FORM NO. REG00914-02

AIR COMPRESSORS

TU-FLO 300, 400, 500, 501 & 1000 COMPRESSORS

PREPARED FOR CATERPILLAR TRACTOR CO. BY
BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.

TU-FLO 300 COMPRESSORS

TU-FLO 400, 500 and 1000 COMPRESSORS

TU-FLO 501 COMPRESSORS

Bendix-Westinghouse MAINTENANCE MANUAL

TU-FLO 300 COMPRESSORS

Chapter III

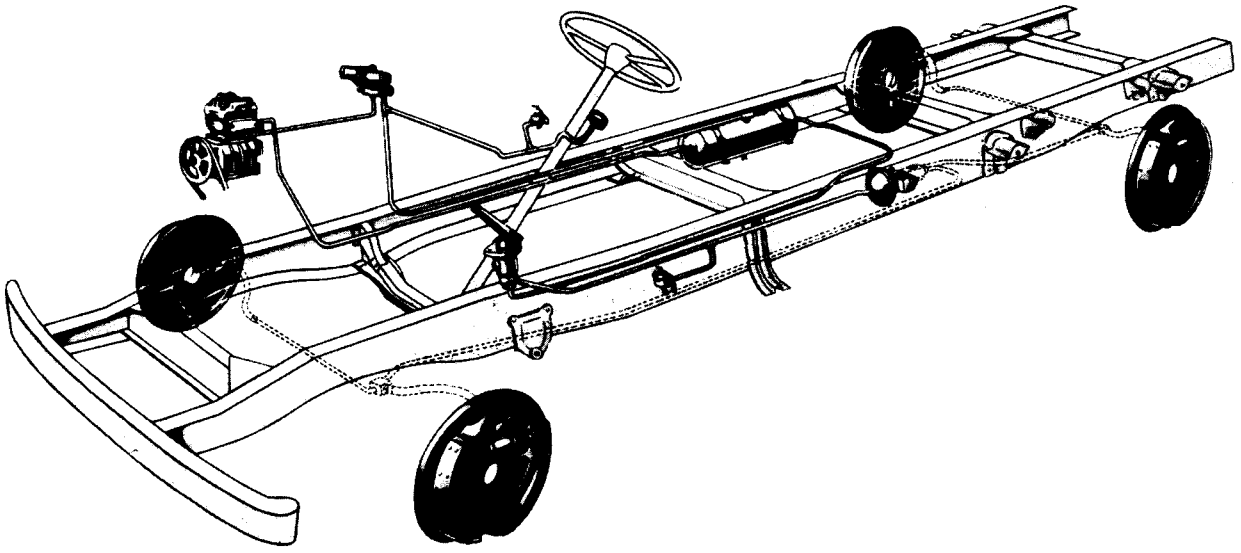


FIG. 1—Piping Diagram Showing a Compressor in an Air Brake System

DESCRIPTION AND OPERATION

GENERAL

The Tu-Flo 300 Compressor is primarily used in air over hydraulic brake systems (Figure 1). Another use for this type compressor is in air supply systems for service trucks used for inflating tires, cleaning, driving tools, etc.

DESCRIPTION

Tu-Flo 300 Compressors are single stage, reciprocating piston types. Their rated capacity in piston displacement when running at 1250 RPM is 4 cubic feet per minute. They are designed for vertical mounting and are fitted for belt drive only. Only air cooled type Tu-Flo 300 Compressors are made.

Tu-Flo 300 Compressors have automatic type inlet valves. Their unloading mechanisms are located in the cylinder block and they have no external moving parts.

Tu-Flo 300 Compressors are either engine (Figure 2) or self-lubricated (Figure 3). If engine lubricated, they receive their oil supply for lubrication from the engines on which they are mounted. Self-lubricated compressors contain their own oil supply and pumping system. The method of lubricating the moving parts is the same in either type (Figure 4). Oil is forced through an oil passage in the crankshaft and out at each connecting rod journal. As the crankshaft turns, the oil that is forced out at the journals is splashed against the cylinder bores and crankshaft bearings.

Die cast aluminum connecting rods and cast iron pistons are used in the Tu-Flo 300 Compressor. The wrist pins are lubricated by oil dripping from a drip-boss on the piston into a catch-funnel at the top of the connecting rod and through a drilled passage to the wrist pin and its bushing.

A name plate is attached to the crankcase of all Tu-Flo 300 Compressors. It shows the piece number, compressor type, and a serial number. The nameplate with a black background indicates a new compressor; if the background is red it indicates that the compressor is a factory reconditioned unit. The piece number identifies the compressor and it is the number used when reference is made to a particular unit. The serial number and type are additional information.

OPERATION

The air compressor runs whenever the engine runs, but it only compresses air when the governor is cut in. The governor starts or stops the compression by acting in conjunction with the compressor unloader mechanism located in the cylinder block. When the desired maximum and minimum system pressures are reached the governor either unloads or loads the compressor.

INTAKE AND COMPRESSION (Loaded)
Figures 5 and 6

During the down stroke of the piston a slight vacuum is created above the piston. Air from the outside then moves the inlet valve off its seat and is drawn into the cylinder bore above the piston. As the piston starts its upward stroke, the air that was drawn in on the down stroke starts to compress and returns the inlet valve to its seat. The air above the piston is further compressed until it overcomes the discharge valve spring and system air pressure to move the discharge valve off its seat. With the discharge valve open, the compressed air is forced through the discharge line to the reservoir.

—Exterior View of Engine Lubricated Compressor

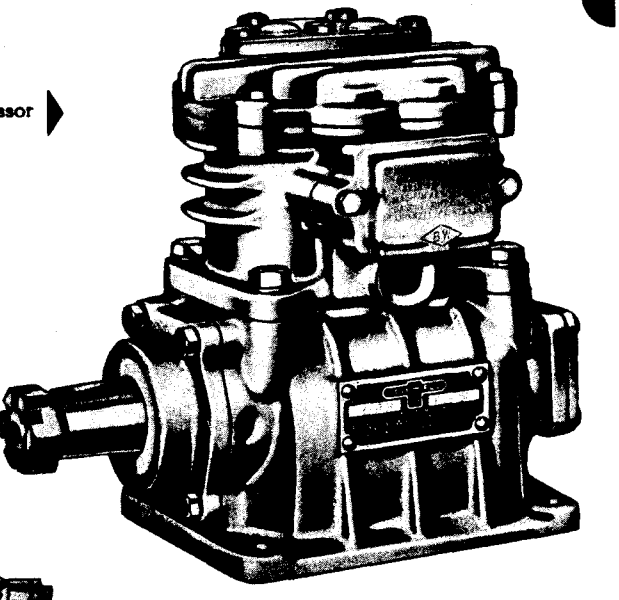
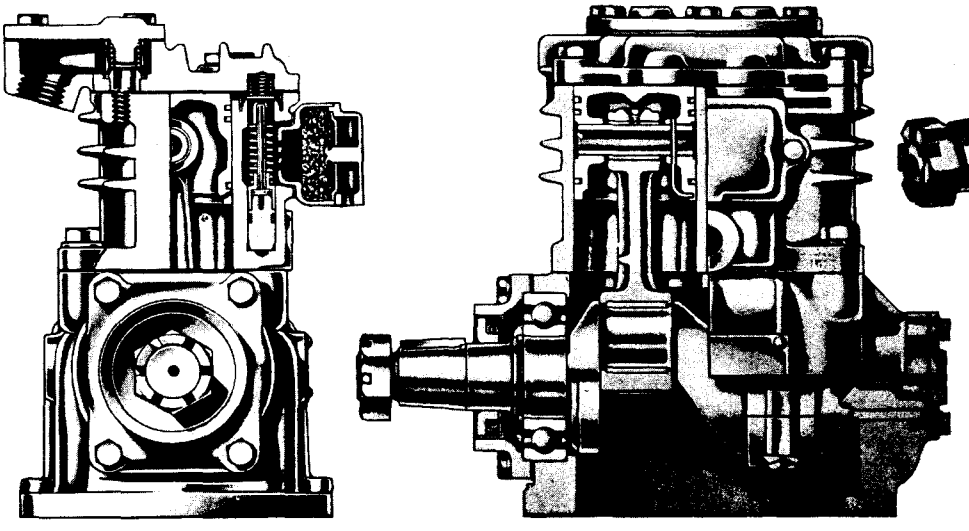


FIG. 2—Sectional View of Engine Lubricated Compressor



—Exterior View of Self-Lubricated Compressor

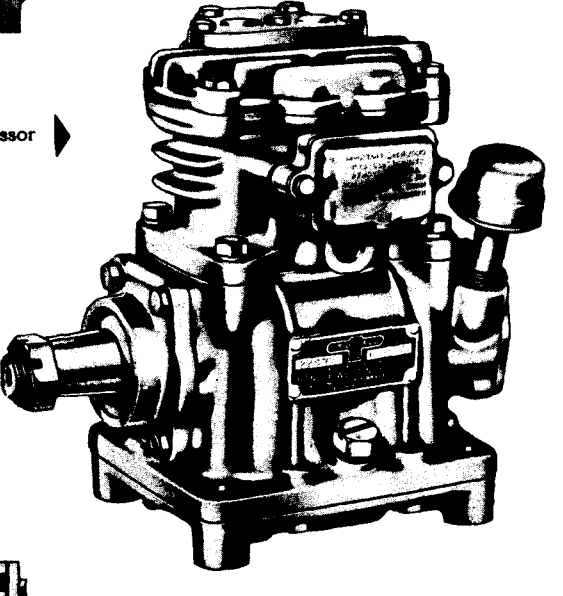
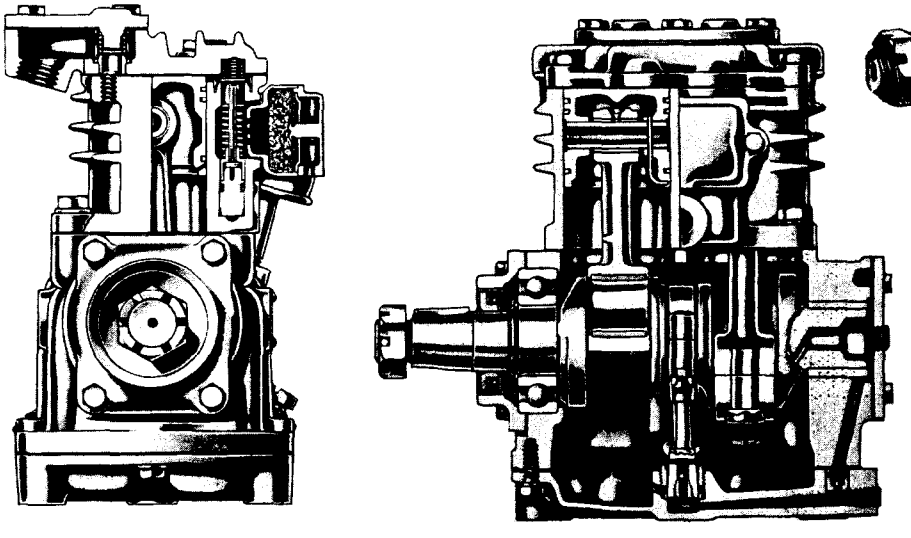


