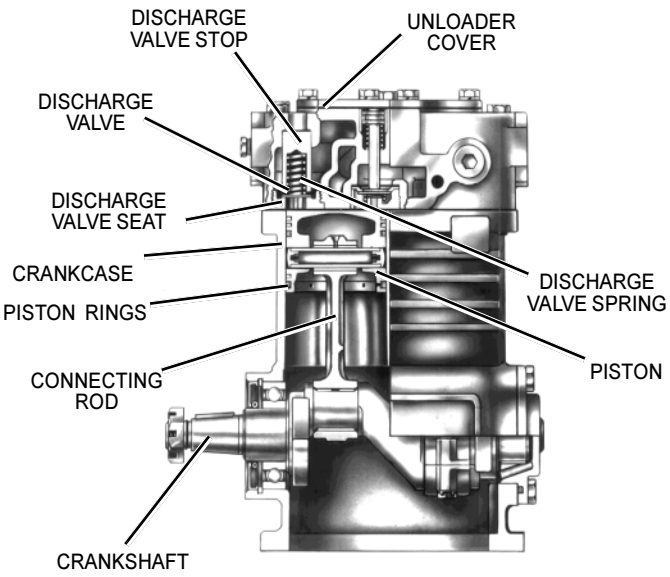
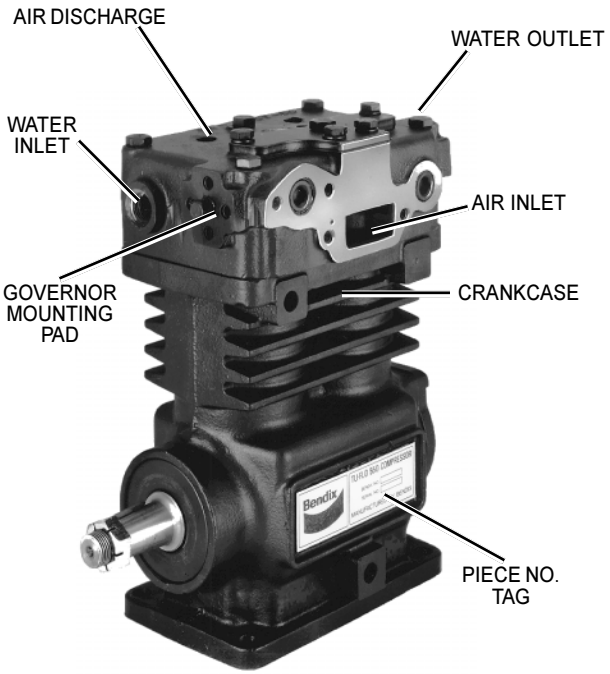
# TU-FLO 550® COMPRESSOR




BENDIX TU-FLO 550 COMPRESSOR
(CROSS SECTION)

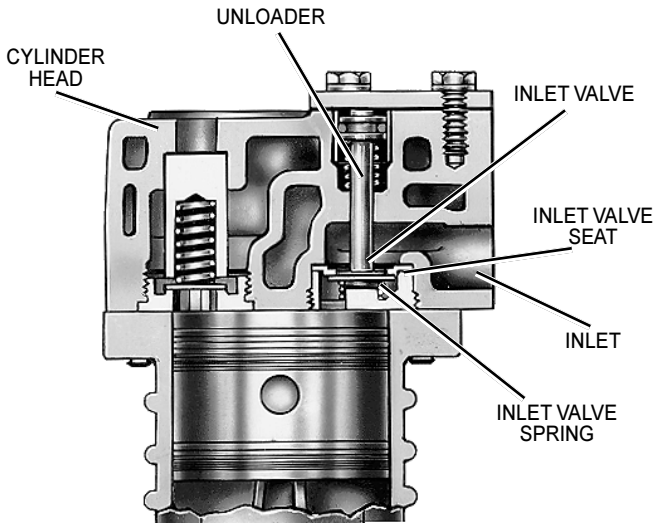



BENDIX TU-FLO 550 COMPRESSOR
(EXTERIOR)

## DESCRIPTION

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. The Tu-Flo 550 compressor is a two cylinder single stage, reciprocating compressor with a rated displacement of 13.2 cubic feet per minute at 1250 RPM.

