4-4,c.

5-4. Lubricating Oil Change. To change lubricating oil in crankcase, refer to paragraph 4-4,b.

5-5. Adjustments.

5-6. Unloader Pilot Valve. The unloader pilot valve (See Figure 11) has a definitely set spring tension and when the air receiver pressure drops, the spring tension will close off receiver air pressure to the suction valve unloaders in the cylinder heads. Thus the suction valves operate normally so that compression occurs. If the air receiver reaches its maximum pressure, as determined by the unloader pilot valve setting, the pressure from air receiver to pilot valve will be greater than spring tension and thus cause pilot valve to open, directing pressurized air to unloaders in the intake valves of *cylinder heads.* This pressure causes the intake valves to remain

open and only breathe air in and out *to atmosphere*, thus avoiding compression. To change the pressure at which the compressor will load and unload, adjust unloader pilot valve as follows:

a. To increase the variation between load and unload, move the hooked spring position toward the lower numbered end of the notched lever.

b. To decrease the variation between load and unload, move the hooked spring position toward the higher numbered end of the notched lever.

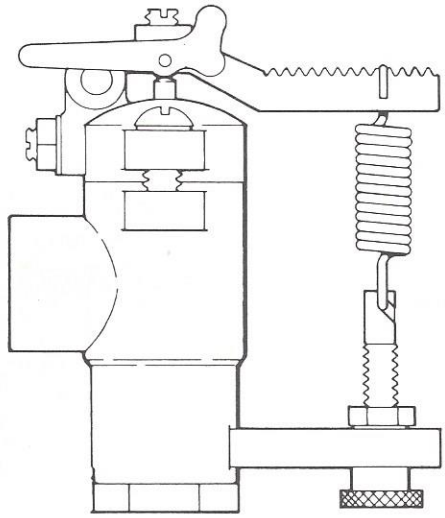


Figure 11 — Unloader Pilot Valve

5-7. Fan Belt Tension Adjustment. Adjust fan belt tension as follows:

a. Remove screws from rear pulley half. Remove key.

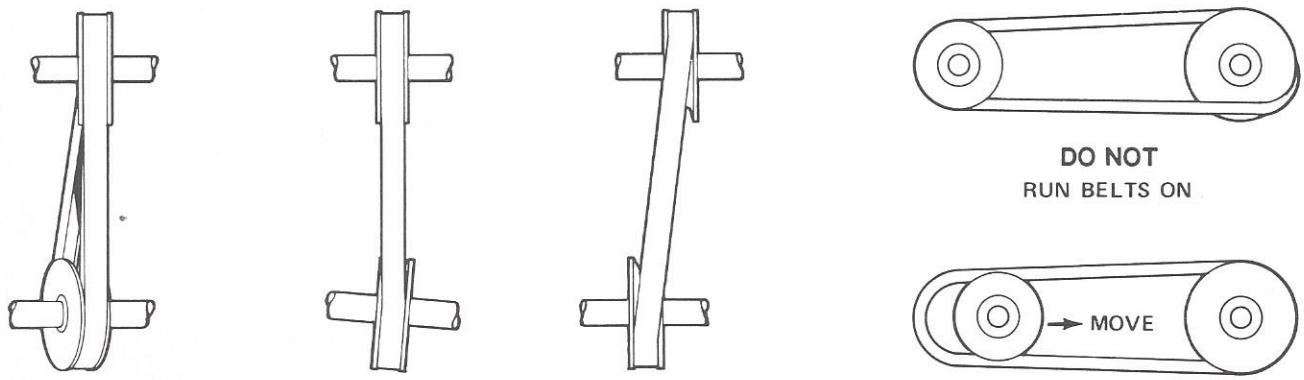
b. Turn rear pulley half clockwise to increase tension and counter-clockwise to decrease tension. Proper tension is attained when the fan belt cannot be *slipped* by hand.

c. Replace key and screw.

5-8. Drive Belt Tension and Alignment Procedure. (Refer to Figure 12.) Checking parallel shaft alignment and axial groove alignment may be done simultaneously. To obtain accurate alignment, a straight edge should be used for this measurement, or, when a straight edge is not available, a taunt line may be substituted. Perfect alignment should be obtained. However, if perfect alignment proves to be impossible, a rough rule of thumb to determine permissible limit of misalignment is 1/64 inch out of line for each 12 inches of shaft centers. Belt tension should be checked as described in paragraph 4-3,b. If drive belts are too loose, there is slippage and rapid wear of belts. Slippage is usually indicated by a squealing or howling noise. Always refer to belt manufacturer's catalog for proper tension to be applied. Adjust belt tension by moving engine in direction necessary to increase or decrease tension. Tighten flywheel nut to 1,000 lbs. ft. torque.

5-9. Repair or Replacement.

5-10. The following paragraphs are devoted to repairing compressors, mostly by replacing parts. Any parts that show excessive wear or deterioration must be replaced with new factory service parts.



Shafts must be in angular and parallel alignment and the sheave grooves axially aligned to obtain proper performance of V-belt drives. Angular alignment is obtained by levelling shafts.

Six basic steps make up V-belt installation procedure: (1) Reduce centers so belt can be slipped on sheaves; (2) Have all belts slack on same side (top of drive); (3) Tighten belts to eliminate slack; (4) Start unit and allow belts to seat in grooves; (5) Stop the unit—then retighten to make sure belts have proper tension; and (6) Recheck tension in 24 to 48 hours.

Figure 12 — Drive Belt Installation

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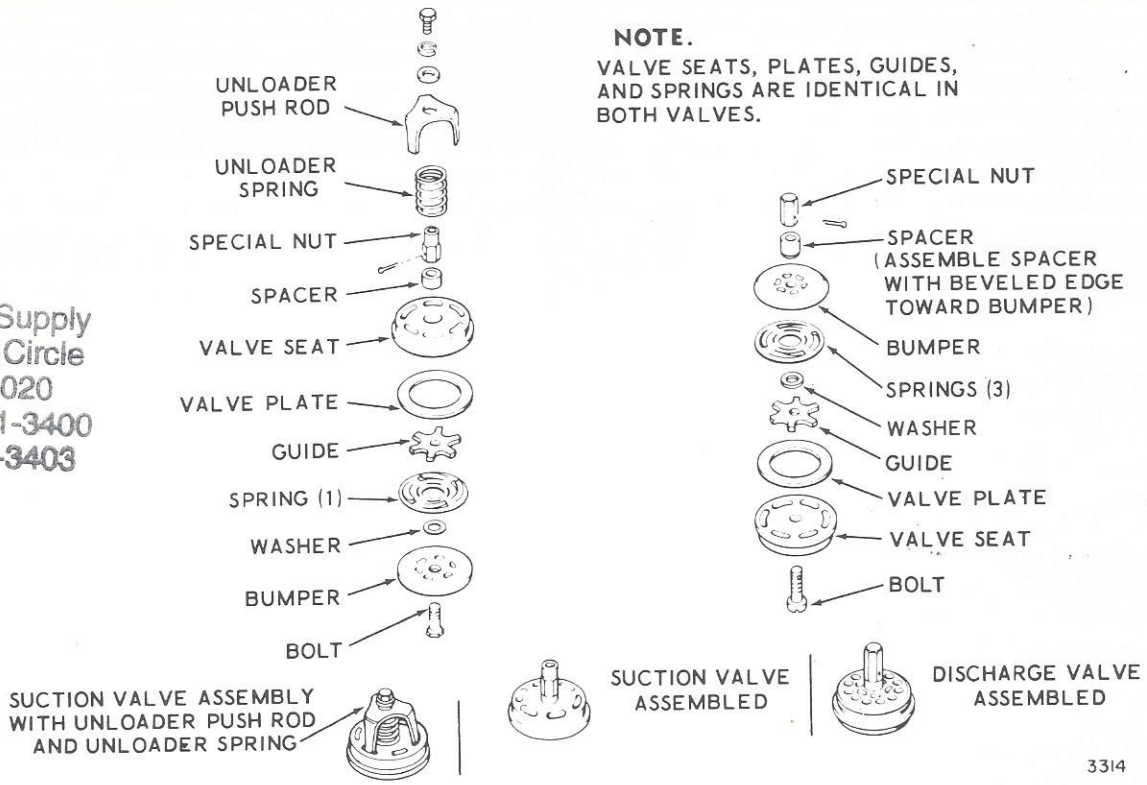