FIG. 3 Sectional View of Self-Lubricated Compressor



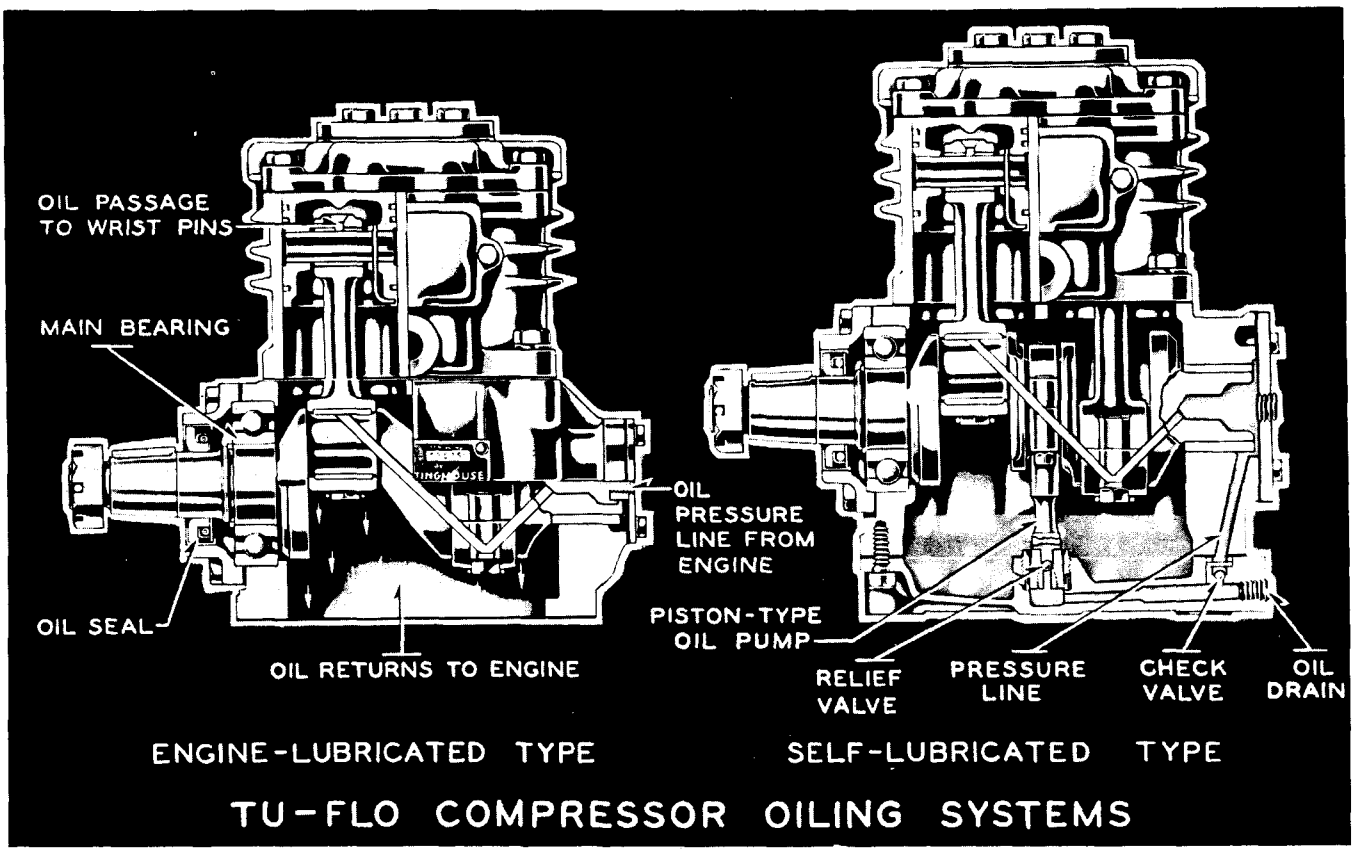


FIG. 4—Compressor Oiling Systems

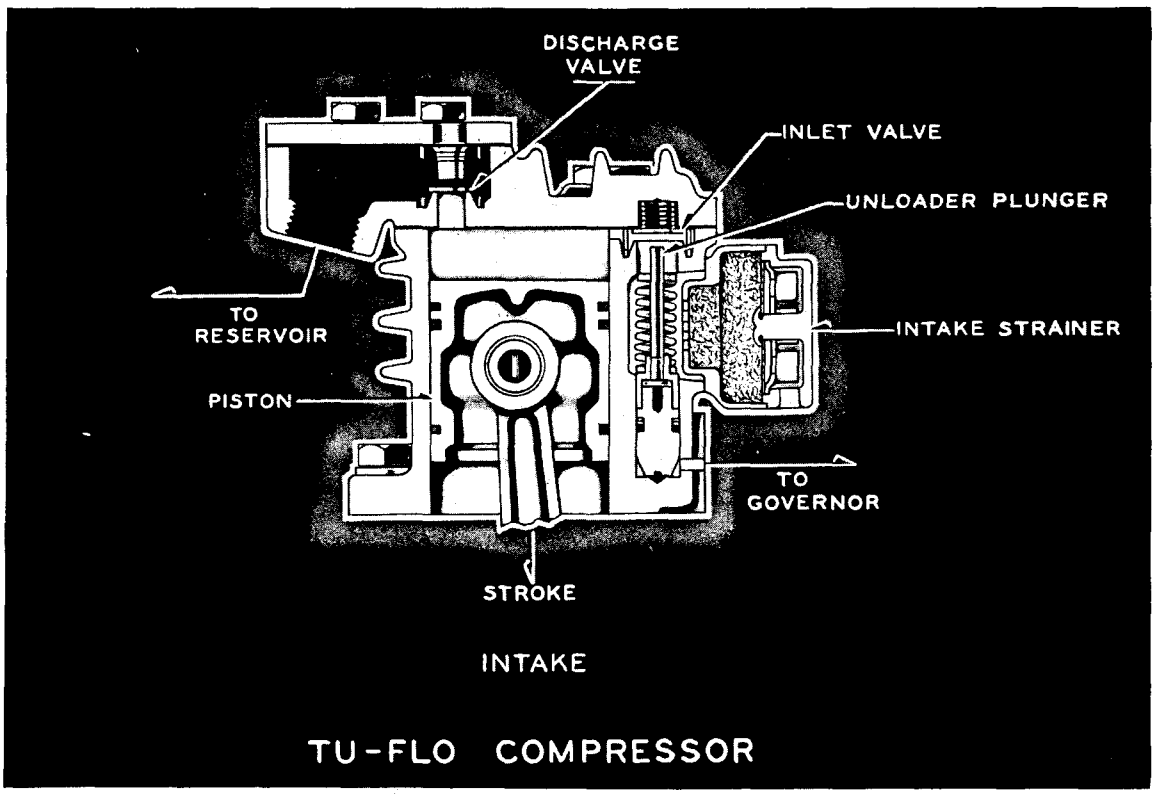


FIG. 5-Intake of Air

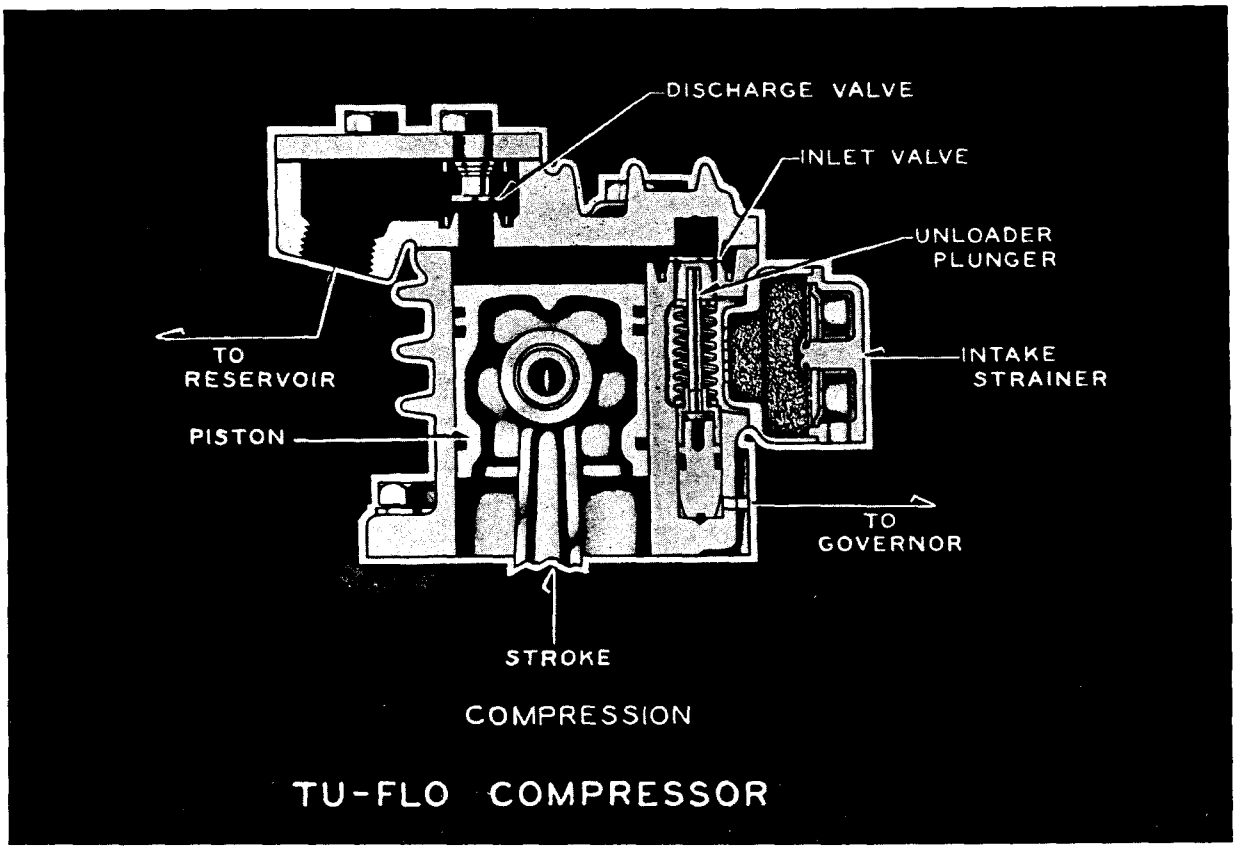


FIG. 6 – Compression of Air

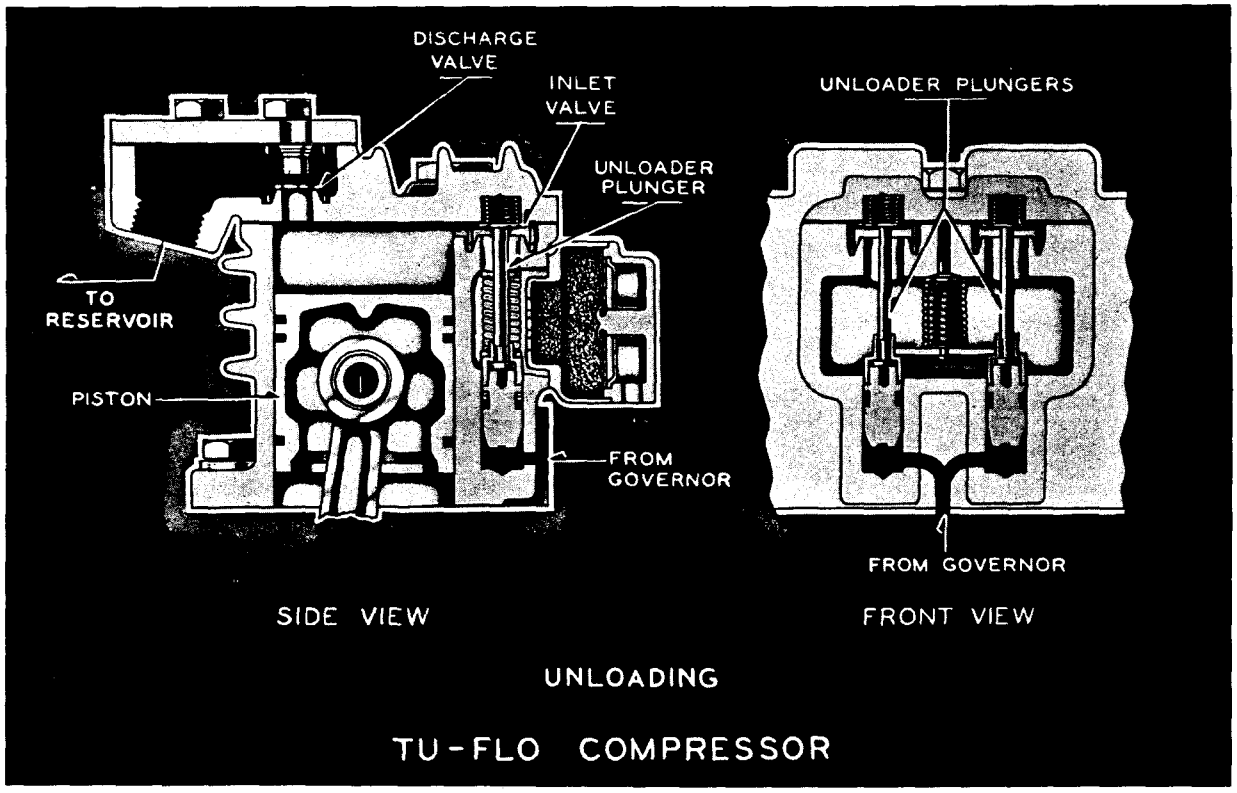


FIG. 7– Compressor Unloading Mechanism

As the piston reaches the top of its stroke and starts down, the discharge valve spring returns the discharge valve to its seat. This prevents the compressed air from returning to the cylinder bore as the intake and compression cycle is repeated.

NON-COMPRESSION (Unloaded)
Figure 7

When reservoir air pressure reaches the high pressure setting of the governor, it passes through the governor and into the cavity beneath the unloader pistons in the compressor cylinder block. The unloader pistons lift and the plungers move up and hold the inlet valves off their seats.

With the inlet valves held off their seats by the unloader pistons and plungers, air is merely forced back and forth between the two cylinders. As reservoir air is used and the pressure drops to the low pressure setting of the governor, the governor closes and exhausts the air from beneath the unloader pistons. The unloader spring forces the saddle, pistons and plungers down and the inlet valves again seat. Compression is then resumed.

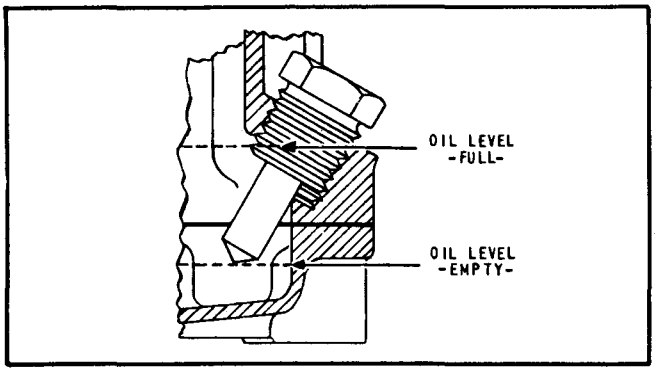


FIG. 8—Oil Level

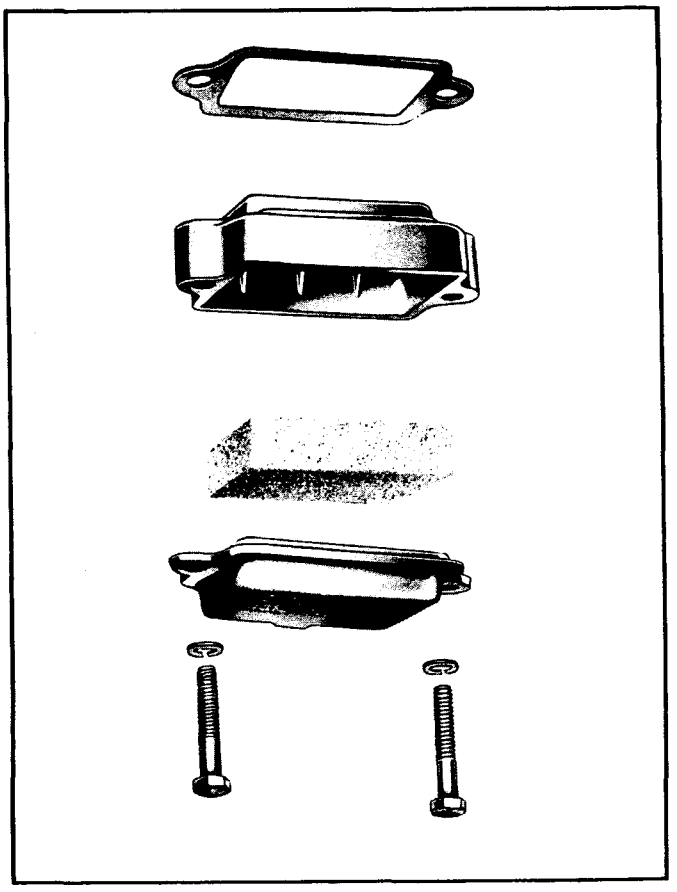


FIG. 9—Exploded View of Compressor Air Strainer

PREVENTIVE MAINTENANCE

If the compressor is a self-lubricated type, its oil level should be checked at the same time the engine oil level is checked. The oil level should be kept from overflow out of the crankcase to the bottom of the dipstick (Figure 8). The oil should be changed at same time as engine oil or often enough to keep it non-abrasive and non-corrosive.

EVERY 100 OPERATING HOURS OR AFTER EACH 5,000 MILES

Depending on operating conditions and experience, the compressor air strainer should be serviced (Figure 9). Remove and wash all parts and clean or replace element. If the element is cleaned it should be washed in gasoline, methyl alcohol, carbon tetrachloride, or soap and water. Before replacing the element it should be saturated in clean oil, then squeezed dry.

Check compressor drive alignment and belt tension. Also note that all mounting bolts are tightened securely.

EVERY 350 OPERATING HOURS OR AFTER 10,000 MILES

If compressor is self-lubricated type the oil should be drained, the crankcase flushed then filled with clean oil. The same SAE grade oil as is generally used in engines should be used in the compressor.

EVERY 1000 OPERATING HOURS OR AFTER EACH 35,000 MILES

Remove cylinder head cover and check for presence of excessive carbon deposits. Also check discharge line for restriction due to carbon deposits. If restrictions are found in either of these checks, the cylinder head or discharge line should be cleaned or replaced.

The crankcase breather of self-lubricated type compressor should be serviced. It can be flushed with a good cleaning solvent and dried.

EVERY 3000 OPERATING HOURS OR AFTER EACH 100,000 MILES

Depending upon operating conditions and experience, the compressor should be disassembled, cleaned and all parts inspected. All damaged or worn parts should be replaced or the complete compressor should be replaced with a factory reconditioned repair exchange unit.

SERVICE CHECKS

It is of the utmost importance that the compressor is taking in clean air. The air strainer must be properly installed and kept clean.

Check compressor mounting to be sure it is secure. The drive should be checked for alignment, and proper belt tension.

If the compressor is engine lubricated its oil supply and return lines must be inspected to see that the compressor is getting the proper supply of oil and that the oil is returning to engine unrestricted.

Check to make sure the engine fan blast is flowing by the compressor unrestricted.

Compressor unloading mechanism should be checked for proper operation.

OPERATING TESTS

Because of the many different types of air systems using the Tu-Flo 300 Compressor on different types of vehicles, it is difficult to set up a specific series of tests to determine the serviceability of the compressor on the vehicle. The best guide is familiarization with the vehicle and its air system. Should the compressor fail to maintain adequate air pressure in the system, it usually denotes loss of efficiency due to wear, provided leakage in the air system is not excessive. Oil passing is another sign of wear.

AIR LEAKAGE TESTS

The discharge valves and the unloader pistons can be checked for leakage by first building up the air system until the governor cuts out, then stopping the engine. With the engine stopped, carefully listen for escaping air at the intake to pin-point leakage, if noted, squirt a little oil around the unloader pistons. If there is no noticeable leakage at the pistons, the discharge valves may be leaking.

Another method of checking the discharge valves is to disconnect the discharge line and apply shop air back through the discharge port.

If the compressor does not function as described above, or leakage is excessive, it is recommended that it be returned to the nearest Bendix-Westinghouse authorized distributor for a factory rebuilt compressor under the repair exchange plan. If this is not possible, the compressor can be repaired with genuine Bendix-Westinghouse parts in which case the following information should prove helpful.

REMOVING AND INSTALLING

These instructions are general and in some cases additional precautions must be taken.

Block vehicle to hold by means other than air brakes.

Drain air brake system.

Disconnect all air and oil lines to and from compressor.

Remove compressor mounting bolts, and compressor from engine.

Use a gear puller to remove the pulley from the compressor crankshaft.

INSTALLATION
ENGINE LUBRICATED TYPES

Clean oil supply line. Before connecting the supply line run the engine briefly to make sure oil is flowing freely through the line.

Clean the oil return line or oil return passages in the bracket; these passages must unrestricted.

Prelubricate compressor cylinder walls and bearings with clean engine oil.

Always use a new mounting gasket.

SELF - LUBRICATED TYPE

Fill compressor crankcase with clean engine oil before installing and operating compressor. Refer to "Tabulated Data" Section for proper amount of oil to be used.

ALL TYPES

Inspect pulley and associated parts for wear or damage. The pulley must be a tapered interference fit on the compressor crankshaft. Replace pulley if worn or damaged.

Install the pulley on the crankshaft making sure it does not ride on the key. Install crankshaft nut securely and lock with cotter pin.

Be sure the air cleaner is clean and properly installed.

Clean or replace any damaged or restricted air lines before connecting them to compressor.

Install and tighten compressor mounting bolts.

Align compressor drive.

Connect belt and adjust its tension.

After installation, run the compressor, check and correct any oil or air leaks. Also check for noisy operation.

DISASSEMBLY

Clean road dirt and grease from compressor exterior using a good cleaning solvent.

Before disassembling the complete compressor the relationship of several sub-parts should be marked so the compressor can be assembled properly:

The cylinder block in relation to the crankcase,

The cylinder head in relation to the block,

The oil filler plug in relation to the crankcase, if self-lubricated type.

CYLINDER HEAD Figure 10

Remove cap screws and lift off cylinder head cover.

Scrape off cylinder head cover gasket.

Remove discharge valve guides, springs, and discharge valve.

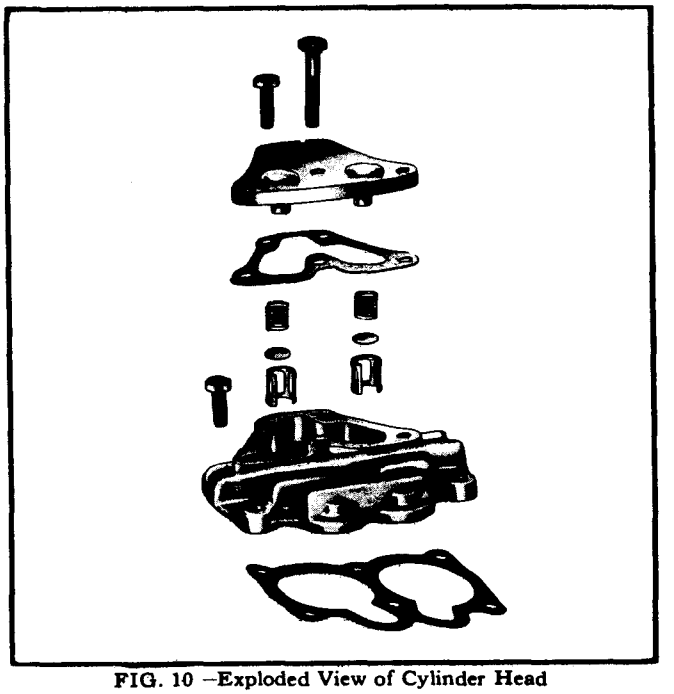


FIG. 10 —Exploded View of Cylinder Head

Remove cylinder head body cap screws, then body. It may be necessary to tap cylinder head body with a rawhide or similar hammer to free it.

Remove inlet valve springs, guides and inlet valve from top of block.

CRANKCASE BASE - SELF - LUBRICATED TYPE

Remove crankcase base cap screws, then base.

Remove oil pressure check valve from crankcase base.

The oil pump cylinder should not be removed from the base unless it is worn or damaged.

OIL PUMP ROD - SELF LUBRICATED TYPE
Figure 11

Bend back prongs of oil pump rod bolt lockwasher; remove bolts, lockwasher, oil pump rod, and its cap. Reassemble oil pump rod cap to the rod to protect rod bearing.

Remove oil relief valve seat from piston end of oil pump rod. Also remove oil relief ball valve and spring.

REMOVING AND DISASSEMBLING PISTONS AND CONNECTING RODS

Straighten prongs of connecting rod bolt lockwashers and remove bolts, lockwashers, and bearing caps.

Push pistons with connecting rods attached up and out the top of the cylinder block.

Replace bearing caps on their respective connecting rods.

Remove piston rings from pistons.

If pistons are to be removed from connecting rods, remove wrist pin lock wires and press wrist pins from piston and connecting rods.

CRANKCASE

Remove cap screws securing end cover at drive end of crankshaft.

Remove end cover with oil seal. Remove or scrape off end cover gasket.

If oil seal needs replacing, it should be removed from end cover.

Remove cap screws that hold opposite end cover to crankcase; remove end cover and its gasket.

Press the crankshaft and ball bearing from the crankcase, then press bearing from crankshaft.

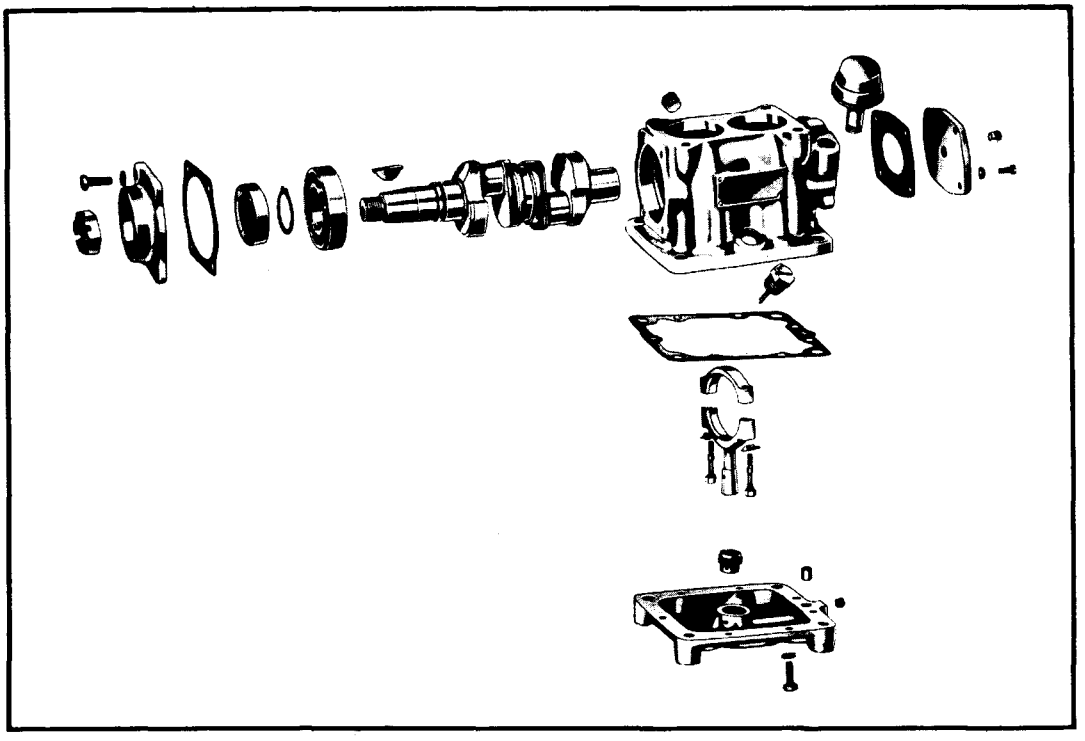


FIG. 11
—Exploded View of Crankcase

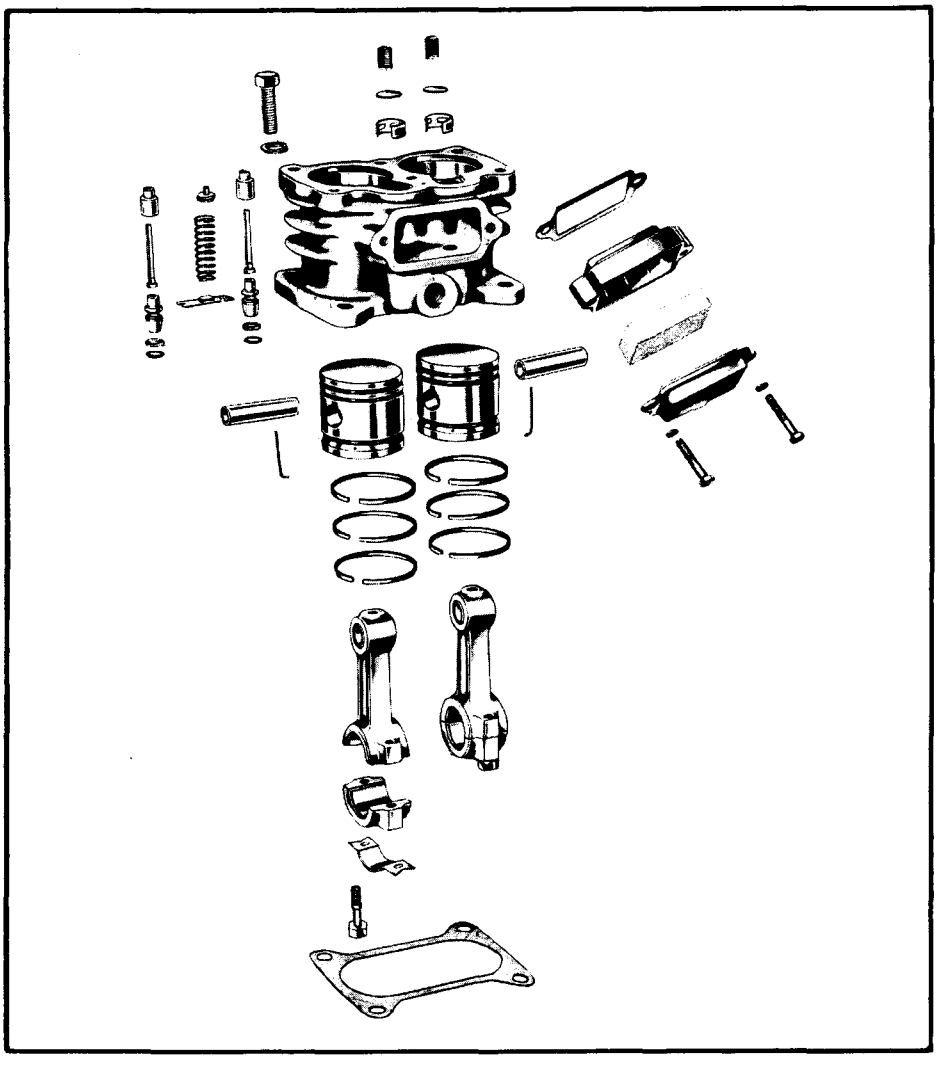


FIG. 12-
-Exploded View of Cylinder Block

CYLINDER BLOCK - Figure 12

If compressor is fitted with an air strainer, inlet fitting or governor, remove same.

Remove cap screws securing cylinder block to crankcase; separate crankcase and cylinder block and scrape off gasket.

Remove unloader spring, spring saddle, and spring seat from cylinder block.