The compressor assembly consists of two major subassemblies, the cylinder head and the crankcase. The cylinder head is an iron casting which houses the inlet, discharge, and unloader valving. (See Figure 1.) The cylinder head contains the air inlet port and is designed with both top and side air discharge ports. Three water coolant ports provide a choice of coolant line connections. Governor mounting surfaces are provided at both the front and the rear of the cylinder head. The head is mounted on the crankcase and is secured by six cap screws. The Tu-Flo 550 compressor is designed such that the cylinder head can be installed in one of two positions which are 180 degrees apart. The crankcase houses the cylinder bores, pistons, crankshaft and main bearings, and provides the flange or base mounting surface.




END VIEW OF CYLINDER HEAD

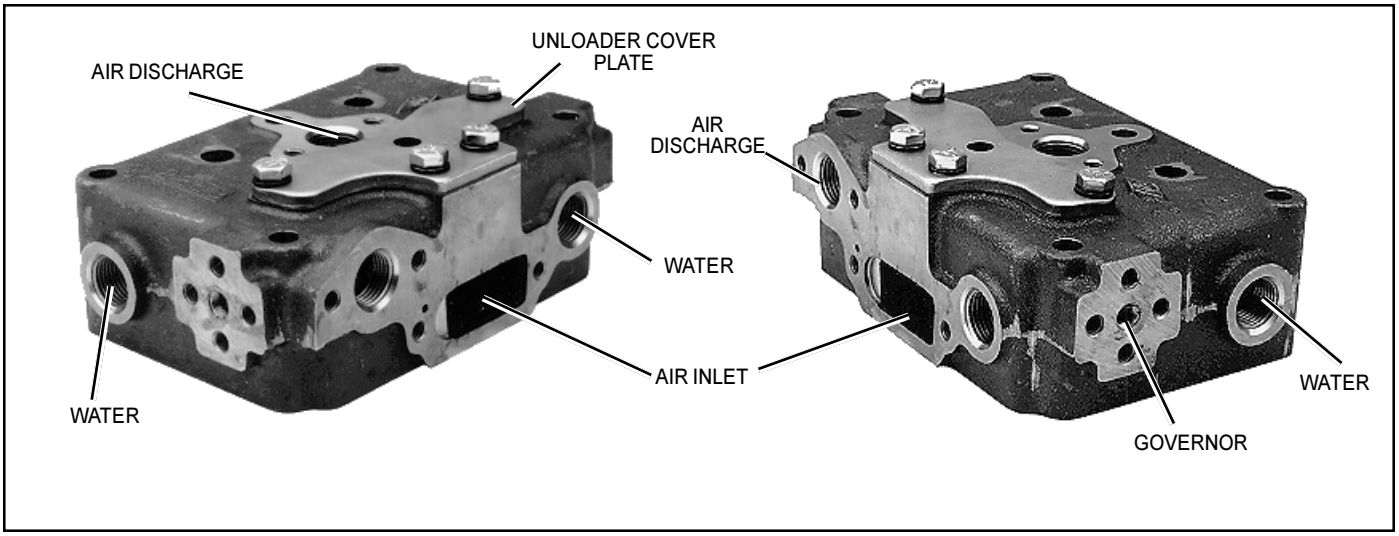



*FIGURE 1 -* ***CYLINDER HEAD***

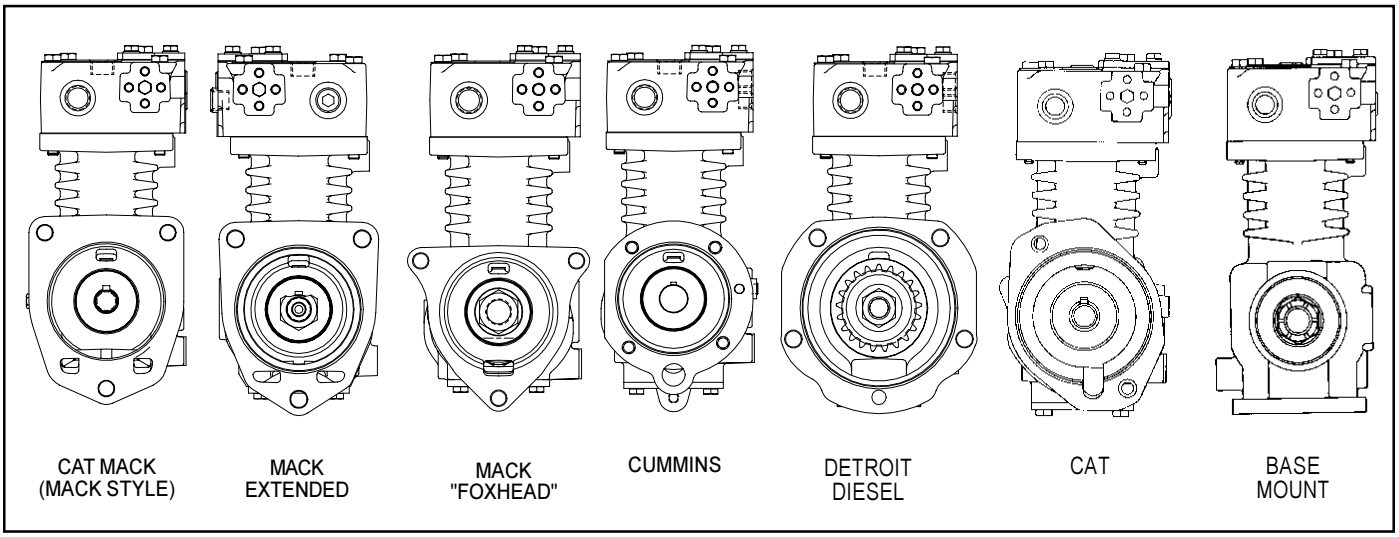



*FIGURE 2 -* ***FLANGE CONFIGURATIONS***

Various mounting and drive configurations, as shown in Figure 2, are supplied as required by the vehicle engine designs. A nameplate identifying the compressor piece number and serial number is attached to the side of the crankcase. (Reference Figure 3.)