Figure 13 — Suction and Discharge Valves

5-11. Valve Repair. Both suction and discharge valves are located in the cylinder head. The suction and discharge valves are plate type and consist of a seat, plate type valve disc, circular plate type springs, valve guide, and bumper held together in an assembly with a through bolt and nut (See Figure 13). These valve assemblies may be removed from cylinder head without removing the cylinder head.

5-12. Valve Removal. To remove valves from cylinder head, proceed as follows:

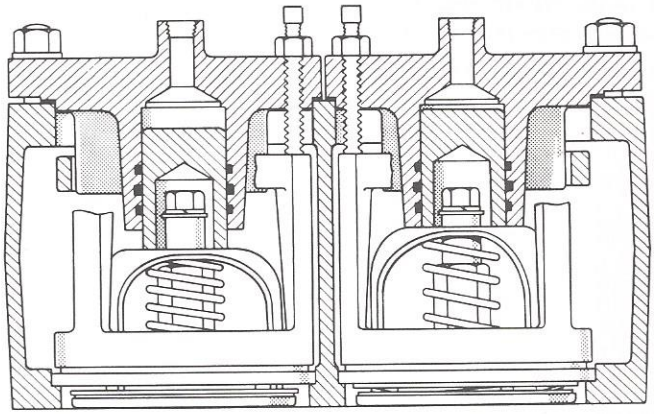
a. Disconnect the unloader tubing from the valves.

b. Loosen jamb nuts and back off set screws two turns.

c. Remove valve covers.

d. Lift out valve assemblies. (See Figure 14)

NOTE: A special tool (part no. 88-361-1) is required to disassemble or assemble valve. (See Figure 15). The tool consists of a reversible lower plate, an upper plate, and two capscrews. One side of the lower plate is designed to hold the slotted head of the discharge valve bolt and the other side to hold the hexagon head of the suction valve bolt.



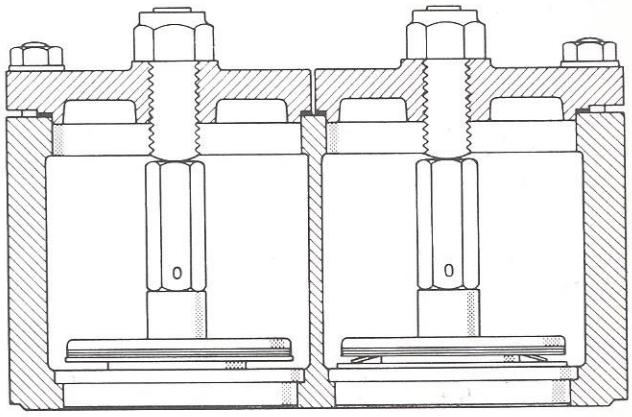


Figure 14 — Valve Assemblies

5-13. Valve Disassembly. (See Figure 15.) Place lower plate of special valve tool in vise (close to the top of vise jaw). Place valve on lower plate so that valve bolt will be held securely. Install upper plate and capscrews. Tighten capscrews finger tight. Remove special hex nut from valve and then remove upper plate of special valve tool. Valve may now be completely disassembled.

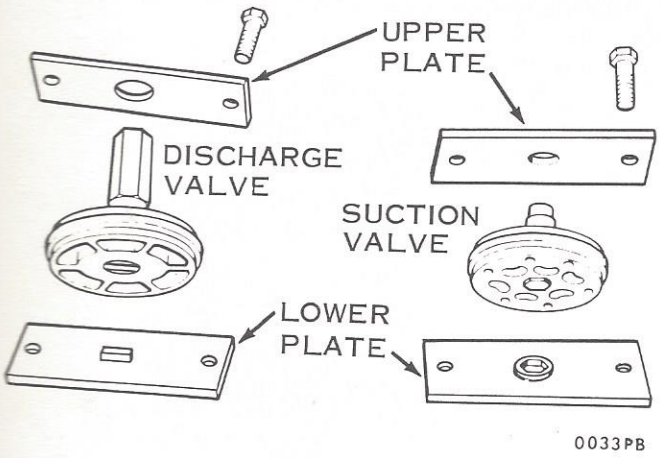


Figure 15 — Valve Tool 88-361-1

5-14. Valve Inspection. Inspect valve plate for wear or damage. Plate, spring, bumper or valve guide must be replaced if there is any indication of damage or wear. Examine other parts carefully for possible damage. Always use new valve springs. Regrind valve seat to 20 RMS maximum finish removing a maximum of 0.030 in. of material.

5-15. Valve Reassembly. Use the following sequence to reassemble valves:

a. Examine new parts for rust and nicks; clean as necessary.

b. Assemble valve guide with fingers in line with webb of bumper (See Figure 16).

c. Assemble circular plate type springs.

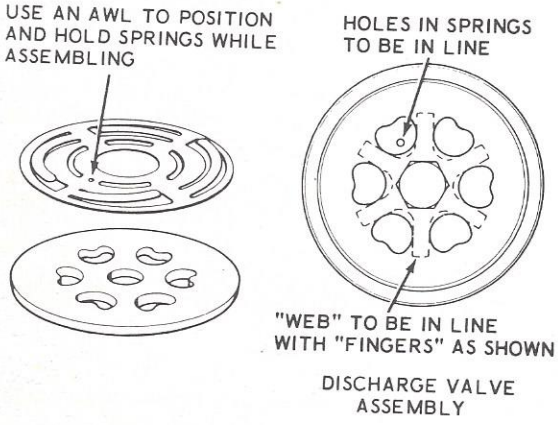


Figure 16 — Valve Reassembly

NOTE: On valves requiring more than one spring, stack springs with all segments in same direction and with the locating hole in line (See Figure 16).

d. Assemble the remaining componments of the valve. Be sure to place the beveled edge of the discharge valve spacer downward toward the bumper.

e. Place valve assembly in special valve tool and tighten special nut to a torque of 70 lbs. ft. If reusing the original bolt in the valve and special nut, locate and drill a new cotter pin hole approximately 1/8 inch higher or lower and crosswise (90°) from the old hole. If unable to drill new hole, replace bolt.