Connect shop air to unloader port and slowly apply air pressure to lift up unloader pistons, guides and plungers. Remove unloader guides and plungers, then unloader pistons.

Inlet valve seats can be removed but only if they are worn or damaged and are being replaced.

CLEANING AND INSPECTION OF PARTS

CLEANING

All parts should be cleaned thoroughly in a good cleaning solvent before inspection.

CYLINDER HEAD ASSEMBLY

Remove any carbon deposits that may have collected on the head discharge cavities or on the cylinder head cover.

The discharge valves, if they are only slightly worn or grooved, can be reclaimed by lapping them on fine crocus cloth (Figure 13), but it is recommended that new valves be used.

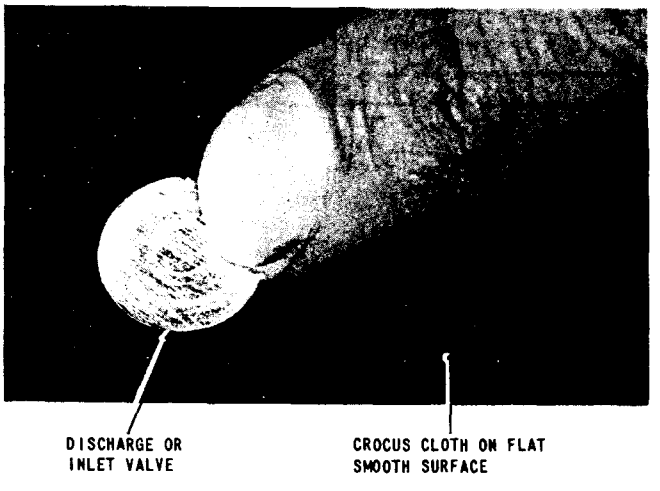


FIG. 13—Cleaning Discharge and Intake Valves

CYLINDER BLOCK

Clean carbon and dirt from intake and unloader passages. Use air to blow out unloader passages.

Like the discharge valves, the inlet valves can be reclaimed by lapping them on fine crocus cloth, if they are only slightly worn, but it is suggested that new inlet valves be used.

COMPRESSOR OIL PASSAGES

Thoroughly clean out oil passages through the crankshaft, connecting rod tops, crankcase, end cover, and base plate. If necessary inspect these passages with a wire, then blow foreign matter out with air pressure.

The crankcase breather of the self-lubricated type should be cleaned thoroughly.

INSPECTION OF PARTS

CYLINDER HEAD

Inspect body for cracks or other damage. Discharge valve stops on cylinder cover should not be peened. If the stops are peened excessively, the cylinder head cover should be replaced.

If the discharge valve seats are worn excessively so that there is no longer enough metal left to reclaim them by lapping, the seats or a complete cylinder head body should be replaced.

It is recommended that used discharge valve springs, discharge valve guides and the discharge valves be replaced.

CRANKCASE AND END COVERS

Check for cracks or broken lugs in crankcase and end covers. Also check their oil passages to make sure they are open and clean.

Crankcase bearing bore should be checked with cylinder block installed on crankcase. Check fit of ball bearing in its bore. It should be a snug press fit.

Check rear sleeve bearing for scores or damage. It should be a tight press in the crankcase.

Check oil seal of drive end cover for lip wear and flexibility. Replace seal if necessary.

CYLINDER BLOCK

Check for cracks or broken lugs on cylinder block.

Check unloader piston bores to be sure they are clean and free of rust.

Check inlet valves. If they are slightly worn or grooved they can be reclaimed by lapping them on a fine piece of crocus cloth, but it is recommended that they be replaced. If the inlet valve seats are worn or damaged excessively and cannot be reclaimed, they should be replaced.

CYLINDER BORES

Cylinder bores should not be scored, or be out of round by more than 0.0002", or be tapered more than 0.0003".

The bores must be smooth, straight and round.

Clearance between pistons and cylinder bores should be between .002" minimum and .004" maximum.

PISTONS

Check pistons for scores, cracks, or enlarged ring grooves. Replace pistons if any of these conditions are found.

WRIST PINS

Check fit of wrist pins in pistons and in connecting rod bushings; they should be a light press fit. If the wrist pins are loose and worn the wrist pins and pistons should be replaced.

Clearance of the wrist pin in the connecting rod bushing should not exceed 0.0015".

Used wrist pin lock wires should be replaced.

PISTON RINGS

Check fit of piston rings in piston ring grooves.

Check ring gap with rings installed in cylinder bore. Refer to (Figure 14) for correct gap and groove clearance.

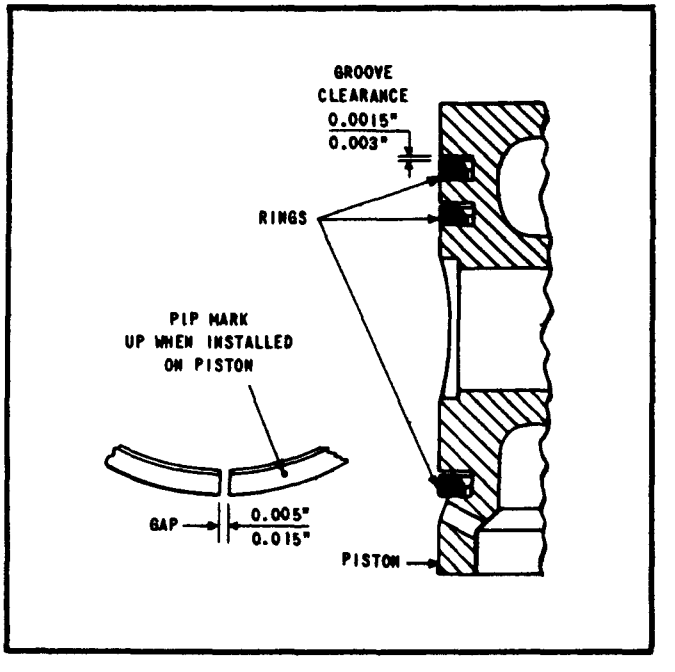


FIG. 14—Location of Piston Ring Groove Clearance

CRANKSHAFT

Check crankshaft screw threads, keyways, tapered ends, and all machined and ground surfaces for wear, scores, cracks, or other damage.

Check oil passages of crankshaft to be sure they are open and clean.

CONNECTING ROD BEARING

Check fit of connecting rod bearing on crankshaft journals. Worn connecting rods should be replaced.

Connecting rod caps are not interchangeable so they should not be mixed.

The locking slots of the connecting rod and its cap should be positioned adjacent to each other.

Clearance between the connecting rod journals and connecting rod bearings should not be less than 0.0003" or more than 0.0021".

MAIN BEARINGS

Check for wear or flat spots on ball bearing and replace if these conditions are found. The rear sleeve bearing should be checked for scores and wear.

UNLOADER MECHANISM

Used unloader parts should be replaced with unloader kit piece number 265013. The new unloader pistons should be a free sliding fit in the unloader piston bores of the cylinder block.

PARTS SPECIAL TO SELF-LUBRICATED TYPE COMPRESSORS

Check fit of oil pump piston in the base plate oil pump bushing to be sure it is a free sliding fit. If excessive clearance is found the oil pump piston and rod, its bushing, or both, should be replaced.

The oil pump relief ball valve seat should be checked for excessive wear. The ball valve should be checked also. If either show excessive wear the oil pump rod should be replaced.

Check the base plate for cracks or other damages, be sure its oil passages are clear and clean.

A new oil pressure check valve should be installed properly in the base plate.

REPAIRS

DISCHARGE VALVE AND SEATS

If discharge valve seats merely show signs of slight wear, they can be dressed by using a lapping stone, grinding compound, and lapping tool. New discharge valves and discharge valve springs should be used.

To test for leakage by the discharge valves, apply about 100 pounds of air pressure through the discharge port and check for leakage at the discharge valves and seats. If excessive leakage is found, leave the air pressure applied and with a fibre or hardwood dowel and hammer, tap the discharge valves off their seats several times. (Figure 15). This will coin the valves on their seats and reduce any leakage.

With the air pressure still applied, check for leakage at the cylinder head cover.

INLET VALVES AND SEATS

Like the case of the discharge valve seats, the inlet seats can be dressed if they show signs of wear. If seats are beyond repair they should be replaced.

It is suggested that new inlet valves and inlet valve spring be used.

ASSEMBLY

CYLINDER BLOCK

Prior to assembly lubricate unloader pistons and piston bores with B-W lubricant, piece number 239379 (dimethyl polysiloxane BW-328-M). If new prelubricated pistons are used, no additional lubricant is necessary.

Install unloader pistons in their bores with caution against cutting the grommets or distorting the back-up rings.

Position unloader plungers in their guides and slip them in over the tops of the pistons.

Install unloader spring seat in the cylinder block.

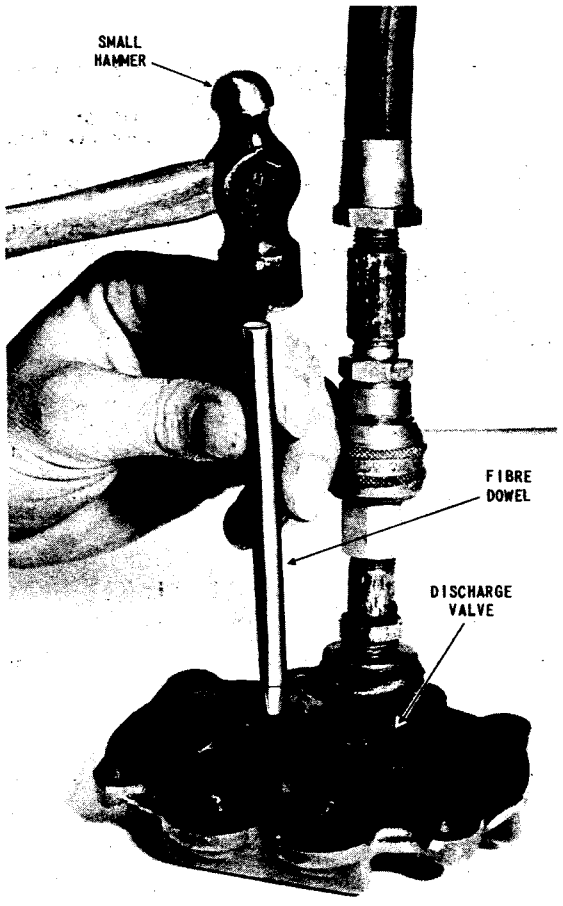


FIG. 15—Seating Discharge Valve with Dowel

Position unloader saddle between unloader piston guides so its forks are centered on the guides.

Install the unloader spring making sure it seats over the spring seats both in the block and on the saddle.

Position cylinder block gasket and block on crankcase according to markings made prior to disassembly. Install cap screws with lockwashers and tighten block to crankcase.

INSTALLING CRANKSHAFT

Press ball bearing on the crankshaft.

Position ball bearing and crankshaft in crankcase, making sure they are in correct alignment, then carefully press them into the crankcase using an arbor press.

Position and install the rear end cover gasket and end cover with lockwashers and cap screws.

If the front end cover requires an oil seal which was removed on disassembly, a new seal should be pressed into the end cover.

Position a new end cover gasket and carefully install the end cover over the crankshaft and on to the crankcase avoiding damage to the seal.

Secure end cover with cap screw and lockwashers.

PISTONS AND CONNECTING RODS

If new wrist pin bushings are to be used they should be pressed into the connecting rods so that the oil hole in the bushing lines up with the one in the rod. The new bushings should then be reamed or honed to provide between 0.0003" and 0.0008" clearance on the wrist pin.

Position connecting rod in piston and press in wrist pin so that lock wire hole in the pin aligns with that of the piston. Install new lock wires through pistons and wrist pins and lock same by snapping short end into lock wire holes at the piston skirt.

Install piston ring in correct location with pip-marks up. Stagger the position of the ring gaps.

Prelubricate piston, piston rings, wrist pins and connecting rod bearings with clean oil before installing them in the cylinder block.

Remove connecting rod bolts and bearing cap from one connecting rod.

Turn crankshaft so one of its connecting rod journals is in the bottom dead center position. Insert the connecting rod with piston through the top of this cylinder using a piston ring sleeve compresser. Position and attach the related bearing cap to the connecting rod. Follow with the lockwasher and connecting rod bolts. Tighten the connecting rod bolts evenly and then bend up the corners of the lockwasher to lock and hold the bolts.

Install the second connecting rod with piston in the same manner.

Install inlet valve seats if they have been removed. Position and install inlet valve guides then drop inlet valves into their guides. They should be a loose sliding fit between the valve and guide.

CYLINDER HEAD ASSEMBLY

If previously removed, the discharge valve seats should be installed in the cylinder head body.

Turn the cylinder head body over and stick the inlet valve spring in the body. It may be necessary to use a small amount of grease to hold the springs in place.

Position the cylinder head gasket and cylinder head body on the cylinder block.

Install cap screws with lockwashers and connect head body to cylinder block.

Install discharge valve guides in proper place in cylinder head. The open sides of the guides should face the discharge port.

Drop discharge valves in the guides and check to be sure they are a loose sliding fit.

Position discharge valve spring on top discharge valves.

Install cylinder head cover making sure discharge valve stops are correctly positioned inside the discharge valve springs.

Install cylinder head cover cap screws and tighten evenly and securely.

BASE PLATE - SELF LUBRICATED TYPE COMPRESSORS

Position oil relief valve spring and relief ball valve in oil pump piston. Install and tighten relief valve seat until bottomed.

Install oil pump piston bushing in base plate if it was removed on disassembly. Check fit of piston in base plate bushing; the piston must be a medium sliding fit.

Install new oil pressure check valve in base plate properly with check valve and seat down in the plate and the check valve stop pin visible at the top of the plate.

Install oil pump piston and rod on crankshaft. This fit must be the same as specified for connecting rod bearings on crankshaft.

Position base plate gasket on crankcase.

Position base plate assembly on the bottom of the crankcase being sure the oil pump piston engages the oil pump bushing in the base plate and secure plate to crankcase with cap screws and lockwashers.

Install oil dip stick plug in crankcase.

AIR STRAINER

Assemble the strainer. Use a new strainer gasket and install the strainer on the cylinder block.

GOVERNOR - Figure 16

If compressor is type with governor attached, install a new or rebuilt governor to the compressor with the governor mounting bracket. This bracket is secured to the compressor with the cylinder head and block cap screws.

Connect the unloader port of the compressor to the governor unloader port with tubing and fittings.

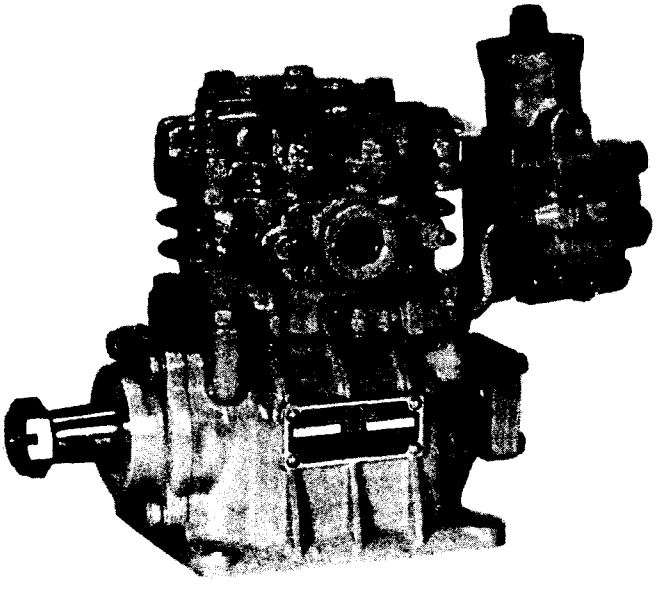


FIG. 16-Compressor with Governor Attached

INSPECTION OF REBUILT UNIT

Use covers, plugs, or making tape to protect all ports if compressor is not to be installed immediately.

Fit the crankshaft end with key, nut, and cotter pin and then protect the end against damage by wrapping with masking or friction tape.

The open bottom of engine lubricated compressors should be protected against the entrance of dirt during handling or storage, by installing a temporary cover over the open base.

TESTING REBUILT COMPRESSOR

To properly test a compressor under operating conditions, an elaborate test rack to accommodate correct mounting, cooling, lubricating and driving the compressor is necessary. Such tests are not compulsory if the unit has been carefully rebuilt by an experienced person.

A simple compressor efficiency and build up test can be run. Before the test is performed, the crankcase of self-lubricated type compressor should be filled with clean lubricating oil. An engine lubricated compressor must be connected to an oil supply line of at least 15 pounds pressure during the test and an oil return must be connected to keep the crankcase drained. The compressor when tested should be less strainer.

To the discharge port of the compressor connect a reservoir or reservoirs whose volume plus the volume of the connecting line equals 1300 cubic inches. Run the compressor between 1700 and 1750 RPM's. Elapsed time that the Tu-Flo 300 type compressor takes to build up from 0 to 100 psi should not exceed 85 seconds.

During this test the compressor should be checked for oil leakage and for noisy operation.

TROUBLE SHOOTING

SYMPTOMS AND PROBABLE CAUSES

COMPRESSOR FAILS TO MAINTAIN SUFFICIENT PRESSURE IN THE AIR SYSTEM

Dirty intake strainer.
Restriction in compressor cylinder head discharge cavity or in the discharge line.
Restriction at the intake cavity or inlet valves.
Leaking discharge valves.
Excessive wear.
Drive belt slipping.
Inlet valve stuck open or worn inlet valves.
Excessive system leakage.

NOISY OPERATION

Loose drive pulley.
Worn or burned out bearings.
Restriction in cylinder head or discharge line.
Compressor not getting proper lubrication.
Excessive wear.
Damaged oil pump.
Mounting bracket vibration.

COMPRESSOR PASSING EXCESSIVE OIL

Dirty air strainer.
Excessive wear.
Too high oil pressure.
Oil supply or return line flooded.
Defective or worn oil seals.
Piston rings improperly installed.
Back pressure from engine crankcase.

COMPRESSOR NOT UNLOADING

Excessive system leakage or air usage.
Defective unloader pistons or bores.
Intake cavity restricted.
Defective governor.
Unloader line or cavity to governor restricted.
Unloader mechanism binding or stuck.

TABULATED DATA

Tu-Flo 300 Compressor Specifications

Number Cylinders	2
Bore Size	1 ¾"
Stroke	1 5/32"
Piston Displacement at 1250 RPM	4 cu. ft.
Piston Displacement per Revolution	5.5 cu. in.
Maximum Recommended Speed with Specified Fan Blast Cooling (RPM's)	3000
Horsepower Required at 1250 RPM against 90 psi	.85
Minimum Oil Pressure Required at Engine Idling Speed	5
Minimum Oil Pressure Required at Maximum Engine Governor Speed	15
Oil Capacity (Self-Lube Type)	.29 qt. (275 cc)

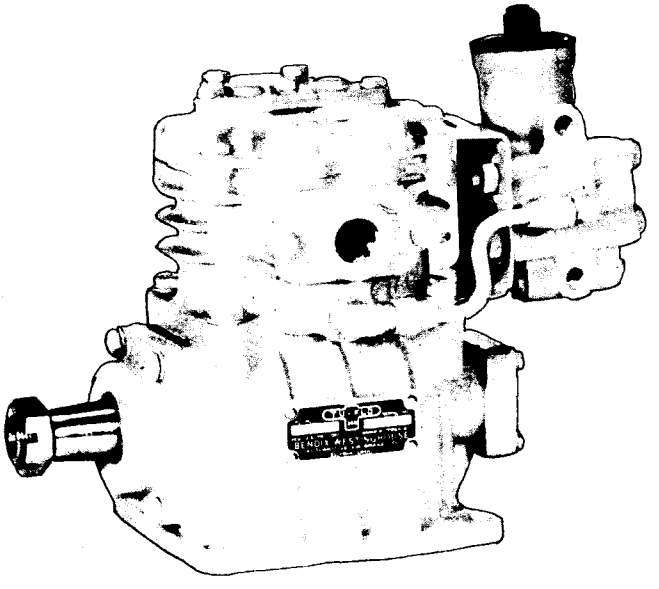
Bendix-Westinghouse

TECHNICAL DATA

Revised February, 1969

TU-FLO 300 COMPRESSOR

I Symbol



II Description: The Tu-Flo 300 Compressor is a single acting, single stage, reciprocating air compressor. The two cylinder, in-line machine is air cooled, self or engine lubricated; belt driven; bracket mounted; vehicular or stationary application; governed compression with atmospheric or supercharged inlet.

III Design Features: Minimum clearance gives high volumetric efficiency. Head and block cooling fans give low discharge temperatures. Hardened automatic poppet inlet and exhaust valves give long life. Low distortion blocks give long ring life. Proven unloader design; silicone rubber seals and lubricant. Sintered bronze rear and ball bearing front end to protect against high drive loads, weight saving construction with no sacrifice in durability.

This device is to be maintained and serviced periodically as shown and outlined in B-W Instruction and Service Data. For additional details, please contact one of our Regional Sales Offices.