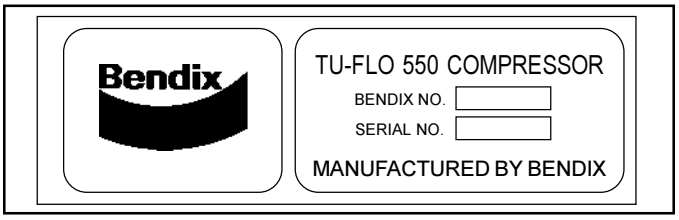



*FIGURE 3 -* ***NAMEPLATE***

## OPERATION

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 which is generally mounted on the compressor maintains the brake system air pressure to a preset maximum and minimum pressure level.

### INTAKE AND COMPRESSION OF AIR (LOADED)

During the down stroke of the piston, a slight vacuum is created between the top of the piston and the cylinder head, causing the inlet valve to move off its seat and open. (Note: The discharge valve remains on its seat.) Atmospheric air is drawn through the air strainer and the open inlet valve into the cylinder (see Figure 4). 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 the inlet valve plus the force of the inlet spring, returns the inlet valve to its seat and closes. The piston continues the upward stroke and compressed air pushes the discharge valve off its seat and air flows by the open discharge valve, into the discharge line and to the reservoirs (see Figure 5). 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