CAUTION

The valve bolt and nut may only be reused once. After two holes have been drilled, a new bolt and nut must be used.

5-16. Final Valve Test. After valve has been reassembled test as follows:

a. Check seating of valve plates by pouring "stoddard" solvent into the top of the suction valve or bottom of the discharge valve to a half full level. Slight seepage allowed. If great leakage occurs, the valve must be disassembled and the faulty part replaced. Another test for suction or discharge valve is to secure valve in a fixture, apply 110 psi air to pressure part of valve and coat the opening (opposite end from pressure in) with soap suds. Leakage must not exceed a 1/2 inch bubble in three seconds time.

b. Dry valve throughly and oil lightly to prevent formation of rust. Store in suitable container (a sealed plastic bag is recommended) to exclude dirt.

5-17. Discharge Valve Installation. (See Figure 17.) When installing a new or rebuilt discharge valve in a cylinder head, proceed as follows:

a. Install new valve seat gasket. Don't forget the gasket because without it there may be interference between the piston and valve assembly.

b. Install discharge valve assembly into its proper location in the cylinder head and rotate it back and forth to insure proper seating.

c. Install new copper-asbestos gasket on the valve cover.

d. Back out valve cover setscrew. Remove nut and clean setscrew throughly.

e. Replace cover.

f. Replace valve cover, capscrew, washers, and setscrew "O" ring. Tighten capscrews alternately to 40 lbs. ft. torque.

g. Tighten setscrews to 90 lbs. ft. torque and lock in place.

NOTE: It is very important that setscrews be tight against the valve assembly at all times. Check setscrew tightness frequently.

5-18. Suction Valve Installation. (See Figure 17.) Use the following procedure to install suction valves in cylinder heads:

a. Clean valve seating surfaces and install new valve seat gasket.

b. Install unloader push rod and spring on valve assembly.

c. Install suction valve assembly in cylinder head and rotate it back and forth to insure proper seating.

d. Install brass clamp with notches opposite the valve cover capscrews.

e. Assemble "O" ring, felt washers, and unloader plunger into valve cover. Lubricate "O" ring and felt with silicone grease (Dow — Corning No. 55A or MIL-L-4343-A, WABCO Part No. 204-275).

f. Back out three valve cover setscrews at least three turns and the locknuts several more turns.

g. Replace the valve cover, holding the unloader plunger in place until it is located over the suction valve top. Be sure to use new copper-asbestos gasket.

h. Replace washers and capscrews. Tighten capscrews alternately to 40 lbs. ft. torque.

i. Tighten the three setscrews to 7-1/2 lbs-ft. torque and lock in place.

j. Connect tubing to suction valve unloader.

5-19. Cylinder Head Removal and Installation. Each cylinder head is attached to the cylinder with four capscrews and special washers. The two capscrews passing through the suction and discharge ports use copper sealing washers while the remaining capscrews use hardened washers. All cylinder heads and valves are embossed "SUCTION" and "DISCHARGE" for assembly identification. It is not necessary to remove cylinder heads to remove

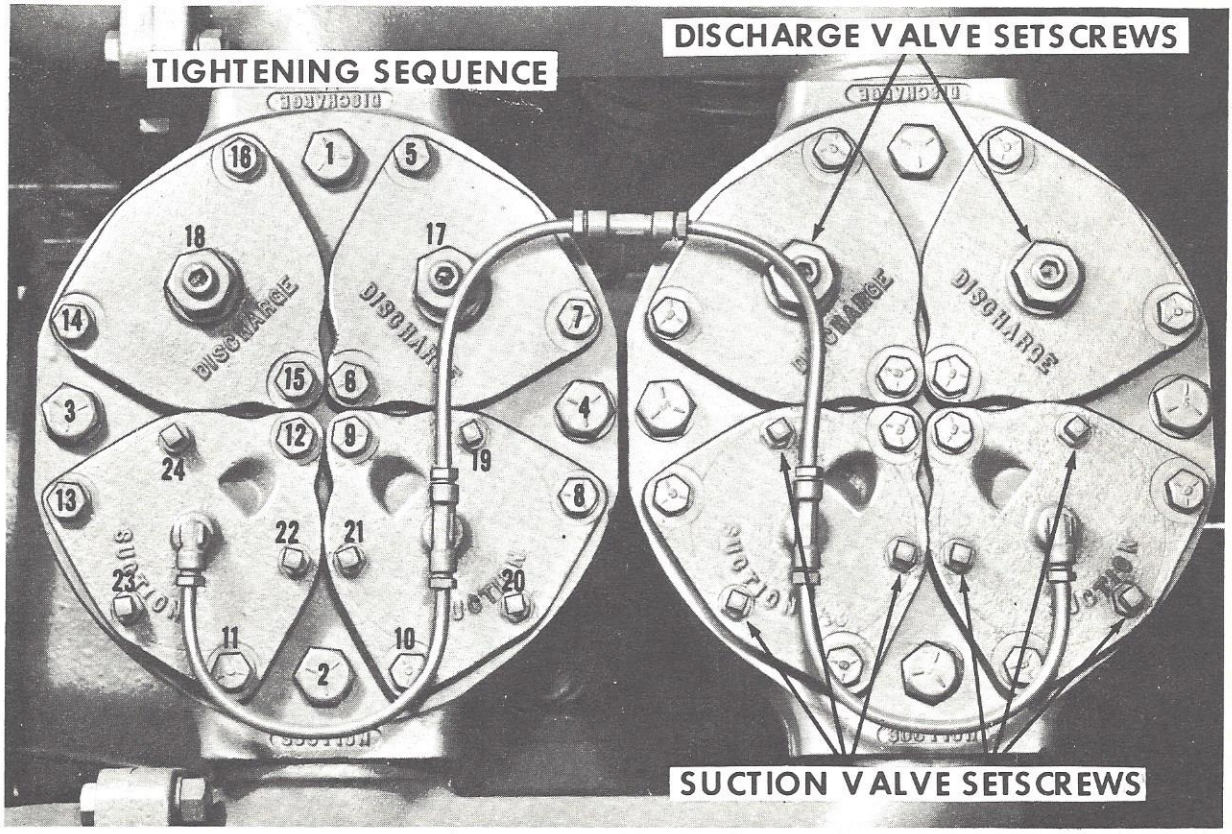


Figure 17 — Cylinder Head Tightening Sequence and Location of Setscrews

valves. Remove the unloader tubing to suction valves of head to be removed. Remove piping to and from head by removing capscrews (4 to each discharge port and one to each suction port) attaching piping to head. Remove the four capscrews (90° apart) around head that retains head to cylinder. Always mark the head so that it will be returned to the same cylinder from which it was removed.

Replace the head on the cylinder from which it was removed. Install the four capscrews and nuts and tighten them to 175 lbs.-ft. torque. First tighten one, then tighten the next capscrew that is 180° from the first. The third capscrew to be tightened should be 90° clockwise from the second. Then tighten the last capscrew. Reinstall suction and discharge piping. Reinstall unloader tubing.

5-20. Cylinder Removal. Compressor cylinders must be removed to service rings, pistons, connecting rods and cylinders. When cylinders are removed, they must be marked so that they will be reinstalled in the same position. Proceed with cylinder removal as follows:

a. Remove cylinder head as described in paragraph 5-19.

b. Remove the capscrews and nuts at base of cylinder and lift off cylinder.

c. Remove all gaskets from base of the cylinder.