Printed in U.S.A. March, 1969

TECHNICAL DATA

Revised February, 1969

DIMENSIONAL SPECIFICATIONS

TU-FLO 300 AIR COMPRESSOR

1.	Inlet Valve Lift (New)	.049 - .073
2.	Inlet Valve Seat - Worn Groove not to Exceed	.005
3.	Discharge Valve Seat - Worn Groove not to Exceed	.002
4.	Discharge Valve Lift (New)	.038 - .080
5.	Piston	
	Number of Grooves	3.
	Width of Ring Grooves	.0955 - .0965
	Diameter at Top of Piston	1.7485 - 1.7490
	Diameter at Ring Groove	1.533 - 1.543
	Diameter at Ring Land	1.7485 - 1.7490
6.	Piston to Head Clearance	.009 - .035
7.	Piston Ring Gap (In Cylinder)	.005 - .015
8.	Piston Ring Clearance (In Groove)	.0015 - .0035
9.	Clearance Between Piston and Cylinder Wall	.0010 - .0025
10.	Cylinder Bore	
	Maximum Out-of-Round Wear Limit	.002
	Maximum Taper Wear Limit	.001
11.	Crankshaft Journal Maximum Out-of-Round	.0003
12.	Main Sleeve Bearing Clearance (New)	.0008 - .0017
13.	Clearance Between Connecting Rod Bushing and Piston Pin (Ream)	.0003 - .0008
14.	Discharge Valve Travel (with New Valves, Springs, and Cap Nuts)	.051 - .075
15.	Clearance Between Connecting Rod Bearing and Crankshaft Journal (New)	.0010 - .0021
16.	Inlet Valve Spring	
	Free Height	.41
	Height under Load of	.34" @ 1.3 oz to 1.7 oz
	Solid Height	.22
	Number of Active Coils	8.5
17.	Discharge Valve Spring	
	Free Height	.41
	Height under Load of	.36" @ 1.65 oz to 2.35 oz
	Solid Height	.23
	Number of Active Coils	6.
18.	Unloader Valve Spring	
	Free Height	.91
	Height under Load of	.75" @ 5# 6 oz to 6# 10 oz
	Unloader Piston to Inlet Valve Clearance - Max	.052
	Solid Height	.53
	Number of Active Coils	7.5
19.	Wrist Pin	
	Length	1.609 - 1.625
	I.D.	.297 - .328
	O.D.	.4375 - .4377
20.	Wrist Pin Bushing I.D.	.4380 - .4383
21.	Wrist Pin to Piston Clearance	.0000 - .0002 Loose
22.	Maximum Rear Bearing Clearance at Replacement - 1"	.008

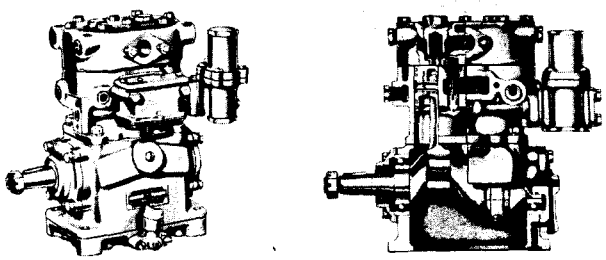
DESCRIPTION AND OPERATION

GENERAL

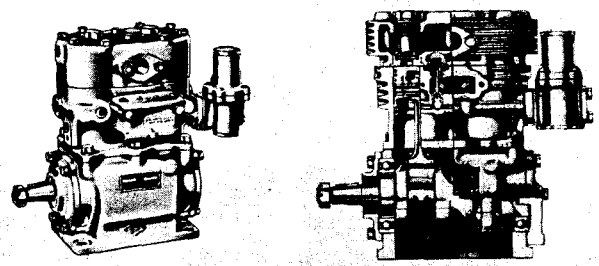
The function of the air compressor is to build up and maintain the air pressure required to operate air powered devices in air brake or air auxiliary systems.

DESCRIPTION

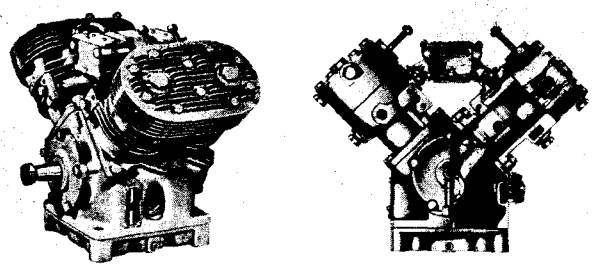
Tu Flo Type 400, 500, and 1000 Compressors are single stage, reciprocating piston type compressors. Tu Flo 400 (Fig. 1) and 500 (Fig. 2.) compressors have two cylinders while the Tu Flo 1000 (Fig. 3) is a V-type design having four cylinders. The rated capacity of all Bendix-Westinghouse compressors is their piston displacement in cubic feet per minute when operating at 1250 RPM. The rated capacity of the Tu Flo 400 compressor is 7¼ cubic feet per minute. The Tu Flo 500 is rated at 12 cubic feet per minute and the Tu Flo 1000 has a rating of 24 cubic feet per minute.



EXTERIOR FIG. 1 – TU-FLO 400 SECTIONAL



EXTERIOR FIG. 2 – TU-FLO 500 SECTIONAL



EXTERIOR FIG. 3 – TU-FLO 1000 SECTIONAL

Tu Flo type compressors have automatic type inlet valves. Their unloading mechanisms are located in the cylinder block and they have no external moving parts. Both air and water cooled type compressors are available. Various mounting and drive adaptations are used as required by different vehicle engine designs (Fig. 4).

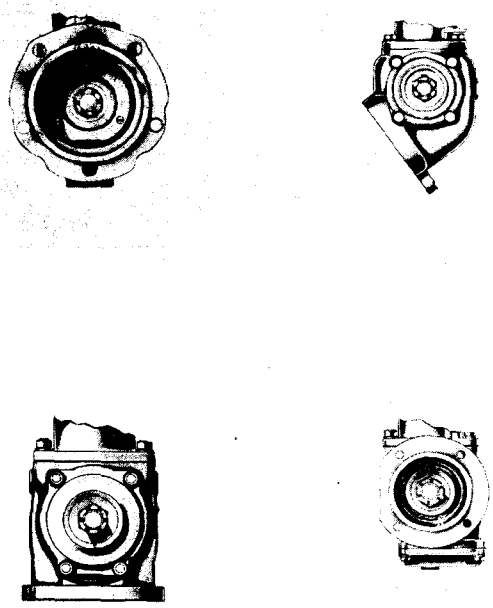


FIG. 4 – VARIOUS COMPRESSOR MOUNTINGS

Compressors are either engine or self-lubricated. The majority used are the engine lubricated types (Fig. 5) which obtain the oil necessary to lubricate their moving parts from the engines on which they are mounted. To meet the requirements of some manufacturers and for field installations, self-lubricated types (Fig. 6) are available. They are compressors having a self-contained oil supply and pumping system.

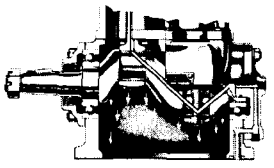


FIGURE 5 –
ENGINE LUBRICATED TYPE

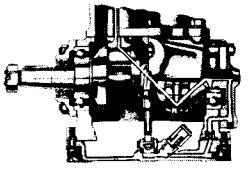


FIGURE 6 –
SELF LUBRICATED TYPE

The method of lubricating the moving parts of the compressor is the same in either type. Oil is forced through the oil passage in the crankshaft and out around each connecting rod journal. The turning motion of the crankshaft throws the oil that is forced out at the journals, against the cylinder bores and crankcase walls, lubricating the bores and crankshaft bearings.

The wrist pins and wrist pin bushings are lubricated in two ways depending upon the type connecting rods used (Fig. 7). If forged steel rods are used, the oil is forced from the crankshaft through a drilled passage in the rod to the wrist pins and bushings. The other type connecting rod which is currently being used is the aluminum die cast type. The die cast type rod is not drilled between the crankshaft journal and wrist pin connections, but is drilled at the top of the rod. The wrist pins and bushings are lubricated by oil dripping from a drip-boss on the piston into a "catch-funnel" at the top of the rod and through the drilled passage to the bushings and pins.

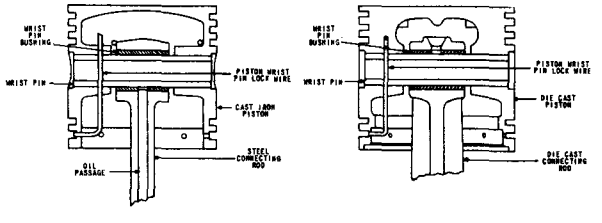


FIGURE 7 –
PISTONS & CONNECTING RODS

A name plate is attached to the crankcase of all compressors. It shows the piece number, type and serial number (Fig. 8). A name plate with a black background denotes a new compressor, whereas a name plate with a red background designates that the compressor is a factory reconditioned unit. All compressors are identified by the piece number which is the number to use when reference is made to a particular compressor. The type and serial number is supplementary information.

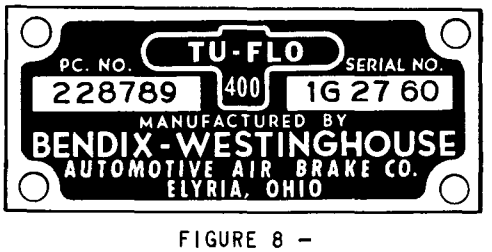


FIGURE 8 –
COMPRESSOR NAMEPLATE

OPERATION

GENERAL

All compressors run continuously while the engine is running but actual compression of air is controlled by a governor which stops or starts the compression of air by loading or unloading the compressor in conjunction with its unloading mechanism. This is done when the air pressure in the system reaches the desired maximum or minimum pressures.

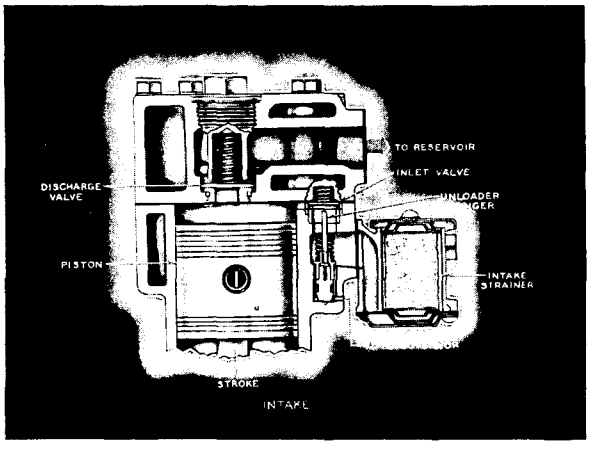


FIGURE 9 –

INTAKE AND COMPRESSION (Loaded)

During the down stroke of the piston, a slight vacuum created above the piston causes the inlet valve to move off its seat. Atmospheric air is drawn in through the compressor intake, by the open inlet valve, and on top of the piston (Fig. 9) As the piston starts its upward stroke, the air that was drawn in on the down stroke is being compressed. Now, air pressure on top of the inlet valve plus the force of its spring, returns the inlet valve to its seat. The piston continues the upward stroke and compresses the air sufficiently to overcome the discharge valve spring and unseat the discharge valve. The compressed air then flows by the open discharge valve, into the discharge line and on to the reservoirs (Fig. 10).

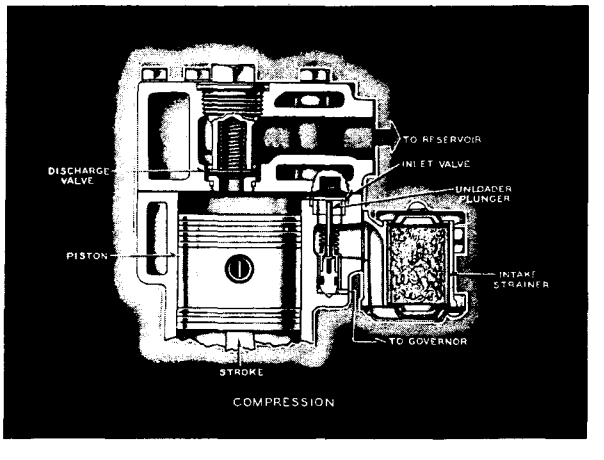


FIGURE 10 –

As the piston reaches the top of its stroke and starts down, the discharge valve spring returns the discharge valve to its seat. This prevents the compressed air in the discharge line from returning to the cylinder bore as the intake and compression cycle is repeated.

NON-COMPRESSION (Unloaded)

When the air pressure in the reservoir reaches the high pressure setting of the governor, the governor opens, allowing air to pass from the reservoir through the governor and into the cavity beneath the unloader pistons. This lifts the unloader pistons and plungers. The plungers move up and hold the inlet valves off their seats (Fig. 11).

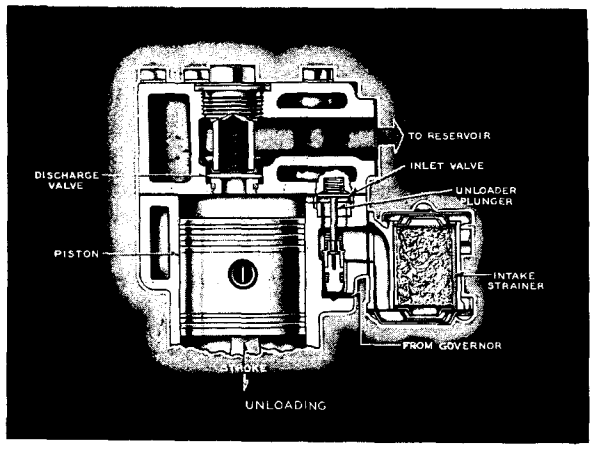


FIGURE 11 –

With the inlet valves held off their seats by the unloader pistons and plungers, air is merely pumped back and forth between the two cylinders. When air is used from the reservoir and the pressure drops to low pressure setting of the governor, the governor closes and in doing so exhausts the air from beneath the unloader pistons. The unloader saddle spring forces the saddle, pistons and plungers down and the inlet valves return to their seats. Compression is then resumed.

PREVENTIVE MAINTENANCE

If the compressor is a self-lubricated type, its oil level should be checked at the same time the engine oil level is checked. The oil level should be kept between the bottom of the dip-stick threads and the bottom of the dip-stick (Fig. 12.) The oil should be changed often enough to keep it non-abrasive and non-corrosive.

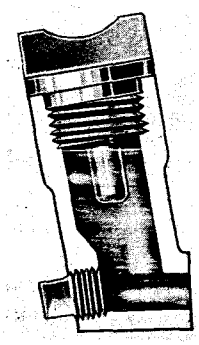


FIGURE 12 –
OIL LEVEL–SELF LUBRICATED COMPRESSOR

EVERY 100 OPERATING HOURS OR AFTER EACH 5,000 MILES

Depending on operating conditions and experience, service compressor air strainer. Remove and wash all parts. Strainer element should be cleaned or replaced. If the element is cleaned, it should be washed in gasoline, methyl alcohol, carbon tetrachloride, or soap and water. The element should be saturated in clean engine oil then squeezed dry before replacing it in the strainer.

Check compressor drive alignment belt tension and note that all mounting bolts are securely fastened.

EVERY 350 OPERATING HOURS OR AFTER 10,000 MILES

If compressor is self-lubricated type, the oil should be drained and the compressor crankcase flushed and refilled with clean engine oil.

EVERY 1,000 OPERATING HOURS OR AFTER EACH 35,000 MILES

Remove compressor discharge valve cap nuts and check for presence of excessive carbon deposits. Also, check the discharge line for carbon. If excessive carbon is found in either check, the cylinder head or discharge line should be cleaned or replaced.

If compressor is self-lubricated type, service crankcase breather. Clean and wash breather in cleaning solvent.

EVERY 3,000 OPERATING HOURS OR AFTER EACH 100,000 MILES

Depending upon operating conditions and experience, disassemble compressor, clean and inspect all parts thoroughly. Repair or replace all worn or damaged parts or replace compressor with a factory reconditioned, repair-exchange unit.

Important — Should it be necessary to drain the engine cooling system to prevent damage from freezing, water cooled compressors must be drained as both cylinder block and cylinder head are water cooled. Use drain cock or remove head and/or block pipe plugs.

SERVICE CHECKS

INSPECTION

It is of the utmost importance that the compressor is taking in clean air. The air strainer must be properly installed and kept clean. If the compressor intake is connected to the engine air cleaner, supercharger, etc., these connections must be properly installed and maintained.

Check compressor mountings to be sure they are secure. Check drive for proper alignment, belt tension, etc.

If compressor is engine-lubricated type, inspect oil supply and return lines. Be sure these lines are properly installed and that the compressor is getting the proper supply of oil, and just as important, that the oil is returning to the engine properly.

Check water lines to and from compressor if a water-cooled type.

If the compressor is air-cooled, check to be sure the engine fan blast is flowing by the compressor unrestricted.

Check unloader mechanism for operation.

OPERATING TESTS

Due to the many different types of air brake systems found on the many different types of vehicles, it is impossible to set up any specific series of tests to determine the serviceability of the compressor on a vehicle. Familiarization with the vehicle and its air system is the best judge. If the compressor fails to maintain adequate air pressure in the air brake system of the vehicle, it usually denotes loss of efficiency because of wear, provided leakage in the air system is not excessive. Oil passing is another sign of excessive wear.

AIR LEAKAGE TESTS

Leakage past the discharge valves can be detected by removing the discharge line, applying shop air back through the discharge port and listening for escaping air. Also the discharge valves and the unloader pistons can be checked for leakage by building up the air system until the governor cuts out, then stopping the engine. With the engine stopped, carefully listen for escaping air at the intake. To pin-point leakage if noted, squirt soapy water around the unloader pistons. If there is no noticeable leakage at the unloader pistons, the discharge valves may be leaking.

If the compressor does not function as described above, or leakage is excessive, it is recommended that it be returned to the nearest Bendix-Westinghouse authorized distributor for a factory rebuilt compressor under the repair exchange plan. If this is not possible, the compressor can be repaired with genuine Bendix-Westinghouse parts in which case the following information should prove helpful.

REMOVING AND INSTALLING

REMOVING

These instructions are general and in some cases additional precautions must be taken.

Drain air brake system.

If water cooled type compressor, drain engine cooling system, compressor cylinder head and block.

Disconnect all air lines, water and oil lines to and from compressor.

Remove compressor mounting bolts and compressor from engine.

Use a gear-puller to remove the gear or pulley from compressor crankshaft.

INSTALLATION

ENGINE LUBRICATED TYPES

Clean oil supply line. Before connecting this line to the compressor run the engine briefly to be sure oil is flowing freely through the supply line.

Clean the oil return line or return passages through the brackets; these passages must be unrestricted so oil can return to the engine.

Prelubricate compressor cylinder walls and bearings with clean engine oil before assembling compressor.

Always use a new mounting gasket and be sure oil hole in gasket and compressor is properly aligned with oil supply line.

SELF-LUBRICATED TYPES

Fill compressor crankcase with clean engine oil before operating compressor. Refer to "Tabulated Data" Section for proper amount.

ALL TYPES

Inspect pulley or gear and associated parts for wear or damage. They must be a neat fit on compressor crankshaft. Replace pulley or gear if worn or damaged.

Install pulley or gear on compressor crankshaft making sure it properly contacts the shaft and does not ride the key. Tighten crankshaft nut securely and install cotter pin.

Be sure the air cleaner is clean and properly installed. If the compressor intake is connected to either the engine air cleaner or supercharger, these connections must be tight with no leakage.

Clean or replace any damaged or dirty air or water lines which may be corroded, before connecting them to the compressor. Use a new discharge fitting gasket.

Align compressor drive and adjust proper belt tension.

Tighten mounting bolts securely and evenly.

After installation run compressor and check for air, oil, or water leaks at compressor connections. Also check for noisy operation.

DISASSEMBLY

Clean compressor exterior of road dirt and grease using a good cleaning solvent.

Before compressor is completely disassembled the following items should be marked to show their relationship when the compressor is assembled:

The cylinder block in relation to crankcase.

End covers' relation to crankcase.

Position of crankshaft in relation to crankcase.

The cylinder head's relation to the block.

If a self-lubricated type, the relation of oil filter fitting to base plate.

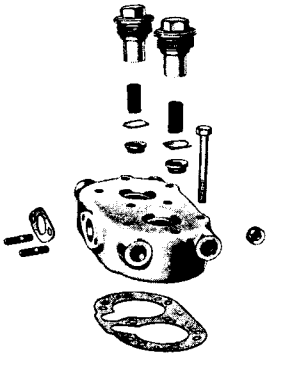


FIGURE 13 –
CYLINDER HEAD EXPLODED VIEW

CYLINDER HEAD (Fig. 13)

Remove cap screws and lift off cylinder head. It may have to be tapped with a rawhide hammer to break gasket joint.

Remove inlet valve springs from head and inlet valves from their guides in the block.

Scrape off cylinder head gasket from cylinder head and block.

Remove discharge valve cap nuts and lift out discharge valve springs and valves.

The discharge valve seats can be removed, but it is not necessary unless they are badly worn or nicked.

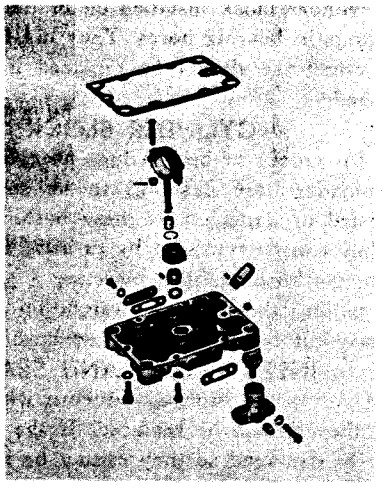


FIGURE 14 –
BASE PLATE SELF LUBRICATED TYPE COMPRESSOR

REMOVING AND DISASSEMBLING BASE PLATE-SELF-LUBRICATED TYPE COMPRESSORS (Fig. 14)

Remove screws that hold base plate. Remove base plate.