5-21. Cylinder Inspection. The compressor cylinders are precision honed for standard size pistons only. Inspect the cylinder bore closely. If a cylinder is *out of round, worn, or deeply scratched*, it must be replaced with a new one. A worn cylinder is *indicated by visible ridging* at the end of the ring travel while an out of round cylinder can be determined as follows:

a. Take micrometer readings at various positions along the length of the interior of the cylinder.

b. Place a new ring in position in the cylinder bore and direct a strong light beam under the ring. Look for strong light gaps between the cylinder bore and the ring. A clear light shining through indicates an out of round cylinder.

5-22. Cylinder Deglazing. When replacing piston rings and reusing an old cylinder, it is recommended that the cylinder bore be deglazed to provide a proper "seating in" surface for the new rings. To deglaze a cylinder, wet a piece of No. 80 grit abrasive cloth in oil and scrub over the cylinder bore with rotating, recriprocating figure 8 motion. Do not overdo this procedure as only a dulling of the glaze is usually sufficient and can be accomplished with a light pressure. After deglazing, throughly clean the cylinder bore using ordinary soap, hot water, and a stiff bristle brush (not wire). Rinse throughly with clear, hot water and then dry. Apply a light coat of oil to the cylinder bore to prevent rusting.

5-23. Cylinder Installation. Proceed as follows to install a cylinder:

NOTE: If a cylinder has been removed, it is usually advisable to service rings, rods, or pistons. Therefore, these instructions assume that new rings will be installed on the piston.

a. Place gasket on the crankcase at position where cylinder is to be installed.

b. Remove the piston rings as described in paragraph 5-29.

c. Clip the cylinder over the piston and into place. Tighten down cylinder with capscrews and nuts.

d. Crank the crankshaft slowly until the piston in the reinstalled cylinder reaches top dead center.

e. Refer to (figure 18), and place a steel straight edge across the top of the cylinder walls and check the clearance between it and the top of the piston with a feeler gauge. The clearance should be 0.010 to 0.050 inch.

f. When proper clearance has been obtained, remove the cylinder, install the piston rings as described in paragraph 5-31.

NOTE: During this stage of assembly, adequate lubrication must be provided to reduce the chance of scuffing the cylinder walls. Use clean compressor oil and cover the inside walls of the cylinder and dip the piston in the clean oil so that both components are throughly lubricated.

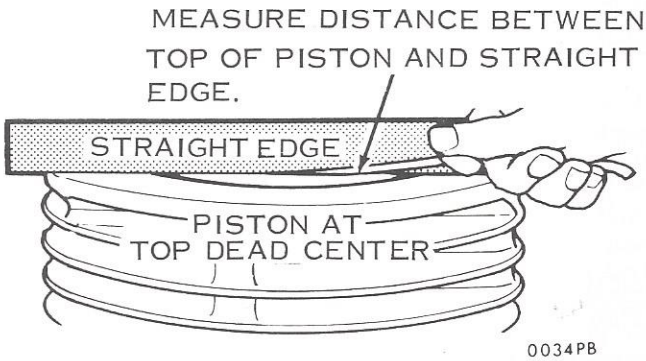


Figure 18 — Checking Cylinder Clearance

g. Use a piston ring compression tool and install cylinder as shown in (figure 19.)

h. Tighten capscrews and nuts to 90 lbs-ft. torque.

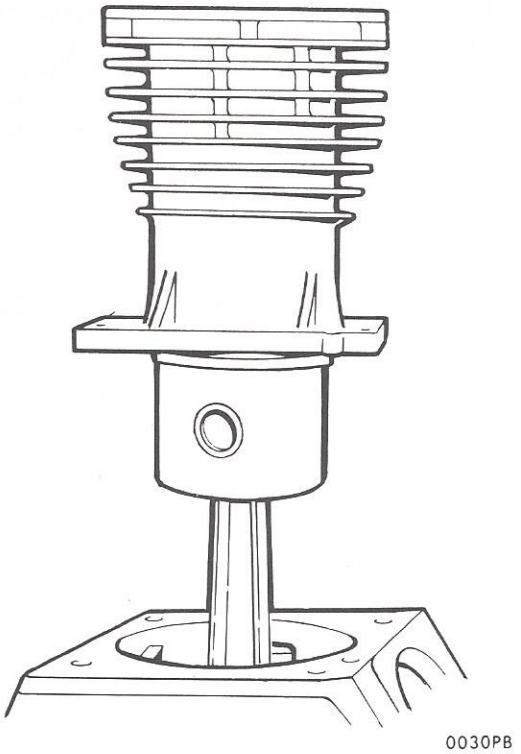


Figure 19 — Installing Cylinder

5-24. Rings, Pistons and Connecting Rods.

5-25. General.

5-26. When servicing compressor pistons and connecting rods, there must be a positive understanding of the need of the clearance between the top of the piston and the cylinder head flange. This small clearance, essential to efficient compressor operation, makes it necessary to measure and adjust the piston top and cylinder flange positions each time the cylinder is disassembled for inspection or replacement of parts. Otherwise, the piston may strike the cylinder head.

5.27. A great amount of air escaping through the compression oil filter tube or excessive carry-over of oil into the intercooler and receiver may be caused by worn cylinder walls or worn, stuck, or broken piston rings. It should be noted that it is normal to have a small amount of air escaping through the oil filter tube. These indications, plus a flat slapping sound when the compressor accelerates, may be due to excessive clearance between the piston and the cylinder.

5.28. A metallic knock noticeable when the unit is running unloaded or decelerating, but not noticeable when the unit is running loaded, indicates worn or loose connecting rod bearings. Low oil pressure often accompanies worn connecting rod bearings.

CAUTION

If unusual or suspicious noises are detected, do not continue operating the compressor. Investigate the cause and correct it before serious damage results.

5-29. Replacing Piston Rings. Proceed as follows to remove old piston rings:

a. Remove piping, cylinder head and attaching parts as indicated in paragraph 5-19.

b. Remove cylinder per paragraph 5-20.

c. Remove the old worn piston rings from each piston.

NOTE: If new rings are being installed in a used cylinder, deglaze the cylinder as described in paragraph 5-22 prior to installing the new rings.

5-30. Checking Ring Gap End Clearance. Check the end clearance of the ring gap by placing the rings in the cylinder bore, for which they are intended, to simulate the position of the ring on the piston. The end clearance is indicated on Chart 1. This clearance is necessary to allow for expansion (See Figure 20.) If the gap is less than specified on the chart, dress the ends with a fine cut, high carbon file (See Figure 21). New piston rings should be installed from the top of the piston with the bottom ring installed first, then the next

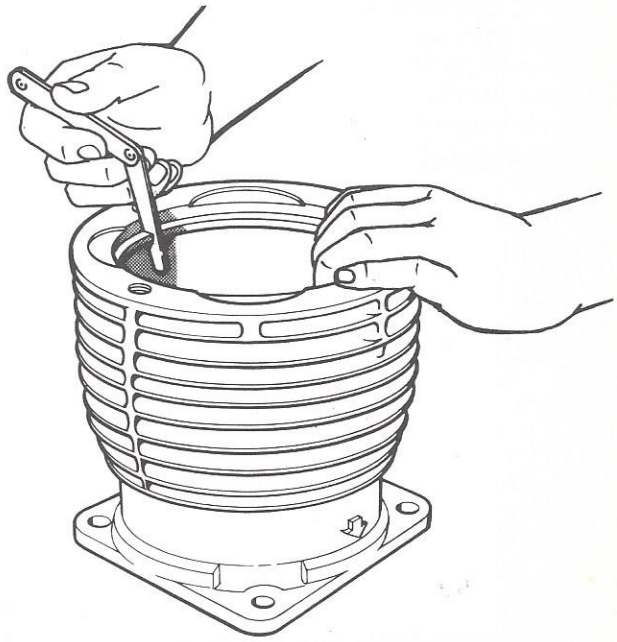


Figure 20 — Checking Ring Gap End Clearance

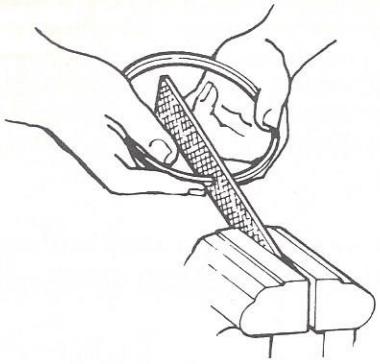


Figure 21 — Filing Piston Ring Gap

adjacent ring, etc. (See Figure 22.) Never attempt to pass one ring over another and always use a piston ring expander to avoid distortion or breakage. Stagger the ring gaps. (See Figure 23.) Double rail expanding type oil control rings are installed in the lower ring grooves while scraper type compression rings are installed in the upper grooves.

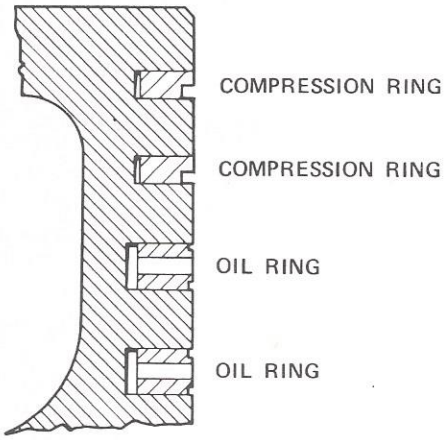


Figure 22 — Piston Ring Installation

CAUTION

When installing piston compression rings, make sure they are placed in the proper attitude. The rings are marked "TOP" on one side. Make sure this side is toward the top of the piston.

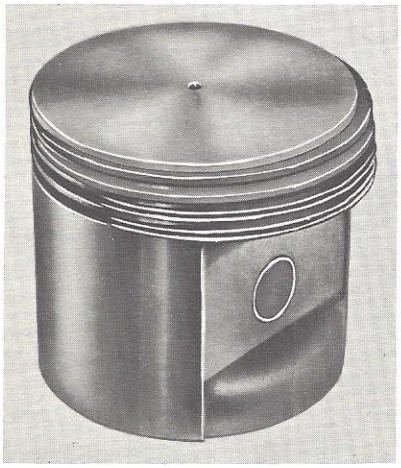


Figure 23 — Piston Rings

5-32. Replacing Pistons. With the cylinder removed, the piston may be removed from the connecting rod. Turn the compressor crankshaft over by hand until the entire piston is exposed above the level of the crankcase. Tip the piston to one side, so that the clamp screw is accessible. Bend the lockwasher ears down, then remove screw and push the piston pin out through the piston. Remove the piston. Check piston clearance by inverting the piston and placing it in the cylinder bore and then checking the clearance with a feeler gauge. (See Figure 24.) Clearance should be as indicated in Chart. When replacing the piston pin on reassembly, use a new lockwasher for the clamp screw.

Figure 24 — Checking End Clearance

5-33. Replacing Connecting Rods. When removing or replacing connecting rods, proceed as follows:

a. Drain the oil from the crankcase.

b. Remove piping, tubing, cylinder head and cylinder.

c. Remove the crankcase hand hole cover on side opposite the oil level indicator by removing the eight capscrews and washers.

d. Remove piston as described in paragraph 5-32.

e. Remove screws and nuts holding connecting rod to crankshaft.

f. Remove cap and insert type bearings from connecting rod.

NOTE: Each connecting rod and cap is identified with a stamped number. Make sure the same rod and cup is reassembled on the same side. Undersize bearings in sizes of 0.010, 0.020, and 0.030 inch are available when the crankpins are ground to match. Shims are not used and are not available so that adjustment for wear is obtained only by the use of bearing inserts.

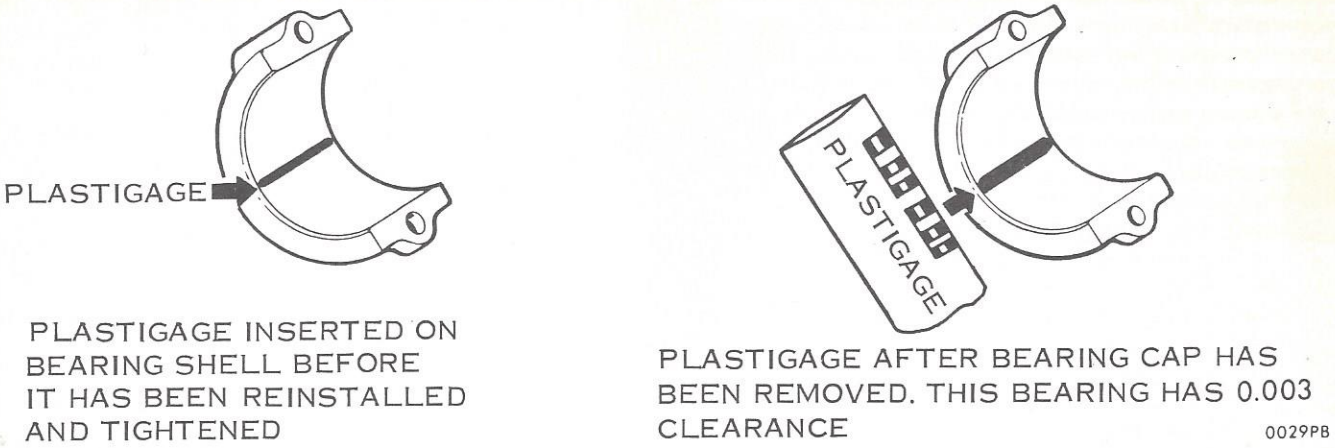


Figure 25 — Plastigage Instructions

g. Install new inserts in connecting rod and reassemble rod.

h. Use a micrometer and take several readings of the bearing and crankpin diameter at various points to determine the existing clearance. The use of Perfect Circle "Plastigage" (See Figure 25.) is also recommended for measuring bearing clearance.

i. Disassemble connecting rod and lubricate. With proper inserts in place, reinstall rod onto crankshaft. Connect piston to rod, replace cylinder, cylinder head, tubing and piping.

5-34. Oil Pump.

5-35. General. It is important to understand the operation of the pump and its relations to the lubrication system of the compressor. Lubricating oil pressure is provided by a plunger type oil pump (See Figure 2.) driven off an integral cam of the crankshaft. Oil is drawn through a screen, located in the crankcase sump, through a check valve and passes through the pump plunger into the oil pressure chamber.