Remove oil relief valve set screw, then oil relief valve.

Remove oil strainer retaining ring and lift out oil strainer.

Unless it is necessary, the oil pump piston bushing should not be removed. If necessary remove the bushing set screw, then bushing and shim.

OIL PUMP ROD AND PISTON-SELF-LUBRICATED TYPE

Remove cotter pin from oil rod cap nuts, remove nuts, oil pump piston rod and cap.

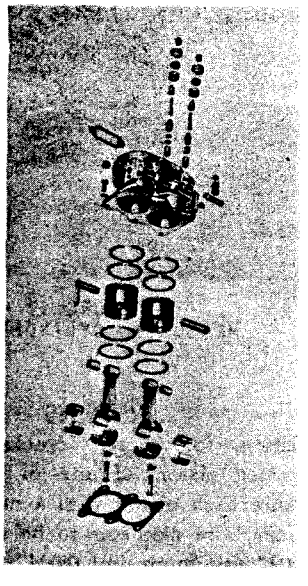


FIGURE 15 –
CYLINDER BLOCKS EXPLODED VIEW

ROD ASSEMBLIES (Fig. 15)

Straighten prongs of connecting rod bolt lock washers and remove bolts, lock washers and bearing caps.

Push piston with connecting rods attached out the top of the cylinder block.

Replace bearing caps on their respective conn rods.

Remove piston rings from pistons.

If pistons are to be removed from connecting rods, remove wrist pin lock wires and press wrist pins from pistons and connecting rods.

Remove cap screws securing end cover at drive end of crankshaft.

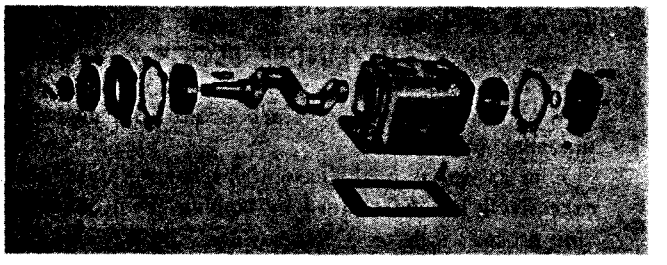


FIGURE 16 –
CRANKCASE – TU-FLO 400 & 500

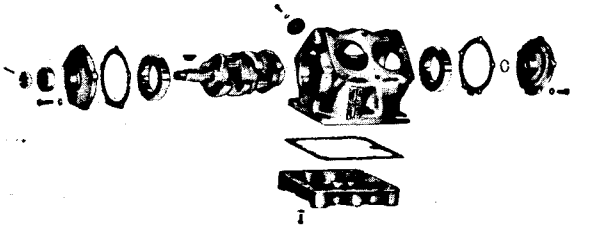


FIGURE 16 A
CRANKCASE – TU-FLO 1000

CRANKCASE (Figs. 16 and 16A)

Remove end cover with oil seal, remove end cover gasket. Replace oil seal after cleaning end cover.

Remove cap screws that hold opposite end cover to crankcase; remove end cover and its gasket. Some compressors have crankcases that have a shoulder for positioning the crankshaft. In these cases the crankshaft must be removed through one particular end.

Press the crankshaft and ball bearings from the crankcase then press ball bearings from crankshaft.

BLOCK (Fig. 15)

If compressor is fitted with an air strainer, inlet elbow or governor, remove same.

Remove cap screws securing cylinder block to crankcase; separate crankcase and cylinder block and scrape off gasket.

Remove unloader spring, spring saddle and spring seat from cylinder block.

Remove unloader guides and plungers and with the use of shop air blow unloader pistons out of cylinder block unloader piston bores.

Remove inlet valve guides; inlet valve seats can be removed but only if they are worn or damaged and are being replaced. Unloader bore bushings should be inspected but not removed unless they are damaged.

CLEANING AND INSPECTION OF PARTS

CLEANING

All parts should be cleaned thoroughly in a good cleaning solvent before inspection.

CYLINDER HEAD ASSEMBLY

Remove all carbon deposits from discharge cavities and all rust and scale from cooling cavities of cylinder head body. Scrape all foreign matter from body surfaces and use air pressure to blow dirt particles from all cavities.

Discharge valves can be dressed by lapping them on a piece of fine crocus cloth on a flat surface, provided they are not excessively worn.

CYLINDER BLOCK

Clean carbon and dirt from inlet and unloader passages. Use air pressure to blow carbon and dirt deposits from unloader passages.

Inlet valves, as in the case of discharge valves, not worn excessively can be cleaned by lapping them on a piece of fine crocus cloth on a flat surface.

OIL PASSAGE

Clean thoroughly all oil passages through crankshaft, connecting rods, crankcase, end covers and base plate. If necessary inspect passages with a wire and blow foreign matter out with air pressure.

AIR STRAINER

Thoroughly clean strainer element, then saturate it in clean oil and squeeze out excess oil before replacing it in air strainer.

CRANKCASE - SELF-LUBRICATED TYPE

The breather should be thoroughly washed and cleaned.

The oil pump check valve in the base should be removed and replaced. It is important when the oil pump check valve is replaced that it be installed correctly with the ball stop pin end pressed in first. When installed the ball and its seat should be visible from the crankcase base.

INSPECTION OF PARTS

CYLINDER HEAD BODY

Inspect cylinder head body for cracks or damage.

WATER-COOLED TYPE

Use air pressure to test water jackets of cylinder head and block for leakage. Replace unit if leakage is found.

DISCHARGE VALVES AND SEATS

If discharge valves are worn and grooved where they contact the seats, they should be replaced. If the discharge valve seats are worn excessively so that there is no longer enough metal left to reclaim them by lapping, the seats should be replaced.

DISCHARGE VALVE SPRING AND CAP NUTS

Replace all used discharge valve springs and cap nuts.

CRANKCASE AND END COVERS

Check for cracks or broken lugs in crankcase and end covers. Also check their oil passages to make sure they are open and clean.

If an oil seal ring is used in the end cover, check fit of ring in ring groove. There should be 0.008" to 0.015" clearance at the gap when placed in the end bore of the crankshaft. If the oil ring is worn thin or is damaged, it should be replaced. Inspect oil ring groove in end cover; if groove is worn excessively replace end cover or machine groove for next oversize oil seal ring.

CRANKCASE BEARING BORES

With cylinder block installed on crankcase, check fit of ball bearings in bearing bores. They must be a tight press fit. The crankcase should be replaced if bores are worn or damaged.

CYLINDER BLOCK

Check for cracks or broken lugs on cylinder block. Also check unloader bore bushings to be sure they are not worn, rusted or damaged. If these bushings are to be replaced they can be removed by running a ⅛" pipe thread tap inside the bushing, then inserting a ⅛" pipe threaded rod and pulling the bushing straight up and out. Do not use an easy-out for removing these bushings.

INLET VALVES AND SEATS

If inlet valves are grooved or worn where they contact the seat, they should be replaced. If the inlet valve seats are worn or damaged so they cannot be reclaimed by facing, they should be replaced.

CYLINDER BORES

Cylinder bores which are scored or out of round by more than 0.002" or tapered more than 0.003" should be rebored or honed oversize. Oversize pistons are available in 0.010, 0.020, and 0.030 oversizes.

Cylinder bores must be smooth, straight, and round.

Clearance between cast iron pistons and cylinder bores should be between 0.002" minimum and 0.004" maximum (Fig. 17). Aluminum pistons are cam ground.

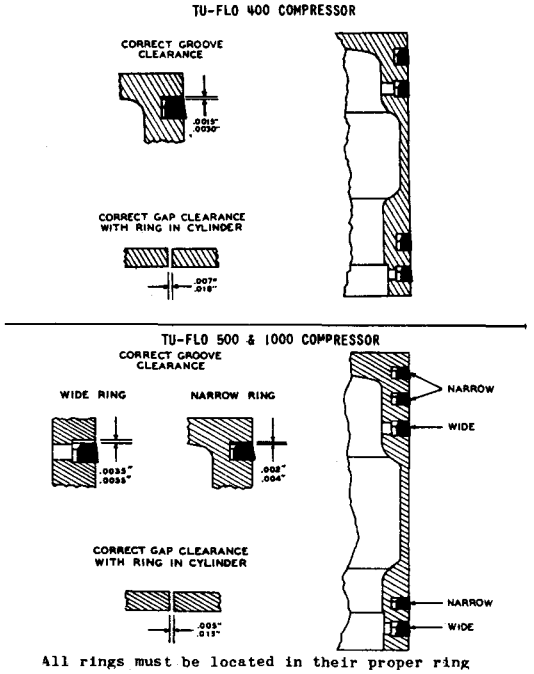
FIGURE 17 –
MEASURING CYLINDER BORES

PISTONS

Check pistons for scores, cracks or enlarged ring grooves; replace pistons if any of these conditions are found. Measure each piston with a micrometer in relation to the cylinder bore diameter to be sure the clearance is between 0.002" minimum and 0.004" maximum.

WRIST PINS

Check fit of wrist pins on pistons and connecting rod bushings. Wrist pin should be a light press fit in pistons. If wrist pin is loose fit, the pin, piston, or both should be replaced. Check fit of wrist pin in connecting rod bushing by rocking the piston. This clearance should not exceed 0.0015". Replace wrist pin bushings if excessive clearance is found. Wrist pin bushings should be reamed after being pressed into connecting rods. Replace used wrist pin lock wires.



All rings must be located in their proper ring grooves as shown. The rings can be identified by the width and should be installed with the bevel or the pip mark (if any) toward the top of the piston. This applies to Cast Iron Pistons (only as shown above).

Die Cast Pistons use five (5) narrow rings.

FIGURE 18 –
PISTON RING POSITIONS –
GAPS AND GROOVE CLEARANCE

PISTON RINGS

Check fit of piston rings in piston ring grooves. Check ring gap with rings installed in cylinder bores. Refer to Fig. 18 for correct gap and groove clearance.

CRANKSHAFT

Check crankshaft screw threads, keyways, tapered ends and all machined and ground surfaces for wear, scores, or damage. Crankshaft journals which are out of round more than 0.001" must be reground. Bearing inserts are available in 0.010", 0.020", and 0.030" undersizes for reground crankshafts. Main bearing journals must be maintained so bearings are snug fit. The oil seal ring groove or grooves in crankshafts fitted with oil seal rings must not be worn. The ring groove walls must have a good finish and they must be square. Check to be sure the oil passages are open and clean through the crankshaft.

CONNECTING ROD BEARINGS

Check connecting rod bearings on crankshaft journals for proper fit. Used bearing inserts should be replaced. Connecting rod caps are not interchangeable. The locking slots of the connecting rod and cap should be positioned adjacent to each other.

Clearance between the connecting rod journal and the connecting rod bearing must not be less than 0.0003" or more than 0.0021" after rebuilding.

MAIN BEARINGS

Check for wear or flat spots; if found, bearings should be replaced. If type with sleeve bearing, this bearing should be checked for scores and wear and replaced if necssary.

UNLOADER MECHANISM

Used unloader mechanism should be replaced by unloader kits 265014 for Type Tu Flo 400 compressors and 265015 for Types Tu Flo 500 and 1000 compressors. The Tu Flo 1000 compressor requires two kits per compressor.

The new unloader pistons should be a loose sliding fit in the unloader piston bores of the cylinder block.

PARTS SPECIAL TO SELF-LUBRICATED TYPE COMPRESSORS

OIL PUMP SCREEN

Check oil pump screen to be sure it is clean and not damaged; replace if damaged.

OIL PUMP PISTON AND BUSHING

Check fit of oil pump piston in base plate pump bushing. It must be a medium sliding fit. If excessive clearance is found the oil rod and/or bushing must be replaced.

OIL PUMP RELIEF VALVE

If the oil pump relief valve is defective, it should be replaced.

OIL PUMP CHECK VALVE

The check valve should be replaced. It can be checked by applying air pressure back through the pin stop end and noting that ball check seals on its seat.

REPAIRS

DISCHARGE VALVES AND SEATS

If discharge valve seats merely show signs of slight wear, they can be dressed by using a lapping stone, grinding compound and grinding tool. Install new discharge valves, valve springs, and cap nuts. The discharge valve travel should be between .036" - .058" for the Type Tu Flo 400, and .056" - .070" for the Tu Flo 500 and 1000.

To test for leakage by the discharge valves apply about 100 pounds of air pressure through the cylinder head discharge port and apply soap suds at the discharge valves and seats. Leakage in the forming of soap bubbles is permissible.

If excessive leakage is found, leave the air pressure applied, and with the use of a fibre or hardwood dowel and hammer, tap the discharge valves off their seats several times. This will help the valves to seat and should reduce any leakage.

With the air pressure still applied at the discharge port of the cylinder head, check for leakage at the discharge valve cap nuts. No leakage is permissible.

INLET VALVES AND SEATS

If inlet valve seats show sign of slight nicks or scratches, they can be redressed with a fine piece of emery cloth or by lapping with a lapping stone, grinding compound and grinding tool. If the seats are excessively damaged to the extent that they cannot be reclaimed, they should be replaced. The dimension from the top of the cylinder block to the inlet valve seat should not exceed 0.145" nor be less than 0.101".

Slightly worn or scratched inlet valves can be reclaimed by lapping them on a piece of fine crocus cloth on a flat surface, but it is suggested that new inlet valves be installed.

ASSEMBLY

INSTALLING CYLINDER BLOCK

Position cylinder block gasket and block on crankcase according to markings made prior to disassembly. Using cap screws with lockwashers, secure cylinder block to crankcase.

INSTALLING CRANKSHAFT

If the crankshaft is fitted with oil seal rings, install rings. Position ball bearings and crankshaft in crankcase making sure the drive end of the crankshaft is positioned as marked before disassembly.

If one end of the crankcase is counterbored for holding a bearing, be sure the crankshaft is installed through the correct end of the crankcase.

Carefully press crankshaft and bearings into crankcase using arbor press.

Position a new rear end cover gasket over the rear end of the crankcase making sure the oil hole in the gasket lines up with the oil hole in the crankcase. Position end cover with oil seal ring, if used, installed over crankcase and end cover gasket. The end cover should be positioned correctly in relation to the oil holes in the gasket and crankcase. Secure end cover to crankcase with cap screws and lock washers.

If the opposite end cover requires an oil seal which was removed on disassembly, a new seal should be pressed into end cover. Position new end cover gasket and carefully install end cover over crankshaft and to crankcase avoiding damage to the seal. Secure end cover with cap screw and lock washers.

PISTONS AND CONNECTING RODS

If new wrist pin bushings are to be used, they should be pressed into the connecting rods so that the oil hole in the bushing lines up with the one in the rod. The new bushings should then be reamed or honed to provide between 0.0001" and 0.0006" clearance on the wrist pin. Position connecting rod in piston and press in wrist pin so that lockwire hole in the pin aligns with that of the piston. Install new lockwire through piston and wrist pin and lock same by snapping short end into lockwire hole at the bottom of the piston (Fig. 7).

Install piston rings in correct location with ring pipmarks up (Fig. 18). Stagger the position of the ring gaps.

Prelubricate piston, piston rings, wrist pin and connecting rod bearings with clean engine oil before installing them in the compressor.

Remove connecting bolts and bearing cap from one connecting rod. Turn crankshaft so one of its connecting rod journals is in the downward, center position. Insert the connecting rod with piston through the top of the cylinder whose journal is down. Position and attach the bearing cap to the connecting rod making sure the bolt lock washers are properly positioned on the cap. Tighten connecting rod bolts evenly and bend the two new lock washer prongs up against the hex head of the bolt. Install the other connecting rod and piston in the same manner.

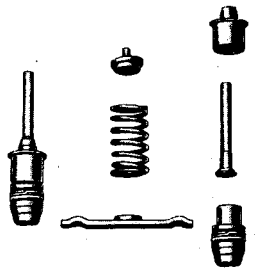


FIGURE 19 –
UNLOADER MECHANISM

UNLOADER MECHANISM (Fig. 19)

The unloader pistons and their bores must be lubricated with special lubricant piece number 239379 (dimethyl polysiloxane) prior to installation. If new unloader kits are being installed, the pistons in the kit are already lubricated.

Install the unloader pistons in their bores with caution against cutting the grommets or distorting the back-up rings. Position unloader plungers in their guides and slip them in and over the tops of the pistons.

Install the unloader spring seat in the cylinder block; a small hole is drilled in the block for this purpose. Position the saddle between unloader piston guides so its forks are centered on the guides. Install the unloader spring making sure it seats over the spring seats both in the block and on the saddle.

Install inlet valve seats if they have been previously removed. Position and install inlet valve guides, then drop inlet valves in their guides. There should be a loose sliding fit between guides and valves.

CYLINDER HEAD ASSEMBLY

If previously removed the discharge valve seats should be installed. Drop discharge valves into their seats. Install discharge valve springs and cap nuts.

Stick the inlet valve springs in the cylinder head. Use a small quantity of grease to hold them in place, just enough grease to keep the springs from falling out. Place cylinder head gasket on cylinder block. Carefully align cylinder head assembly on block and install cap screws with lock washers. Tighten securely and evenly cap screw that holds cylinder head to block.

BASE PLATE-
SELF-LUBRICATED TYPE COMPRESSORS

Install oil pump piston and rod on crankshaft.

Oil rod bearing fit must be the same as specified for connecting rod bearings. Install oil rod cap nuts and cotter pins to lock oil rod nuts.

Install oil pump relief valve in base plate. The relief valve can be tested at this stage by applying air pressure to the relief valve. The valve should open when the pressure is between 14 psi minimum and 24 psi maximum. When the relief valve is properly installed in the base plate, install set screw that locks it in place.

Place oil pump screen in base and install retaining ring making sure it snaps in place and secures the screw.

Install oil filter fitting on base plate in its proper place. Install blanking cover on opposite oil filter fitting hole in plate.

Install a new oil seal gasket around oil pump-check valve and position a new base plate gasket on the crankcase. Position base plate assembly on crankcase, making sure oil pump piston engages the oil pump bushing in the base plate. Install and tighten base plate screws.

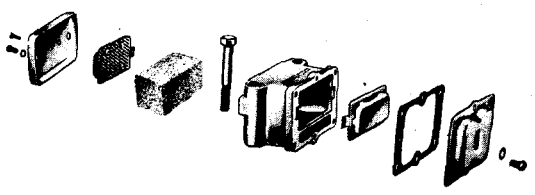


FIGURE 20 –
AIR STRAINER EXPLODED VIEW

AIR STRAINER

If the compressor is type with air strainer, assemble strainer (Fig. 20). Install a new strainer gasket, then strainer on cylinder block.

GOVERNOR

If compressor is type with pad mounted governor, install a new or factory rebuilt governor using a new governor gasket.

INSPECTION OF REBUILT UNIT

Check to be sure that covers, plugs or masking tape are used to protect all ports if compressor is not to be installed immediately.

Fit the end of all crankshafts with keys, nuts and cotter pins as required and then protect the ends against damage by wrapping with masking or friction tape.

The open bottom of engine lubricated compressors should be protected against the entrance of dirt during handling or storage, by installing a temporary cover over base.

TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test rack for correct mounting, cooling, lubricating and driving the compressor is necessary. Such tests are not compulsory if the unit has been carefully rebuilt by an experienced person.

A compressor efficiency or build-up test can be run which is not too difficult. Before the test the crankcase of a self-lubricated type compressor should be properly filled with lubricating oil. An engine lubricated compressor must be connected to an oil supply line of at least 15 pounds pressure during the test and an oil return line must be installed to keep the crankcase drained. The compressor (when tested) should be tested without a strainer.

To the discharge port of the compressor connect a reservoir or reservoirs whose volume plus the volume of the connecting line equals 1300 cubic inches. Run the compressor between 1700 and 1750 RPM. Elapsed time that the compressor takes to build up from 0 to 100 psi depends on the type compressor as follows:

Type Compressor	Build-Up Time 0 to 100 PSI
Tu. Flo 400	47 Seconds Maximum
Tu Flo 500	30 Seconds Maximum
Tu Flo 1000	15 Seconds Maximum

During the above test the compressor should be checked for oil leakage and noisy operation.

TROUBLE SHOOTING

COMPRESSOR FAILS TO MAINTAIN SUFFICIENT PRESSURE IN THE AIR SYSTEM AND PROBABLE CAUSES

Dirty intake strainer.
Restriction in compressor cylinder head intake or discharge cavities or in discharge line.
Leaking or broken discharge valves.
Excessive wear.
Drive belt slipping.
Inlet valves stuck open.
Worn inlet valves.
Excessive system leakage or usage.

NOISY OPERATION

Loose drive pulley.
Restrictions in cylinder head or discharge line.
Worn or burned out bearings.
Worn drive coupling.
Compressor not getting proper lubrication.
Excessive wear.

COMPRESSOR PASSES EXCESSIVE OIL

Excessive wear.
Dirty air strainer. (Improper air strainer maintenance.)
High inlet vacuum.
Small oil return line.
Excessive oil pressure.
Oil supply or return lines to compressor flooded.
Defective or worn oil seal rings in end cover.
Piston rings not properly installed.
Back pressure from engine crankcase.

COMPRESSOR NOT UNLOADING

Defective unloader pistons or bores.
Intake cavity restrictions.
Defective governor.
Unloader line or cavity to governor restricted.
Unloader mechanism binding or stuck.

TABULATED DATA

	Tu Flo 400	Tu Flo 500	Tu Flo 1000
Number Cylinders	2	2	4
Bore Size	2-1/16"	2½"	2½"
Stroke	1½"	1-11/16"	1-11/16"
Piston Displacement at 1250 RPM	7¼ cu. ft.	12 cu. ft.	24 cu. ft.
Piston Displacement Per Revolution at 1250 RPM	10 cu. in.	16.5 cu. in.	33 cu. in.
Maximum Recommended Speed (RPM)	3000	3000	3000
Minimum Cooling Water Flow for Water-Cooled Compressors at Maximum Speed	2.5 gal./min.	2.5 gal./min.	2.5 gal./min.
Minimum Cooling Air Flow for Air-Cooled Compressors at Maximum Speed	250 cfm	500 cfm	1500 cfm
Horsepower Required at 1250 RPM Against 100 PSI	1.2	2.3	3.2
Minimum Oil Pressure Required at Engine Idling Speed	5 PSI	5 PSI	5 PSI
Minimum Oil Pressure Required at Maximum Engine Governed Speed	15 PSI	15 PSI	15 PSI
Oil Capacity (Self-Lubricated Type)	.53 qt. (500 cc)	.53 qt. (500 cc)	.95 qt. (900 cc)

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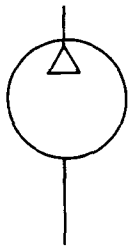
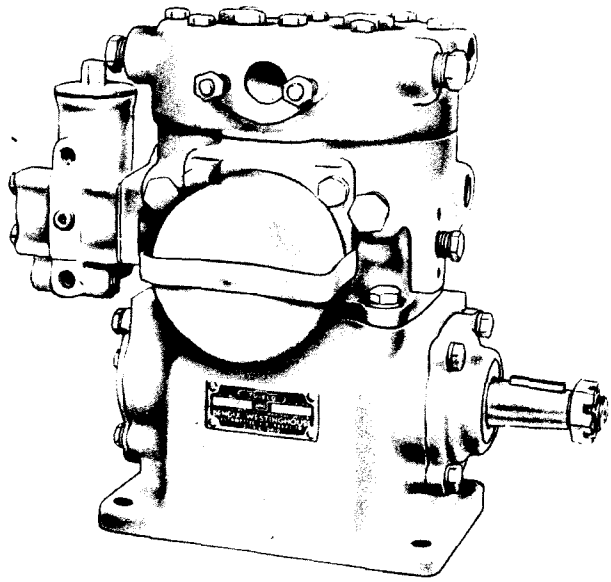
TECHNICAL DATA

I Symbol



Revised February, 1969

TU-FLO 400 COMPRESSOR



II Description: The Tu-Flo 400 Compressor is a single acting, single stage, reciprocating air compressor. The two cylinder, in line machine may be water cooled or air cooled; self or engine lubricated; belt or coupling driven, bracket or flange mounted, vehicular or stationary application; governed compression, atmospheric or supercharged inlet.

III Design Features: Minimum clearance gives high volumetric efficiency. Head and block cooling gives low discharge temperatures. Hardened automatic poppet inlet and exhaust valves give long life. Stress relieved blocks give low distortion and long ring life. These compressors are also convertible to vacuum pumps. Precision sleeve or ball main bearings. Proven unloader design: silicone rubber seals and lubricant.

This device is to be maintained and serviced periodically as shown and outlined in B-W Instruction and Service Data. For additional details, please contact one of our Regional Sales Offices.

Printed in U.S.A. March, 1969

TECHNICAL DATA

Revised February, 1969

DIMENSIONAL SPECIFICATIONS

TU-FLO 400 AIR COMPRESSOR

1.	Inlet Valve Lift	.060 - .086
2.	Inlet Valve Seat - Worn Groove not to Exceed	.005
3.	Discharge Valve Seat - Worn Groove not to Exceed	.002
4.	Discharge Valve Lift (New)	.042 - .056
5.	Piston	
	Number of Grooves	4.
	Width of Ring Grooves	.1255 - .1260
	Diameter at Top of Piston	2.0610 - 2.0615
	Diameter at Ring Groove	1.844 - 1.854
	Diameter at Ring Land	2.0610 - 2.0615
6.	Piston to Head Clearance	.004 - .032
7.	Piston Ring Gap (In Cylinder)	.005 - .015
8.	Piston Ring Clearance (In Groove)	.0015 - .0030
9.	Clearance Between Piston and Cylinder Wall	.0015 - .0030
10.	Cylinder Bore	
	Maximum Out-of-Round Wear Limit	.002
	Maximum Taper Wear Limit	.0015
11.	Crankshaft Journal Maximum Out-of-Round	.0003
12.	Main Sleeve Bearing Clearance (New)	.0017 - .0041
13.	Clearance Between Connecting Rod Bushing and Piston Pin (Ream)	.0002 - .0007
14.	Discharge Valve Travel (with New Valves, Springs, and Cap Nuts)	.042 - .056
15.	Clearance Between Connecting Rod Bearings and Crankshaft Journal (New)	.0003 - .0021
16.	Inlet Valve Spring	
	Free Height	.45
	Height under Load of	.38" @ 2.7 oz to 3.3 oz
	Solid Height	.20
	Number of Active Coils	6.
17.	Discharge Valve Spring	
	Free Height	1.11
	Height under Load of	1.072" @ .25# to .75#
	Solid Height	.81
	Number of Active Coils	13.
18.	Unloader Valve Spring	
	Free Height	.75
	Height under Load of	.70" @ 1# 4 oz to 1# 8 oz
	Unloader Piston to Inlet Clearance - Max	.058
	Solid Height	.31
	Number of Active Coils	5.
19.	Wrist Pin	
	Length	1.859 - 1.875
	I.D.	.297 - .328
	O.D.	.5000 - .5002
20.	Wrist Pin Bushing I.D.	.5004 - .5007
21.	Wrist Pin to Piston Clearance	.0000 - .0002 Loose
22.	Crankshaft End Play with Precision Bearings Both Ends (Flange Type)	.007 - .022
	With Ball Bearings Both Ends Brkt. Mtg.	.014 - .054
	With Ball Front End and Precision Brg.Brkt.Mtg.	.007 - .040
23.	Thrust Washer Thickness at Replacement (Each)	.054
24.	Maximum Precision Bearing Clearance at Replacement Nominal Diameter - 1 3/8"	.0045

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TECHNICAL DATA

Revised February, 1969

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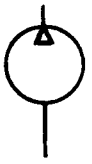
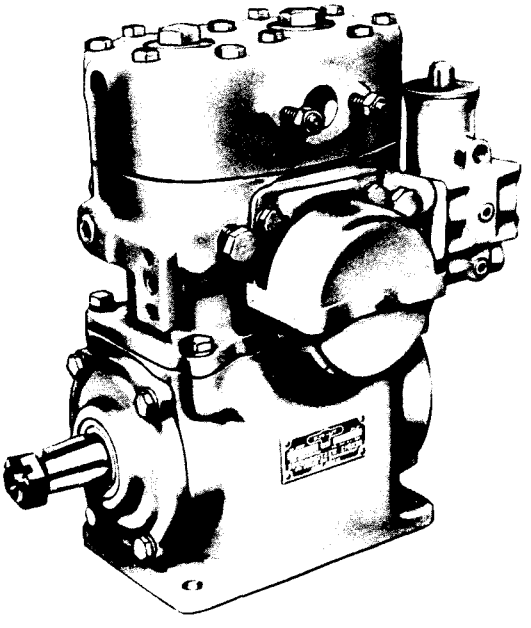


TU-FLO 500 COMPRESSOR



II Description: The Tu-Flo 500 Compressor is a single acting, single stage, reciprocating air compressor. The two cylinder, in-line machine may be water cooled or air cooled; self or engine lubricated; belt or coupling driven, bracket or flange mounted; vehicular or stationary application; governed compression; atmospheric or supercharged inlet.

III Design Features: Minimum clearance gives high volumetric efficiency. Head and block cooling gives low discharge temperatures. Hardened automatic poppet inlet and exhaust valves give long life. Stress relieved blocks give low distortion and long ring life. These compressors are also convertible to vacuum pumps. Precision sleeve or ball main bearings. Proven unloader design: silicone rubber seals and lubricant.

This device is to be maintained and serviced periodically as shown and outlined in B-W Instruction and Service Data. For additional details, please contact one of our Regional Sales Offices.

Printed in U.S.A. March, 1969

TECHNICAL DATA

Revised February, 1969

DIMENSIONAL SPECIFICATIONS TU-FLO 500 AIR COMPRESSOR

1.	Inlet Valve Lift	.060 - .086
2.	Inlet Valve Seat - Worn Groove not to Exceed	.005
3.	Discharge Valve Seat - Worn Groove not to Exceed	.002
4.	Discharge Valve Lift (New)	.030 - .046
5.	Piston	
	Number of Grooves	5.
	Width of Ring Grooves for Wide Ring	.1275 - .1285
	Width of Ring Grooves for Narrow Ring	.0955 - .0965
	Diameter at Top of Piston	2.4980 - 2.4985
	Diameter at Ring Groove	2.220 - 2.230
	Diameter at Ring Land	2.4980 - 2.4985
6.	Piston to Head Clearance	.003 - .031
7.	Piston Ring Gap (In Cylinder)	.005 - .015
8.	Piston Ring Clearance (In Groove)	
	Wide Ring	.0035 - .0055
	Narrow Ring	.002 - .004
9.	Clearance Between Piston and Cylinder Wall	.0020 - .0035
10.	Cylinder Bore	
	Maximum Out-of-Round Wear Limit	.002
	Maximum Taper Wear Limit	.002
11.	Crankshaft Journal Maximum Out-of-Round	.0003
12.	Main Sleeve Bearing Clearance (New)	
	Nominal Diameter - 1 3/8"	.0017 - .0041
	Nominal Diameter - 2 5/32"	.0020 - .0045
13.	Clearance Between Connecting Rod Bushing and Piston Pin (Ream)	.0002 - .0007
14.	Discharge Valve Travel (with New Valves, Springs, and Cap Nuts)	.050 - .066
15.	Clearance Between Connecting Rod Bearing and Crankshaft Journal (New)	.0003 - .0021
16.	Inlet Valve Spring	
	Free Height	.45
	Height under Load of	.38" @ 2.7 oz to 3.3 oz
	Solid Height	.20
	Number of Active Coils	6.
17.	Discharge Valve Spring	
	Free Height	1.11
	Height under Load of	1.072" @ .25# to .75#
	Solid Height	.81
	Number of Active Coils	13.
18.	Unloader Valve Spring	
	Free Height	.75
	Height under Load of	.70" @ 1# 4 oz to 1# 8 oz
	Unloader Piston to Inlet Valve Clearance - Max	.058
	Solid Height	.031
	Number of Active Coils	5.
19.	Wrist Pin	
	Length	2.297 - 2.312
	I.D.	.297 - .328
	O.D.	.5310 - .5312
20.	Wrist Pin Bushing I.D.	.5314 - .5317
21.	Wrist Pin to Piston Clearance	.0000 - .0002 Loose
22.	Crankshaft End Play with Precision Bearings Both Ends (Fl. Type)	.007 - .025
	With ball bearings both ends, Brk.Mtg.	.010 - .047
	With ball front end and Precision Brg.Rear	.007 - .037
23.	Thrust Washer Thickness at Replacement (Each)	.054
24.	Maximum Precision Bearing Clearance at Repl.	
	Nominal Diameter - 1 3/8"	.0095
	Nominal Diameter - 2 5/32"	.0125

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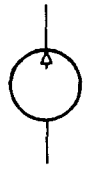
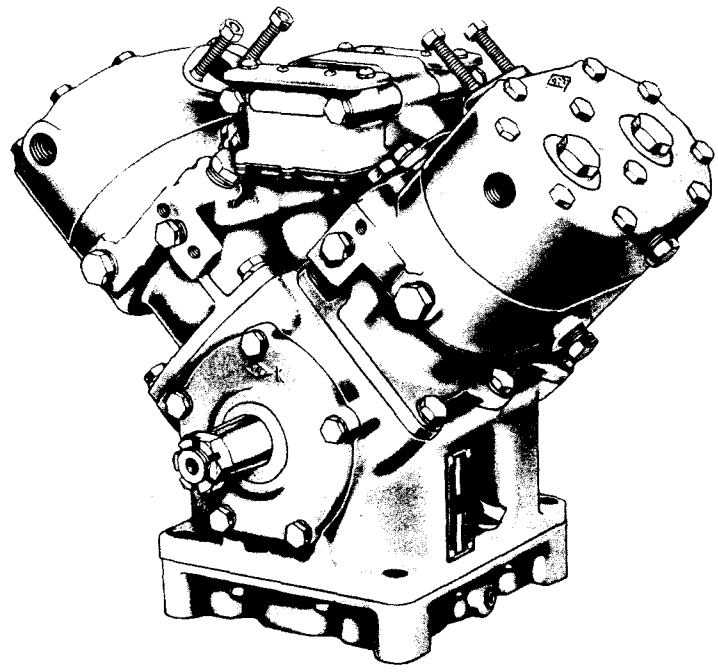
TECHNICAL DATA

I Symbol



Revised February, 1969

TU-FLO 1000 COMPRESSOR



II Description: The Tu-Flo 1000 Compressor is a single acting, single stage, reciprocating air compressor. The four cylinder, vee machine may be water cooled or air cooled; self or engine lubricated; belt or coupling driven, bracket or flange mounted; vehicular or stationary application, governed compression, atmospheric or supercharged inlet.

III Design Features: Minimum clearance gives high volumetric efficiency. Head and block cooling gives low discharge temperatures. Hardened automatic poppet inlet and exhaust valves give long life. Stress relieved blocks give low distortion and long ring life. These compressors are also convertible to vacuum pumps. Proven unloader design: ball main bearings, silicone rubber seals and lubricant. Most parts interchange with Tu Flo 500.

This device is to be maintained and serviced periodically as shown and outlined in B-W Instruction and Service Data. For additional details, please contact one of our Regional Sales Offices.

Printed in U.S.A. March, 1969

TECHNICAL DATA

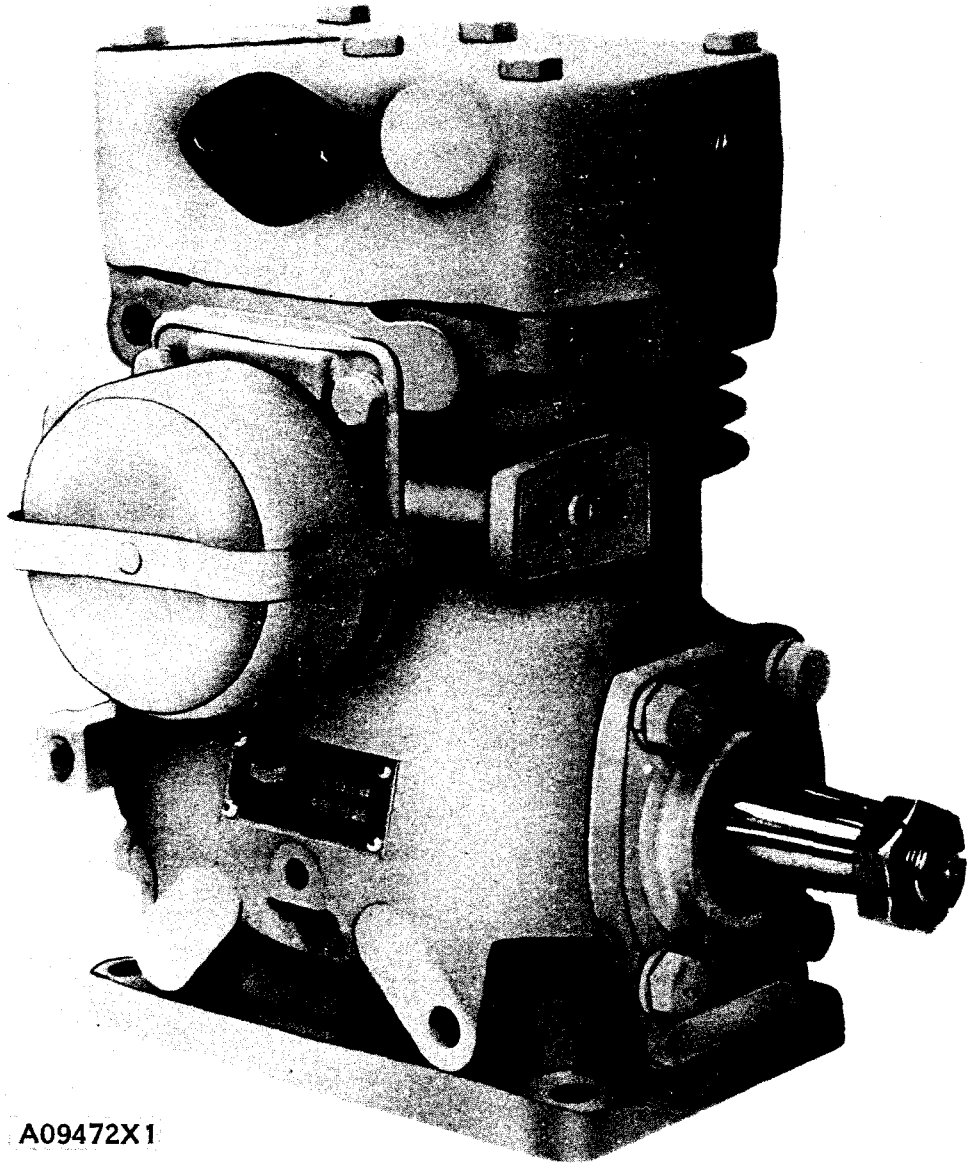
DIMENSIONAL SPECIFICATIONS

Revised February, 1969

TU-FLO 1000 AIR COMPRESSOR

1.	Inlet Valve Lift	.060 - .086
2.	Inlet Valve Seat - Worn Groove not to Exceed	.005
3.	Discharge Valve Seat - Worn Groove not to Exceed	.002
4.	Discharge Valve Lift (New)	.030 - .046
5.	Piston	
	Number of Grooves	5.
	Width of Ring Grooves for Wide Ring	.1275 - .1285
	Width of Ring Grooves for Narrow Ring	.0955 - .0965
	Diameter at Top of Piston	2.4980 - 2.4985
	Diameter at Ring Groove	2.220 - 2.230
	Diameter at Ring Land	2.4980 - 2.4985
6.	Piston to Head Clearance	.003 - .031
7.	Piston Ring Gap (In Cylinder)	.005 - .015
8.	Piston Ring Clearance (In Groove)	
	Wide Ring	.0035 - .0055
	Narrow Ring	.002 - .004
9.	Clearance Between Piston and Cylinder Wall	.0020 - .0035
10.	Cylinder Bore	
	Maximum Out-of-Round Wear Limit	.002
	Maximum Taper Wear Limit	.002
11.	Crankshaft Journal Maximum Out-of-Round	.0003
12.	Clearance Between Connecting Rod Bushing and Piston Pin (Ream)	.0001 - .0006
13.	Discharge Valve Travel (with New Valves, Springs, and Cap Nuts)	.050 - .066
14.	Clearance Between Connecting Rod Bearing and Crankshaft Journal (New)	.0008 - .0028
15.	Inlet Valve Spring	
	Free Height	.45
	Height under Load of	.38" @ 2.7 oz to 3.3 oz
	Solid Height	.20
	Number of Active Coils	6.
16.	Discharge Valve Spring	
	Free Height	1.11
	Height under Load of	1.072" @ .25# to .75#
	Solid Height	.81
	Number of Active Coils	13.
17.	Unloader Valve Spring	
	Free Height	.75
	Height under Load of	.70" @ 1# 4 oz to 1# 8 oz
	Unloader Piston to Inlet Valve Clearance - Max	.058
	Solid Height	.31
	Number of Active Coils	5.
18.	Wrist Pin	
	Length	2.297 - 2.312
	I.D.	.297 - .328
	O.D.	.5310 - .5312
19.	Wrist Pin Bushing	
	I.D. Finished	.5313 - .5316
	O.D.	.6570 - .6575
	Width	.840 - .850
20.	Wrist Pin to Piston Clearance	.0000 - .0002 Loose

TU-FLO 501 AIR COMPRESSOR



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DESCRIPTION AND OPERATION

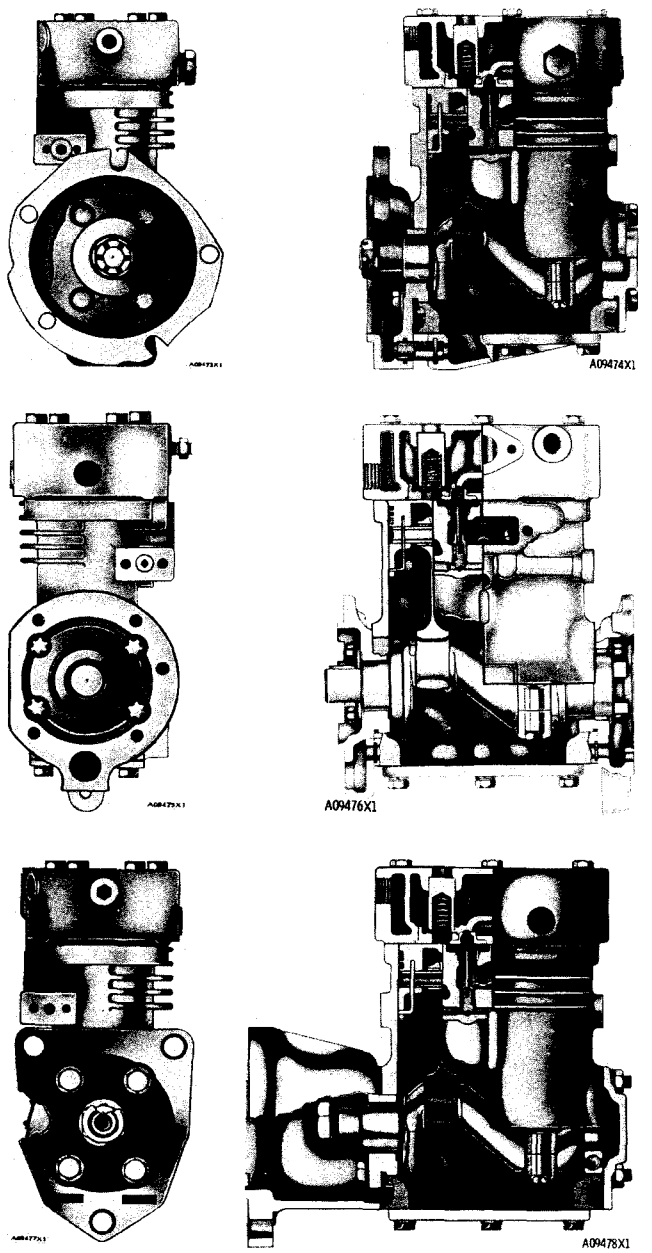
Introduction

The function of the air compressor is to provide and maintain air under pressure to operate devices in the air brake and/or auxiliary air systems.