NOTE: Normal operating oil pressure is indicated, on the 50SDS, by the "Green" area of the oil pressure gauge; on the 100SDS it should read a minimum of 10 PSI on the gauge; and on the 256SDS the indicated oil pressure should read a minimum of 12 PSI.

From this point lubrication is under pressure and is carried through drilled passages in the crankshaft to the connecting rod and main bearings. Pistons, piston rings, and cylinders are splash lubricated by throw-off from the connecting rod bearings. The oil pump plunger is actuated by means of a special connecting rod that is driven off the eccentric of the compressor crankshaft. As the plunger moves upward in the pump cylinder the plunger checkball is drawn onto its seat while the pump check valve ball is lifted off its seat. This action allows oil to be drawn up from the compressor crankcase sump, through the screen into the cavity created by the upward stroke of the plunger. As the pump plunger reverses direction the check valve ball is forced against its seat while the plunger check ball is lifted thus allowing oil to pass through the center of the plunger into the oil chamber above. From this point, oil is delivered, under pressure, through the drilled passages of the compressor crankshaft.

CAUTION

Make-up oil may not be added to the crankcase while the compressor is operating. A heavy oil mist will be blown out the oil filler tube if the filler cap (See Figure 26) is opened while the compres-

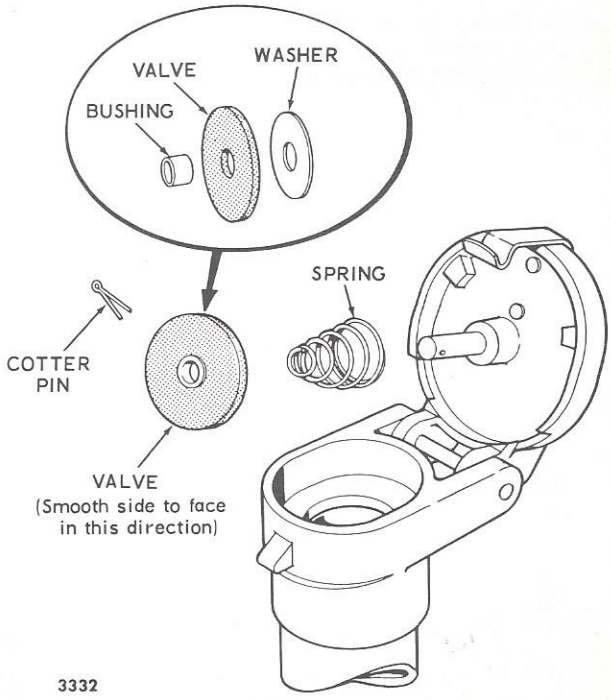


Figure 26 — Oil Filler Tube Breather Cap

sor is operating. This is normal and should not be interpreted as "blow-by". There is a small flapper type relief valve assembled in the filler tube cap, which is spring loaded toward the crankcase. Its function is to dampen out the surges of air pressure in the crankcase caused by the recriprocating motion of the pistons and crankshaft. This valve in the cap allows air pressure to escape from the crankcase and prevents air at atmospheric pressure from entering, and maintains a partial vacumn during operation.

5-36. Oil Pump Removal and Disassembly. (See Figures 27 and 28.) To remove and disassemble the compressor oil pump, it is recommended that the following procedure be used:

a. Remove the piping from the air cleaners to the low pressure cylinders.

b. Remove the tubing leading to and from the Conrader pilot valve.

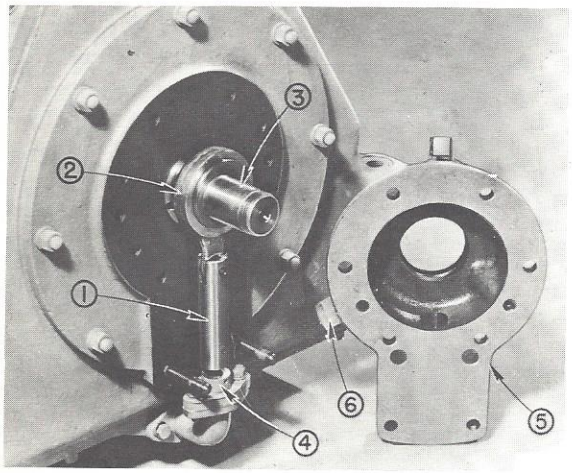
c. Remove all piping between cylinders and intercooler.

d. Remove the intercooler from the compressor installation.

e. Remove the fan belt, fan and fan pulley and bracket assembly.

CAUTION

When removing the fan pulley and pulley shaft be extremely careful not to damage the oil seal. The oil seal is assembled with the lip of the seal facing inward. It must be flush with the outside of the oil pump body, when assembled, so that the oil return inner hole not be obstructed.



1. Plunger
2. Connecting Rod
3. Crankshaft
4. Check Valve Body
5. Oil Pump Body
6. Oil Pressure Relief

Figure 27 — Oil Pump Components

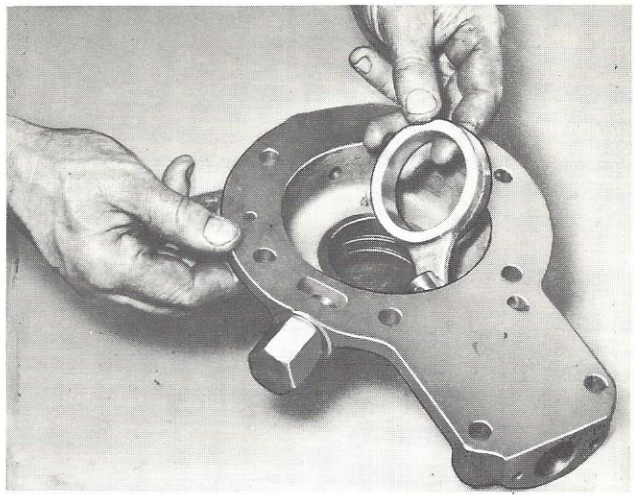


Figure 28 — Removing or Installing Plunger

f. Remove the oil pressure gauge and tubing from the oil pump.

g. Drain all oil from the crankcase.

h. Remove capscrews that secure oil pump to crankcase/

i. Tighten nuts on tapered dowel pins and remove pins.

j. Remove capscrews that secure pump body to retainer then remove pump body.

k. Twist and turn the pump plunger and connecting rod to remove them from pump body.

l. Remove the check valve assembly and oil connection from the pump body by removing the capscrews.

NOTE: Check valve assembly is serviced only as a complete assembly and component parts are not replaceable.

5-37. Reassembly and Reinstalling the Oil Pump. Proceed as follows to reassemble and reinstall the compressor oil pump:

a. Dip the pump plunger in crankcase oil and then insert the plunger into position in the oil pump body by turning and twisting the plunger. Be sure that the pin does not extend beyond the diameter of the plunger on either side.

b. Assemble the check valve assembly and oil connection to the pump body with capscrews.

c. Install the oil seal into the oil pump body with the lip of the seal facing inward. The oil seal must be flush with the outside of the pump body to maintain clearance behind it for free oil passage.