Description

The Tu-Flo 501 is a two cylinder, single stage, reciprocating compressor with a rated displacement of 12 cubic feet (340 litres) of air per minute at 1250 rpm.

The Tu-Flo 501 is constructed from two major assemblies: the head and the crankcase. The head houses the discharge valving and is installed on the upper portion of the crankcase. The crankcase is a one piece casting combining the cylinder block and the crankcase. The upper portion of the casting houses the cylinder bores and inlet valving; the lower portion houses the crankshaft and main bearings. Various mounting and drive configurations, required by the numerous vehicle engine designs, are obtained by bolting different mounting flanges, end covers, and base adapters to the crankcase. Two horizontal governor mounting pads are located on either side of the upper portion of the crankcase to provide convenient governor mounting.

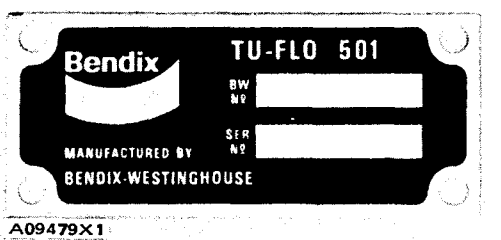


VARIOUS COMPRESSOR MOUNTINGS

Two methods are employed for cooling the Tu-Flo 501 during operation. The cylinder head is connected to the engine's cooling system, while the cylinder bore portion of the crankcase has external fins for efficient air cooling.

All Tu-Flo 501 Compressors utilize the engine's pressurized oil system to lubricate the internal moving parts.

A nameplate is attached to the crankcase to identify the compressor. The nameplate displays a Bendix piece number or in some cases a manufacturer's piece number, along with a serial number.



COMPRESSOR NAMEPLATE

OPERATION

Introduction

The compressor is driven by the vehicle engine and is operating continuously while the engine is running. Actual compression of air is controlled by the compressor unloading mechanism and the governor. The governor is generally mounted on the compressor and maintains the brake system air pressure to a preset maximum and minimum pressure level.

Intake and Compression of Air (Loaded)

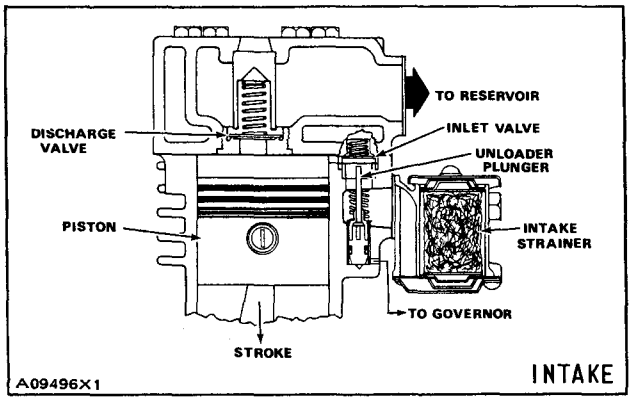


FIGURE 1

During the down stroke of the piston, a slight vacuum is created between the top of the piston and the head, causing the flat circular inlet valve to move up and off its seat. (Note the flat square discharge valve remains on its seat.) Atmospheric air is drawn through the air strainer by the open inlet valve and into the cylinder. (See Fig. 1) As the piston begins its upward stroke, the air that was drawn into the cylinder on the down stroke is being compressed. Air pressure on top of the inlet valve, plus the force of its spring, returns the inlet valve to its seat. The piston continues the upward stroke and compressed air then flows by the open discharge valve, into the discharge line and on to the reservoirs. (See Fig. 2) As the piston reaches the top of its stroke and starts down, the discharge valve spring and air pressure in the discharge line returns the discharge valve to its seat. This prevents the compressed air in the discharge line from returning to the cylinder bore as the intake and compression cycle is repeated.

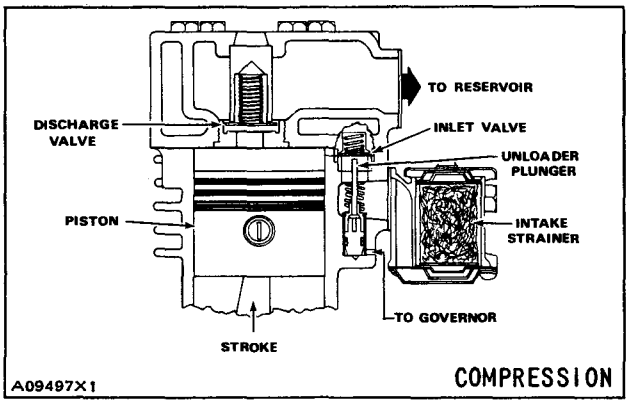


FIGURE 2

Non-Compression of Air (Unloaded)

When air pressure in the reservoir reaches the cutout setting of the governor, the governor allows air to pass from the reservoir into the cavity beneath the unloader pistons. This lifts the unloader pistons and plungers. The plungers move up and hold the inlet valves off their seats. (See Fig. 3)

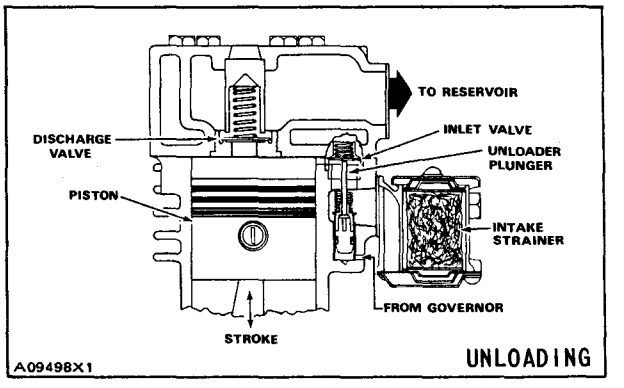


FIGURE 3

With the inlet valves held off their seats by the unloader pistons and plungers, air is pumped back and forth between the two cylinders. When air is used from the reservoir and the pressure drops to the cut-in setting of the governor, the governor closes and exhausts the air from beneath the unloader pistons. The unloader saddle spring forces the saddle, pistons and plungers down and the inlet valves return to their seats. Compression is then resumed.

Lubrication

Since all Tu-Flo 501 Compressors are connected to the engine's pressurized oil system, a continuous flow of oil is provided to the compressor, which is eventually returned to the engine.

Oil is fed into the compressor in various ways, for example: through the rear end cover, the drive end of the crankshaft or through the front flange adapter. An oil passage in the crankshaft conducts pressurized oil to the precision sleeve main bearings and to the connecting rod bearings. Splash lubrication of the cylinder bores, connecting rod wrist pin bushings, and the ball type main bearings, on some models, is obtained as oil is forced out around the crankshaft journals by engine oil pressure.

Cooling

Air flowing through the engine compartment from the action of the engine's fan and the movement of the vehicle assists in cooling the crankcase. Coolant flowing from the engine's cooling system through connecting lines enters the head and passes through the head's water jacket and back to the engine. Proper cooling is important in maintaining discharge air temperatures below the maximum 400° F (204° C) recommended.

PREVENTIVE MAINTENANCE

Every month, 300 operating hours or after each 10,000 miles (16 000 km), depending on the operating conditions, experience and the type of strainer used, service the air strainer.

Polyurethane Sponge Strainer

Remove and wash all of the parts. The strainer element should be cleaned or replaced. If the element is cleaned, it should be washed in a commercial solvent or a detergent and water solution. The element should be saturated in clean engine oil then squeezed dry before replacing it in the strainer. Be sure to replace the air strainer gasket if the entire air strainer is removed from the compressor intake.

Dry Element – Pleated Paper Air Strainer

Remove the spring clips from either side of mounting baffle and remove the cover. Replace the pleated paper filter and remount the cleaned cover making sure the filter is in position. Be sure to replace the air strainer gasket if the entire air strainer is removed from the compressor intake.

NOTE: Some compressors are fitted with compressor intake adapters, which allow the compressor intake to be connected to the engine air cleaner. In this case, the compressor receives a supply of clean air from the engine air cleaner.

When the engine air filter is changed, the compressor intake adapter should be checked. If it is loose, remove the intake adapter, clean the strainer plate, if applicable, and replace the intake adapter gasket, and reinstall the adapter securely. Check line connections both at the compressor intake adapter and at the engine air cleaner. Inspect the connecting line for ruptures and replace it if necessary.

Every 6 Months, 1800 Operating Hours or After Each 50,000 Miles (80 000 km)

Remove the discharge head fittings and inspect the compressor discharge port and discharge line for excessive carbon deposits. If excessive buildup is noted in either, the discharge line must be cleaned or replaced and the compressor checked more thoroughly, paying special attention to the air induction system, oil supply and return system, and proper cooling. If necessary, repair or replace the compressor. Check for proper belt and pulley alignment and belt tension. Adjust if necessary, paying special attention not to overtighten the belt tension. Check for noisy compressor operation, which could indicate a worn drive gear coupling or a loose pulley. Adjust and/or replace as necessary. Check all compressor mounting bolts and retighten evenly if necessary. Check for leakage and proper unloader mechanism operation. Replace if defective in any way.

Every 24 Months, 7200 Operating Hours or After Each 200,000 Miles (320 000 km)

Perform a thorough inspection as indicated below and, depending upon the results of this inspection or experience, disassemble the compressor, clean and inspect all parts thoroughly, repair or replace all worn or damaged parts using only genuine Bendix replacements or replace the compressor with a genuine Bendix remanufactured unit.

CAUTION: Should it be necessary to drain the engine cooling system to prevent damage from freezing, the cylinder head of the compressor must also be drained.

GENERAL SERVICE CHECKS

Inspection

It is of the utmost importance that the compressor receives a clean supply of air. The air strainer must be properly installed and kept clean. If the compressor intake is connected to the engine air cleaner, turbocharger etc., these connections must be properly installed and maintained. Check the compressor mountings to be sure they are secure. Check the drive for proper alignment, belt tension, etc.

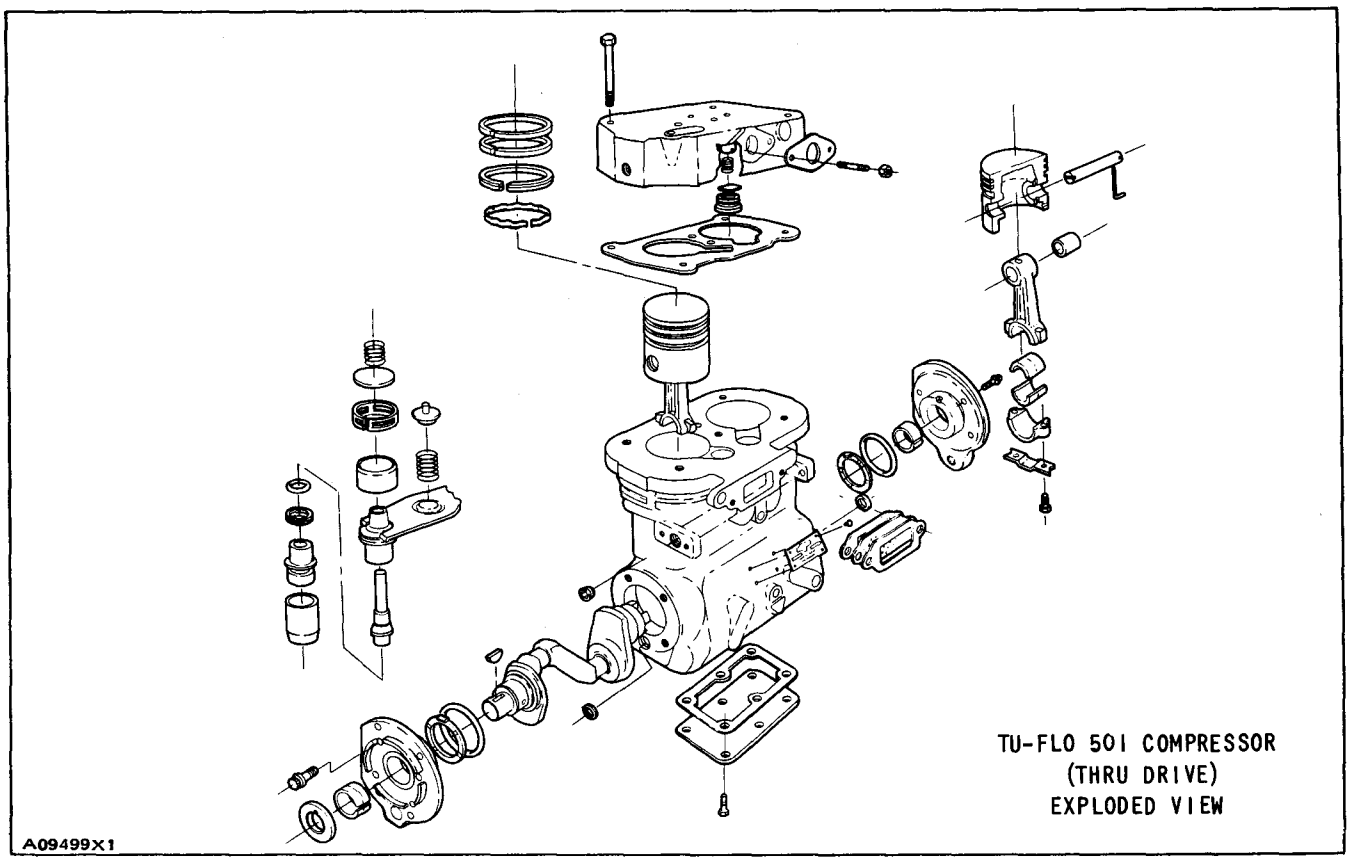
Inspect the oil supply and return lines. Be sure these lines are properly installed and that the compressor is getting the proper supply of oil, and just as important, that the oil is returning to the engine. Check the coolant lines to and from the compressor and see that the cooling fins on the crankcase are not clogged with dirt, grease, etc. Check the unloader mechanism for proper and prompt operation.

Operating Tests

Vehicles manufactured after the effective date of FMVSS 121, with the minimum required reservoir volume, must have a compressor capable of raising air system pressure from 85 to 100 psi (6.0 to 7.0 kg/cm^2) in 25 seconds or less. This test is performed with the engine operating at maximum governed speed. The vehicle manufacturer must certify this performance on new vehicles with appropriate allowances for air systems with greater than the minimum required reservoir volume.

Air Leakage Tests

Leakage past the discharge valves can be detected by removing the discharge line, applying shop air back through the discharge port and listening for escaping air. Also, the discharge valves and the unloader pistons can be checked for leakage by building up the air system until the governor cuts out, then stopping the engine. With the engine stopped, listen for escaping air at the compressor intake. To pinpoint leakage, if noted, apply a small quantity of oil around the unloader pistons. If there is no noticeable leakage at the unloader pistons, the discharge valves may be leaking. If the compressor does not function as described above, or leakage is excessive, it is recommended that it be returned to the nearest authorized Bendix Distributor for a factory remanufactured compressor. If this is not possible, the compressor can be repaired using genuine Bendix replacement parts, in which case the following information should prove helpful.



TU-FLO 501 COMPRESSOR
(THRU DRIVE)
EXPLODED VIEW

REMOVING AND DISASSEMBLY

Removing

These instructions are general and are intended to be a guide. In some cases additional preparations and precautions are necessary. Block the wheels of the vehicle and drain the air pressure from all the reservoirs in the system. Drain the engine cooling system and the cylinder head of the compressor. Disconnect all air, water and oil lines leading to and from the compressor. Remove the drive gear(s) or pulley from the compressor crankshaft using a gear puller. Inspect the pulley or gear and associated parts for visible wear or damage. Since these parts are precision fitted, they must be replaced if they are worn or damaged.

DISASSEMBLY

Introduction

Remove road dirt and grease from the exterior of the compressor with a cleaning solvent. Before the compressor is disassembled, the following items should be marked to show their relationship when the compressor is assembled. Mark both the front and rear end cover in relation to the crankcase. Mark the drive end of the crankshaft in relation to the front end cover and the crankcase. Mark the cylinder head in relation to the crankcase. Mark the base plate or base adapter in relation to the crankcase.

A convenient method to indicate the above

relationships is to use a metal scribe to mark the parts with numbers or lines. Do not use a marking method that can be wiped off or obliterated during rebuilding, such as chalk. Remove all compressor attachments such as governors, air strainers or inlet fittings, discharge fittings and pipe plugs.

Cylinder Head

Remove the six cylinder head bolts and tap the head with a soft mallet to break the gasket seal. Remove the inlet valve springs from the head and inlet valves from their guides in the crankcase. Remove inlet valve guides from around the inlet valve seats on the crankcase, taking care not to damage seats. Scrape off any gasket material from the cylinder head and crankcase. Unscrew the discharge valve seats from the head and remove the discharge valves and springs. Inspect the discharge valve seats for nicks, cracks, and excessive wear and replace if necessary.

The discharge valve stops should be inspected for wear and replaced if excessive peening has occurred. To determine if excessive peening has occurred, measure the discharge valve travel. Discharge valve travel must not exceed .057 in. (1.45 mm). To remove the discharge valve stops, support the machined surface of the cylinder head on an arbor press bed and gently press the stops from the top of the head and out the bottom. Be sure to allow sufficient clearance for the stops between the press bed and the bottom of the cylinder head. The valve stop bores in the cylinder head must be inspected for excessive scoring. A new head body must be used if scoring is excessive. Discard the inlet valves and springs, the discharge valves and springs and the discharge valve seats, if defective.

Crankcase Base Plate or Adapter

Remove the bolts securing the base plate or base adapter. Tap with soft mallet to break the gasket seal. Scrape off any gasket material from crankcase and plate or adapter.

Connecting Rod Assemblies

NOTE: Before removing the connecting rods, mark each connecting rod and its cap. Each connecting rod is matched to its own cap for proper bearing fit, and these parts must not be interchanged.

Straighten the prongs of the connecting rod bolt lock strap and remove the bolts and bearing caps. Push the piston with the connecting rods attached out the top of the cylinders of the crankcase. Replace the bearing caps on their respective connecting rods. Remove the piston rings from the pistons. If the pistons are to be removed from the connecting rods, remove the wrist pin lock wires and press the wrist pins from the pistons and connecting rods.

If the pistons are removed from the rod, inspect the bronze wrist pin bushing. Press out and replace the bushing if it is excessively worn. (See inspection of Parts) Discard the piston rings and the connecting rod journal bearings. Discard the wrist pin bushings if they were removed.

Crankcase

Remove the key or keys from the crankshaft and any burrs from the crankshaft where the key or keys were removed.

NOTE: Through Drive Compressors may have a crankshaft key at both ends.

Remove the four bolts securing front or drive-end end cover or flange adapter. Remove the end cover, taking care not to damage the crankshaft oil seal or front main bearing, if any. Remove both of the small seal rings from the crankcase, and the O-ring seal from around the front end cover. Remove the four bolts securing the rear end cover and remove the rear end cover taking care not to damage the rear main bearing, if any. Remove both of the small seal rings from the crankcase and the O-ring seal from around the end cover. If the compressor has ball type main bearings, press the crankshaft and ball bearings from the crankcase, then press the ball bearings from the crankshaft. Remove the unloader spring, spring saddle, and spring seat from the inlet cavity of the crankcase, using long nose pliers. Remove the unloader plungers and guides. Cover the inlet cavity with a clean shop rag and apply air pressure to the governor mounting pad unloader port to blow the unloader pistons out of their bores and into the inlet cavity.

CLEANING OF PARTS

All parts should be cleaned in a good commercial grade solvent and dried prior to inspection.

Cylinder Head

Remove all the carbon deposits from the discharge cavities and all the rust and scale from the cooling cavities of the cylinder head body. Scrape all the foreign matter from the body surfaces and use shop air pressure to blow the dirt particles from all the cavities.

Crankcase

Clean the carbon and dirt from the inlet and unloader passages. Use shop air pressure to blow the carbon and dirt deposits from the unloader passages.

Oil Passages

Thoroughly clean all oil passages through the crankshaft, crankcase, end covers, and base plate or base adapter. Inspect the passages with a wire to be sure. Blow the loosened foreign matter out with air pressure.