CAUTION

If the oil seal shows any sign of damage or wear it must be replaced with a new seal.

d. Hold the oil pump body in position on the retainer and work the connecting rod into its proper position on the eccentric of the compressor crankshaft, using a slender screwdriver as a tool. (See Figure 29.)

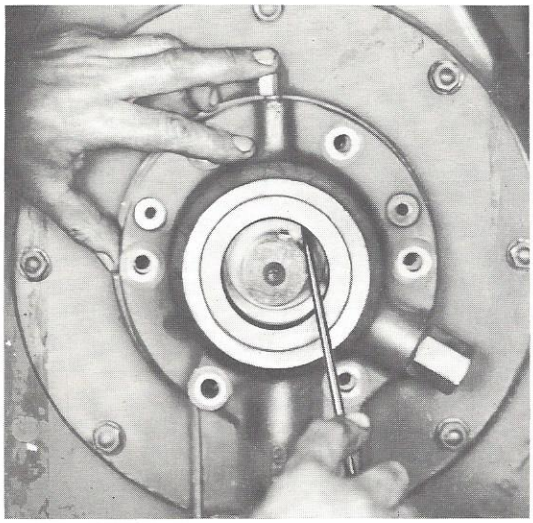


Figure 29 — Installing Connecting Rod

CAUTION

Use extreme caution with the screwdriver so as to not damage the oil seal.

e. Insert the capscrews in place and draw up finger tight.

f. Insert the dowels and then tighten the capscrews to 17 lbs. ft. torque.

g. Install the pump oil pressure gauge and tubing.

h. Attach gasket to rear of pulley. Assemble pulley, lockwasher, and nut to compressor crankshaft.

i. Install fan belt and check belt tension (refer to paragraph 5-7).

j. Install intercooler.

k. Connect piping between cylinders and intercooler.

l. Connect tubing leading to and from Conrader pilot valve.

m. Connect piping from the air cleaners to the low pressure cylinders.

n. Start the compressor and check the oil pump installation for evidence of leakage and adequate oil pressure.

NOTE: Oil pressure must be checked when the oil is warm. The 50SDS oil pressure should read in the green area of the oil pressure gauge; the 100SDS must register at least 10 PSI on the oil pressure gauge while the 256SDS must register at least 12 PSI.

5-38. Crankshaft. (See Figure 30.)

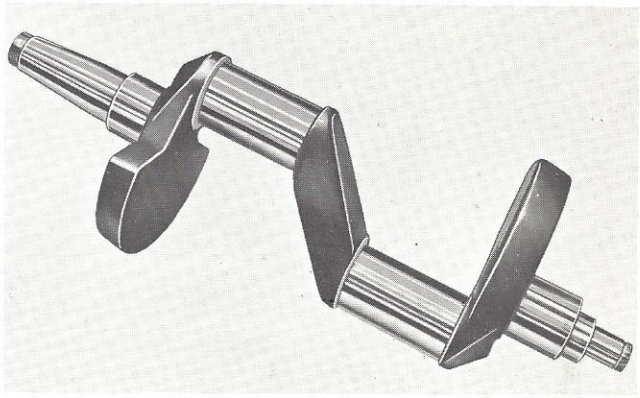


Figure 30 — Crankshaft

5-39. General. The compressor crankcase (Figure 31.) is cast in one piece and is closely machined to carry the crankshaft and cylinders. Tapered roller bearing outer races are a tap fit in the crankcase bore at the pulley (drive) end, and a press fit in the retainer located at the opposite end of the crankcase. Bearing cups or outer race (Figure 32.) are installed in the crankcase and retainer with the bearing surfaces facing the center of the crankcase. Metal shims are placed behind the bearing retainer to control the end thrust of the crankshaft. The main bearings are shrunk fit on the crankshaft. The one piece, forged crankshaft is counter balanced for smooth operation. It is rifle drilled to provide lubrication to the main and connecting rod bearings.

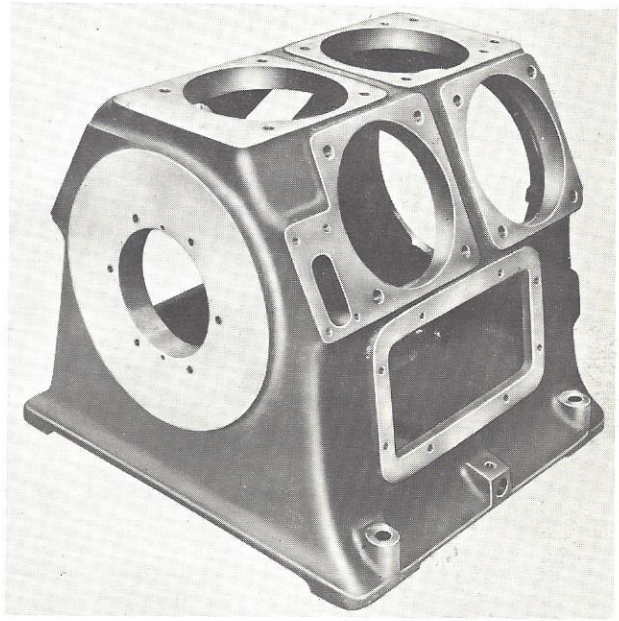


Figure 31 — Compressor Crankcase

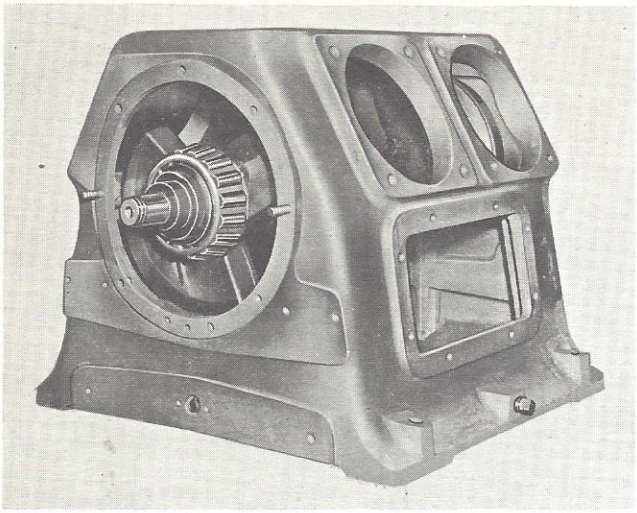


Figure 32 — Bearing Cone Installation

5-40. Crankshaft Removal, Installation and End Thrust Check. To remove and replace the crankshaft, it will be necessary to completely disassemble the compressor. To do this, proceed as follows:

a. Remove all tubing from cylinder heads and between compressor and intercooler.

b. Remove all piping between air cleaners and compressor; between air receiver and compressor; and between intercooler and compressor.

c. Drain oil from compressor crankcase.

d. Remove drive belts and flywheel from compressor.

e. Remove intercooler assembly.

f. Remove the fan belt, fan, fan pulley and brakeset assembly from compressor.

g. Remove the oil pressure gauge and tubing from the compressor oil pump.

h. Remove cylinder heads and cylinders.

i. Remove oil level sight gauge, and hand hole covers on each side of compressor.

j. Remove pistons and connecting rods.

k. Remove oil pump, oil connection and screen in crankcase sump of compressor.

l. Remove end cover and oil seal.

m. Remove bearing cones of tapered roller bearings.

n. Remove crankshaft. Use a bearing puller and remove the bearings from the crankshaft. (Only if replacement is needed!)

o. Inspect the condition of the crankshaft and bearings for indications of excessive wear, galling, pitting, etc.

p. Tap out the main bearing outer races or cone from each end of the crankcase.

q. The crankshaft connecting rod journals may be reground to a maximum removal of 0.030 inch of stock to remove scratches or other damage. After grinding, polish the shaft with a crocus cloth. Use a micrometer to check the shaft diameter after grinding and polishing.