INSPECTION OF PARTS

Cylinder Head Body

Inspect the cylinder head for cracks or damage. Apply shop air pressure to one of the coolant ports with all others plugged, and check for leakage by applying a soap solution to the exterior of the body. If leakage is detected, replace the head.

End Covers

Check for cracks and external damage. If the crankshaft main bearings are installed in the end cover, check for excessive wear and flat spots and replace them if necessary. If the compressor has an oil seal in the end cover, it should be replaced by pressing it out of the end cover.

Crankcase

Check all crankcase surfaces for cracks and damage. On compressors where ball bearing main bearings are used the difference between the O.D. of the outer race and the I.D. of the crankcase hole should be 0 to .0015 in. (0 to 0.038 mm) loose. This is to maintain the correct press fit. The crankcase must be replaced if the fit is too loose.

On compressors fitted with precision, sleeve main bearings, the difference between the O.D. of the crankshaft journal and the main bearing I.D. must not exceed .0065 in. (0.165 mm). If the clearance is greater than .0065 in. (0.165 mm), the end cover or main bearing must be replaced.

Check the unloader bore bushings to be sure they are not worn, rusted, or damaged. If these bushings are to be replaced, they can be removed by running a 1/8 in. pipe thread tap into the bushing, and inserting a 1/8 in. pipe threaded rod and pulling the bushing straight up and out. Do not use an easy-out for removing these bushings.

If the inlet valve seats are worn or damaged, so they cannot be reclaimed by facing, they should be replaced.

Cylinder bores which are scored or out of round by more than 0.001 in. (0.03 mm) or tapered more than 0.002 in. (0.05 mm) should be rebored or honed oversize. Oversized pistons and piston rings are available in 0.010 in. (0.25 mm), 0.020 in. (0.51 mm) and 0.030 in. (0.76 mm) oversizes. Cylinder bores must be smooth, straight, and round. Clearance between the cast iron pistons and cylinder bores should be between 0.002 in. (0.05 mm) minimum and 0.004 in. (0.10 mm) maximum.

Pistons

Check the pistons for scores, cracks, or enlarged ring grooves; replace the pistons if any of these conditions are found. Measure each piston with a micrometer in relation to the cylinder bore diameter to be sure the diametral clearance is between 0.002 in. (0.05 mm) minimum and 0.004 in. (0.10 mm) maximum.

Check the fit of the wrist pins to the pistons and connecting rod bushings. The wrist pin should be a light press fit in the piston. If the wrist pin is a loose fit, the piston and pin assembly should be replaced. Check the fit of the wrist pin in the connecting rod bushing by rocking the piston. This clearance should not exceed .007 in. (0.018 mm). Replace the wrist pin bushings if excessive clearance is found. Wrist pin bushings should be reamed .5314 to .5317 in. (13.498 to 13.505 mm) after being pressed into the connecting rods. Replace the used wrist pin lock wires.

Check the fit of the piston rings in the piston ring grooves. Check the ring gap with the rings installed in the cylinder bores. Refer to Fig. 4 for correct gap and groove clearances.

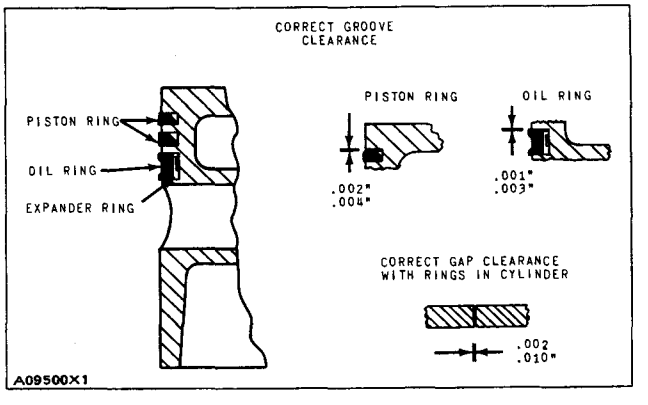


FIGURE 4

Crankshaft

Check the crankshaft threads, keyways, tapered ends and all machined and ground surfaces for wear, scores, or damage. Standard crankshaft journals are 1.1250 to 1.1242 in. (28.575 to 28.555 mm) in diameter. If the crankshaft journals are excessively scored or worn or out of round the crankshaft must be replaced. Connecting rod bearing inserts are available in 0.010, 0.020 and 0.030 in. (0.25, 0.51 and 0.76 mm) undersizes for compressors with reground crankshafts. Main bear-

ing journals must be maintained so the ball bearings are a snug fit or so that no more than .0065 in. (0.165 mm) clearance exists between the precision sleeve main bearing and the main bearing journals on the crankshaft. In crankshafts fitted with oil seal rings, the oil seal ring groove or grooves must not be worn. The ring groove walls must have a good finish and they must be square. Check to be sure the oil passages are open through the crankshaft.

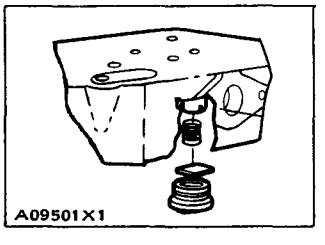
Connecting Rod Bearings

Used bearing inserts must be replaced. Connecting rod caps are not interchangeable. The locking slots of the connecting rod and cap should be positioned adjacent to each other. Clearance between the crankshaft journal and the connecting rod bearing must not be less than 0.0003 in. (0.008 mm) or more than 0.0021 in. (0.053 mm) after rebuilding.

REPAIRS

Discharge Valves, Valve Stops and Seats

If the discharge valve seats merely show signs of slight wear, they can be dressed by using a lapping stone, grinding compound and grinding tool. If the discharge valve stops are to be replaced, an application of a sealer is required, such as "Locktite Retaining Compound No. 75." Be sure that the press fit between the discharge valve stop outside diameter and the valve stop bore in the cylinder head is a minimum of .0008 in. (0.020 mm) and a maximum of .0028 in. (0.071 mm). If this fit can not be maintained, a new cylinder head body must be used. Be sure to completely support the outside top of the cylinder head casting, while pressing in the replacement stops. Install the new discharge valve springs and valves. Screw in the discharge valve seats. Discharge valve travel should be between .041 to .057 in. (1.04 to 1.45 mm).

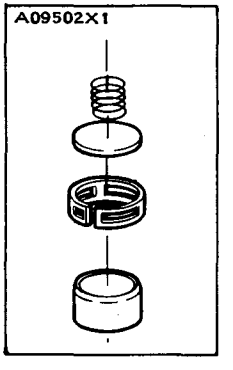


DISCHARGE VALVE, VALVE STOP AND SEAT

To test for leakage by the discharge valves, apply 100 psi (7.0 kg/cm^2) of air pressure through the cylinder head discharge port and apply a soap solution to the discharge valves and seats. A slight leakage in the form of soap bubbles is permissible. If excessive leakage is found, leave the air pressure applied and with the use of a fiber or hardwood dowel and a hammer, tap the discharge valves off their seats several times. This will help the valves to seat and should reduce the leakage. With the air pressure still applied at the discharge port of the cylinder head, check for leakage around the discharge valve stops exposed on the top of the cylinder head casting. No leakage is permitted.

Inlet Valves and Seats

Inlet valves and springs should be replaced, if the inlet valve seats show signs of slight nicks or scratches. They can be redressed with a fine piece of emery cloth or by lapping with a lapping stone, grinding compound and grinding tool. If the seats are damaged to the extent that they cannot be reclaimed, they must be replaced. The dimension from the top of the cylinder block to the inlet valve seat should not exceed .113 in. (2.87 mm) nor be less than .101 in. (2.57 mm).



INLET VALVE AND SEAT

ASSEMBLY

NOTE: All torques specified in this manual are *assembly* torques and can be expected to fall off after assembly is accomplished. *Do not retorque* after initial assembly torques fall.

Crankshaft

CAUTION: All flange mounted compressors *must be assembled without* a gasket between the crankcase and flange adapter and some compressors do not require gaskets on the end cover. Install the new crankcase gaskets *only* where they were removed during disassembly. In service, failure of the compressor will occur if gaskets are used in disregard of the preceeding.

If the compressor uses a ball type main bearing, press the ball bearing onto the correct end of the crankshaft. Position the ball bearing and the crankshaft in the crankcase, making sure the drive end of the crankshaft is positioned in the crankcase as marked before disassembly. Carefully press the crankshaft and ball bearing into the crankcase using an arbor press.

In the case of compressors with a front ball bearing, place two small seal rings in the counter sunk holes at the front of the crankcase, as well as an end cover gasket. Install the front end cover in the proper position as marked before disassembly, taking care not to damage the new oil seal.

In the case of compressors with a rear ball bearing, place two small seal rings in the counter sunk holes at the rear of the crankcase. In one case a gasket is used and in another a large O-ring seal is placed in the counterbore at the rear of the crankcase. These are in addition to the seal rings. Install the rear end cover in the proper position as marked before disassembly.

In the case of compressors with a sleeve bearing either front or rear, place the two small seal rings in the counter sunk holes in the crankcase.

CAUTION: An end cover gasket must not be used.

Place the O-ring seal in the groove around the flange adapter or the end cover, and affix the thrust washer. Install the flange adapter or end cover in the proper position as marked before disassembly, taking care not to damage the sleeve bearing.

Secure the flange adapter or front or rear end cover to the crankcase by tightening the four bolts. See NOTE for torque.

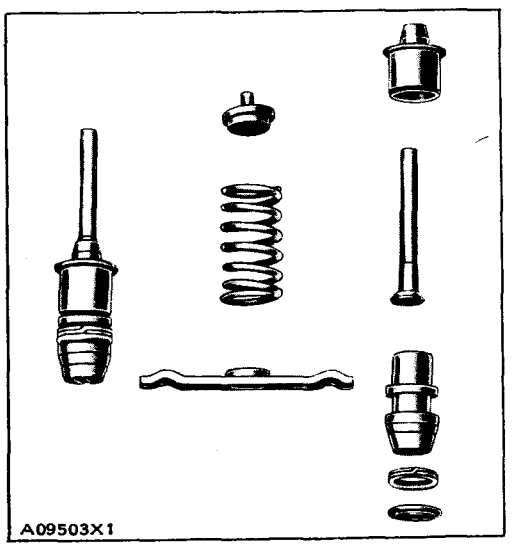
NOTE: For cast iron flange adapters, torque the four 7/16 in. bolts 38 to 45 lb. ft. (5.3 to 6.2 mkg). For die cast aluminum end covers, torque the four 7/16 in. bolts to 25 to 30 lb. ft. (3.5 to 4.1 mkg). All end covers using 5/16 in. bolts or stud and nuts are torqued to 15 to 18 lb. ft. (2.1 to 2.5 mkg). For through-drive compressors with a cast iron end cover, torque the four 7/16 in. bolts to 25 to 30 lb. ft. (3.5 to 4.1 mkg).

Pistons and Connecting Rods

If new wrist pin bushings are to be used, they should be pressed into the connecting rods so that the oil hole in the bushing lines up with the hole in the rod. The new bushings should then be reamed or honed to provide 0.0001 to 0.0006 in. (0.003 to 0.015 mm) clearance on the wrist pin. Position the connecting rod in the piston and press in the wrist pin so the lockwire hole in the pin aligns with that of the piston. Install the new lockwire through piston and wrist pin and lock by snapping the short end into the lockwire hole at the bottom of the piston. Install the piston rings in the correct location with the ring pipmarks up. Stagger the position of the ring gaps. Prelubricate the piston, piston rings, wrist pin and connecting rod bearings with clean engine oil before installing them in the compressor. Remove the connecting bolts and bearing cap from one connecting rod. Turn the crankshaft so that one of its connecting rod journals is in the downward, center position. Install the crankshaft journal bearing segments in the connecting rod and connect the rod cap. Insert the connecting rod with piston through the top of the cylinder. Position and attach the bearing cap to the connecting rod, making sure the bolt lock strap is positioned on the cap. Tighten the connecting rod bolts evenly and torque to 100 to 115 lb. in. (115 to 132 cm.kg.). Bend the new lock strap prongs up against the hex head of the bolts. Install the other connecting rod and piston in the same manner.

Unloader

A new unloader kit should be used when rebuilding (Piece Number 279615). The unloader pistons in the kit are prelubricated with a special lubricant (Piece Number 239379) and need no more lubrication. Install the unloader pistons in their bores being careful not to cut the O-ring seals or distort the back-up rings. Position the unloader plungers in their guides and slip them in and over the tops of the pistons. Install the unloader spring seat in the crankcase inlet cavity; a small hole is drilled in the crankcase for this purpose. Position the saddle between the unloader piston guides, so its forks are centered on the guides. Install the unloader spring, making sure it seats over the spring seats both in the crankcase and on the saddle. Position and install the inlet valve guides, then drop the inlet valves in their guides. There should be a loose sliding fit between the guides and valves.



UNLOADER MECHANISM

Cylinder Head

Install the inlet valve springs in the cylinder head by applying a turning motion to the spring after it

is in the head. The turning motion should dig the spring wire into the spring seat in the bottom of the spring bore in the head. Should this procedure fail after repeated attempts, use a very small quantity of grease to hold them in place, just enough to keep the springs from falling out. Place the cylinder head gasket on the cylinder block. Carefully align the cylinder head assembly on the block and install the bolts, tightening them evenly to a torque of 25 to 30 lb. ft. (3.5 to 4.1 mkg).

Base Plate or Base Adapter

Position the base plate or base adapter gasket on the crankcase and install the base plate or base adapter as marked before disassembly. Tighten the six bolts securing the base plate or base adapter evenly to a torque of 38 to 45 lb. ft. (5.3 to 6.2 mkg).

TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test rack for correct mounting, cooling, lubricating, and driving the compressor is necessary. Such tests are not compulsory if the unit has been carefully rebuilt by an experienced person. A compressor efficiency or build-up test can be run which is not too difficult. An engine lubricated compressor must be connected to an oil supply line of at least 15 psi (1.0 kg/cm^2) during the test and an oil return line must be installed to keep the crankcase drained.

Connect to the compressor discharge port a reservoir with a volume of 1500 cu. in. (24.6 litres), including the volume of connecting line. With the compressor operating at 2100 rpm the time required to raise the reservoir pressure from 85 psi (6.0 kg/cm^2) to 100 psi (7.0 kg/cm^2) should not exceed 5 to 7 seconds. During this test, the compressor should be checked for gasket leakage and noisy operation, as well as unloader operation and leakage.

TROUBLESHOOTING

The following is a listing of the most commonly experienced compressor deficiencies and their probable causes.

Excessive Build-Up and Recovery Time:

1. Dirty intake strainer.
2. Restriction in the compressor inlet or discharge lines or cavities.
3. Leaking or broken discharge valves.
4. Drive belt slipping.
5. Inlet valves worn excessively or stuck open.
6. Excessive air system leakage.
7. Excessive wear on piston rings and/or cylinders.

Noisy Compressor Operation:

1. Loose drive gear or pulley.
2. Excessively worn drive coupling.
3. Worn or burned out bearings.
4. Excessive wear.
5. Improper lubrication to the compressor.
6. Restrictions in the cylinder head or discharge line.

Excessive Oil Passage:

1. Dirty air strainer.
2. A small, kinked, or restricted oil return line.
3. Back pressure from the engine crankcase.
4. High inlet vacuum at the compressor.
5. Excessive engine oil pressure.
6. Defective oil seal or oil seal ring in the end cover(s).
7. Piston rings improperly installed.
8. Excessive ring or cylinder wear.

Compressor Fails to Unload:

1. Defective or worn unloader pistons or bores.
2. Inlet cavity restrictions.
3. Defective governor.
4. Unloader line from governor pistons kinked or the cavity beneath the unloader pistons restricted.
5. Unloader mechanism binding or kinked.

INSPECTION OF REBUILT UNIT

Check to be sure that covers, plugs, or masking tape are used to protect all ports if compressor is not to be installed immediately. Fit the end of all crankshafts with keys, nuts, and cotter pins as required and then protect the ends against damage by wrapping with masking tape or friction tape. The open bottom of a vertical engine lubricated compressor should be protected against the entrance of dirt during handling or storage, by installing a temporary cover over the base.

TECHNICAL DATA

Number of cylinders 2

Bore size ..... 2 5/8 in. (66.675 mm)

Stroke ..... 1½ in. (38.100 mm)

Piston displacement at 1250 rpm ..... 12 cu. ft. (340 litres)

Piston displacement per revolution at 1250 rpm ..... 16.5 cu. in. (270 cm^3)

Maximum recommended rpm 3000

Minimum coolant flow at maximum rpm ..... 2.5 gal./min. (9.5 l/min.)

Horsepower required at 3000 rpm against 100 psi (7.0 kg/cm^2) head pressure ..... 4.9 HP

Recommended minimum discharge line size ..... 5/8 in. (16 mm) O.D. Copper Tube

Recommended minimum oil return line size ..... 5/8 in. (16 mm) O.D. Tubing

Recommended minimum oil supply line size ..... 1/4 in. (6 mm) O.D. Tubing

Recommended minimum unloader line size ..... 1/4 in. (6 mm) O.D. Tubing

Recommended minimum inlet cavity line size (when compressor is connected to engine air cleaner) ..... 5/8 in. (16 mm) ID minimum

Recommended minimum coolant line size ..... 1/2 in. (13 mm) OD Tubing

Recommended maximum inlet air temperature .. 250° F (121° C)

Recommended maximum discharge air temperature ..... 400° F (204° C)

Minimum pressure required to unload ..... 60 psi (4.2 kg/cm^2)

Complete Field Maintenance Kit

Contents of this kit as follows:

1 Unloader mechanism kit
2 Inlet valve guides
2 Inlet valves
2 Inlet valve springs
1 Cylinder head gasket
2 Discharge valves
2 Discharge valve springs
1 Discharge flange gasket
1 Inlet flange gasket
1 Governor flange gasket
1 Filter element
1 Instruction sheet

Contents of unloader kit:

2 Plungers
2 Guides
2 Pistons with O-Ring seals and backup rings
1 Spring and one Spring Saddle

The above parts are pre-packed and lubricated.

DIMENSIONAL SPECIFICATIONS

CRANKCASE:

Maximum permissible clearance between bores in crankcase and outer race of main bearings (with ball bearings) ..... .0015 in. (0.038 mm)

CRANKCASE BASE PLATE or BASE ADAPTER:

Torque for six bolts ..... 38 to 45 lb. ft. (5.3 to 6.2 mkg)

CRANKCASE END COVERS AND FLANGE ADAPTERS:

Torque for 7/16 in. diameter bolts on cast iron flange adapters ..... 38 to 45 lb. ft. (5.3 to 6.2 mkg)

Torque for 7/16 in. bolts on end covers (aluminum or cast iron) ..... 25 to 30 lb. ft. (3.5 to 4.1 mkg)

Torque for 5/16 in. bolts or studs and nuts on end covers ..... 15 to 18 lb. ft. (2.1 to 2.5 mkg)

CRANKSHAFT CONNECTING ROD JOURNALS:

Diameter (standard) ..... 1.1242 to 1.1250 in. (28.555 to 28.575 mm)

CRANKSHAFT MAIN JOURNALS:

Diameter (standard) ..... 1.1242 to 1.1250 in. (28.555 to 28.575 mm)

Fit with ball bearings must be snug.

Maximum permissible bearing clearance (with sleeve bearings) ..... .0065 in. (0.165 mm)

CONNECTING RODS:

Bearing clearance at crankshaft (after rebuilding):

Maximum permissible ..... .0021 in. (0.053 mm)

Minimum permissible ..... .0003 in. (0.008 mm)

There are bearings available ..... .010 in. (0.25 mm), .020 in. (0.51 mm) and .030 in. (0.76 mm) undersize.

Bearing clearance at piston pin:

New, after reaming .0001 to .0006 in. (0.003 to 0.015 mm)

Maximum permissible (worn) ..... .0007 in. (0.018 mm)

Bore in bearing for piston pin (reamed) ..... .5314 to 5317 in. (13.498 to 13.505 mm)

Oil hole in bushing for piston pin and rod must align.

Torque for bearing cap bolts ..... 100 to 115 lb. in. (115 to 132 cm.kg)

CYLINDER BORE:

Permissible out-of-round ..... .001 in. (0.03 mm)

Permissible taper wear ..... .002 in. (0.05 mm)

Clearance between cast iron piston and cylinder bore:

Minimum permissible ..... .002 in. (0.05 mm)

Maximum permissible ..... .004 in. (0.10 mm)

CYLINDER HEAD:

Torque for bolts ..... 25 to 30 lb. ft. (3.5 to 4.1 mkg)

Fit between bore and discharge valve stop ..... .0008 to .0028 in. tight (0.020 to 0.071 mm tight)

PISTON PIN (WRIST PIN):

Fit in piston must be a light press.

PISTON RINGS:

Ring gap (installed) ..... .002 to .010 in. (0.05 to 0.25 mm)

Groove clearance:

Compression rings (2, on top) ..... .002 to .004 in. (0.05 to 0.10 mm)

Oil ring ..... .001 to .003 in. (0.03 to 0.08 mm)

VALVES (DISCHARGE):

Travel ..... .041 to .057 in. (1.04 to 1.45 mm)

VALVES (UNLOADER):

There should be a loose slide fit between the guides and valves.

VALVE SEAT (INLET):

Height above top of cylinder block ..... .101 to .113 in. (2.57 to 2.87 mm)

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