NOTE: Replacement connecting rod bearing shells are available in 0.010; 0.020; and 0.030 inch undersize for use on reground shafts.

r. Insert new tapered roller bearing outer races into each end of the crankcase. The race, at pulley end, is a tap fit and a press fit at the retainer end of the crankcase. Make sure the races are installed with bearing surface facing the center of the crankcase.

s. The main bearings are tapered roller type and are a shrink-fit to the crankshaft. To install the bearings, heat bearing in oil to 350°F (177°C), place it over the shaft until it rests on the machined cheek of the shaft. Make sure that the large diameter of the bearing, formed by the cage, is facing toward the center of the shaft.

CAUTION

Never use dry heat on the bearing. Be sure that the crankshaft rifle drilling has had the pipe plug installed before installing the bearings. Be sure that pipe plug does not protrude and interfere with assembly of bearing race. The orifice plug is placed at the crankshaft end opposite the oil pump. Hand spin the bearings after they cool to make certain they they run freely and quietly.

5-41. Checking Crankshaft End Thrust. (See Figure 33.) Install the crankshaft into the crankcase and proceed as follows to check the crankshaft end thrust:

a. Position an indicator pointer against an end of the crankshaft.

b. Push the crankshaft as far forward toward the pointer as possible. Set the indicator needle of the pointer at zero.

c. Pull the crankshaft rearward as far as possible. Note the indicator reading. Permissible tolerance is 0.003 minimum to 0.005 inch maximum.

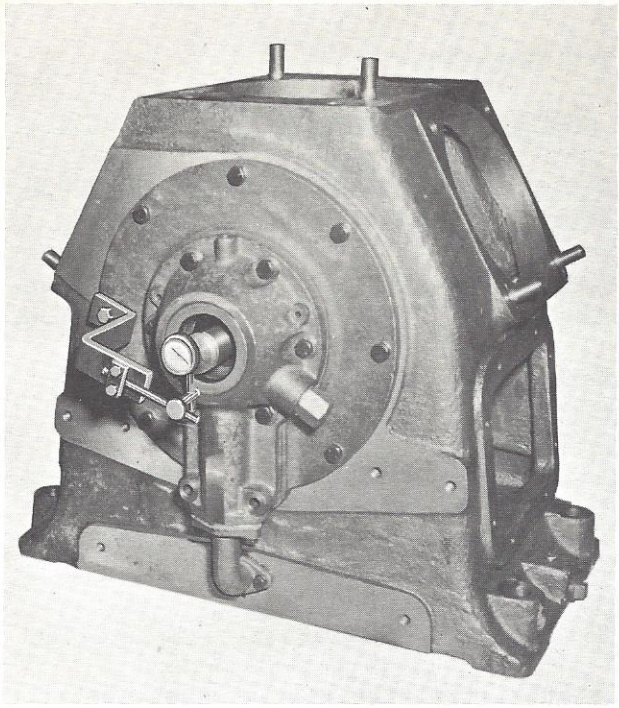


Figure 33 — Checking Crankshaft End Thrust

d. If the crankshaft end thrust is less than the minimum or more than the maximum, remove the end cover and add or subtract shims as necessary to bring end thrust within tolerance.

e. Install the end cover oil seal, pointing the seal lip toward the inside of the compressor. Coat the outside diameter of the seal with shellac or any other good sealer before installing it in the retainer.

NOTE: To avoid cutting the sealing lip while installing the seal, make certain that the shaft area over which the seal slides is free from sharp edges and burrs.

5-42. Compressor Reassembly. To reassemble the compressor, refer to paragraph 5-40 and reverse the order of disassembly.

NOTE: Be sure to tighten the flywheel retaining nut to 1000 lbs. ft. torque.

N.D.S. Drilling Supply
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Elko, MN 55020
Phone #952-461-3400
Fax # 952-461-3403

CHART I

CLEARANCES AND TOLERANCES

	50SDS	100SDS	256SDS
Piston Clearance at Skirt:			
High Pressure	.013-.016 in.	.013-.018 in.	.0045-.0065 in.
Low Pressure	.015-.018 in.	.015-.018 in.	.015-.018 in.
Piston Pin to Bushing Clearance:			
High Pressure	.0012-.0017 in.	.0012-.0017 in.	.0013-.0019 in.
Low Pressure	.0012-.0017 in.	.0012-.0017 in.	.0012-.0017 in.
Piston Ring Gap:			
High Pressure	.015 in. min.	.015 in. min.	.013 in. min.
Low Pressure	.015 in. min.	.015 in. min.	.015 in. min.
Piston Ring Groove Clearance:			
High Pressure Compression	.0015-.0035 in.	.0015-.0035 in.	.0020-.0035 in.
High Pressure Oil Control	.0015-.0035 in.	.0015-.0035 in.	.0020-.0035 in.
Low Pressure Compression	.0015-.0035 in.	.0015-.0035 in.	.0015-.0035 in.
Low Pressure Oil Control	.0015-.0035 in.	.0015-.0035 in.	.0015-.0035 in.
Piston Top to Top of Cylinder Clearance	-.003-+.044 in.	-.003-+.044 in.	-.003-+.044 in.
Crankshaft End Play	.003-.005 in.	.003-.005 in.	.003-.005 in.
Connecting Rod Bearing Running Clearance	.0014-.004 in.	.0014-.004 in.	.0014-.004 in.
Oil Pump Body to Plunger Clearance	.002-.004 in.	.002-.004 in.	.002-.004 in.
Oil Pump Connecting Rod to Crankshaft Clearance	.002-.004 in.	.002-.004 in.	.002-.004 in.

WRENCH TORQUES

Cylinder Mounting Capscrews and Nuts	90 lbs. ft.	90 lbs. ft.	90 lbs. ft.
Cylinder Head Capscrews	175 lbs. ft.	175 lbs. ft.	175 lbs. ft.
Suction Valve Cover Capscrews	40 lbs. ft.	40 lbs. ft.	40 lbs. ft.
Suction Valve Setscrews	7-1/2 lbs. ft.	7-1/2 lbs. ft.	7-1/2 lbs. ft.
Discharge Valve Cover Capscrews	40 lbs. ft.	40 lbs. ft.	40 lbs. ft.
Discharge Valve Setscrew	50 lbs. ft.	50 lbs. ft.	50 lbs. ft.
Special Valve Assembly Nut	70 lbs. ft.	70 lbs. ft.	70 lbs. ft.
Connecting Rod Capscrews	175 lbs. ft.	175 lbs. ft.	175 lbs. ft.
Connecting Rod Wrist Pin Capscrew	79 lbs. ft.	79 lbs. ft.	79 lbs. ft.
Flywheel Clamping Nut	1000 lbs. ft.	1000 lbs. ft.	1000 lbs. ft.

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