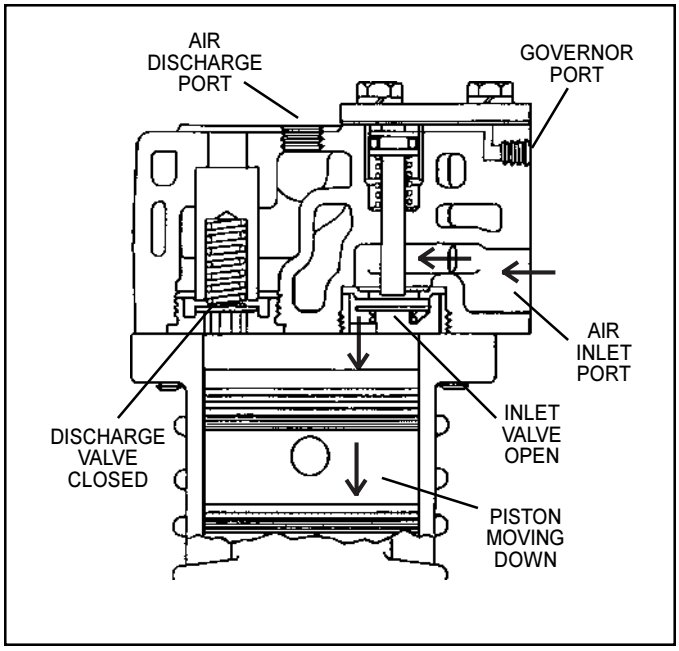



*FIGURE 4 -* ***OPERATIONAL-LOADED (INTAKE)***

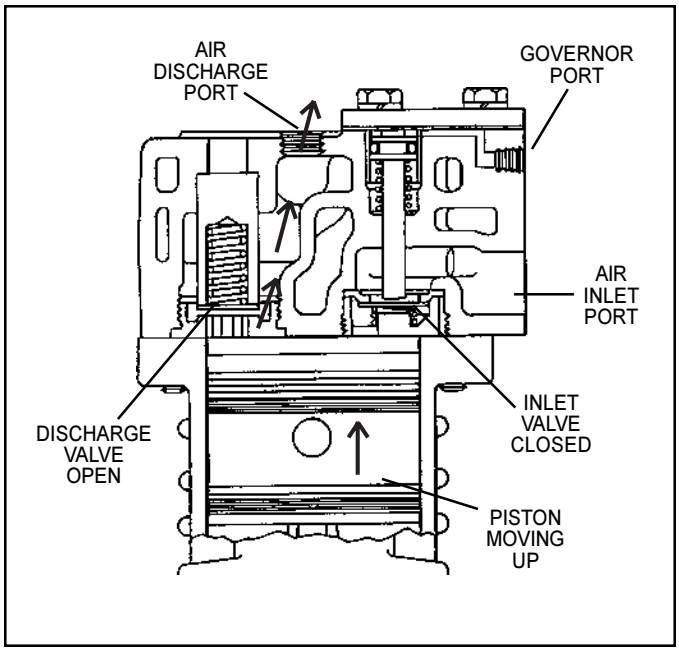



*FIGURE 5 -* ***OPERATIONAL-LOADED (COMPRESSION)***

air in the discharge line from returning to the cylinder bore as the intake and compression cycle is reseated.

## NON-COMPRESSION OF AIR (UNLOADED)

When air pressure in the reservoir reaches the cut-out setting of the governor, the governor allows air to pass from the reservoir, through the governor and into the cavity above the unloader pistons. The unloader pistons move down holding the inlet valves off their seats (see Figure 6.) With the inlet valves held off their seats by the unloader pistons, air is pumped back and forth between the two cylinders, and the discharge valves remain closed. When air pressure from the reservoir drops to the cut-in setting of the governor, the governor closes and exhausts the air from above the unloader pistons. The unloader springs force the pistons upward and the inlet valves return to their seats. Compression is then resumed.

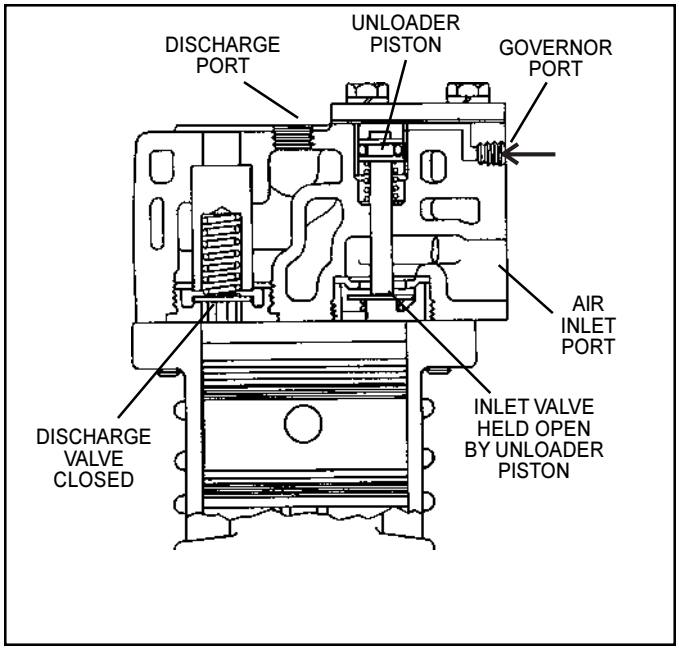



*FIGURE 6 -* ***OPERATIONAL-UNLOADED***

## LUBRICATION

The vehicle's engine provides a continuous supply of oil to the compressor. Oil is routed from the engine to the compressor oil inlet. An oil passage in the compressor crankshaft allows oil to lubricate the connecting rod crankshaft bearings. Connecting rod wrist pin bushings and crankshaft ball bearings are spray lubricated. An oil return line connected from the compressor drain outlet to the vehicle engine crankcase allows for oil return. On flange mounted models the oil drains back directly to the engine through the mounting flange.

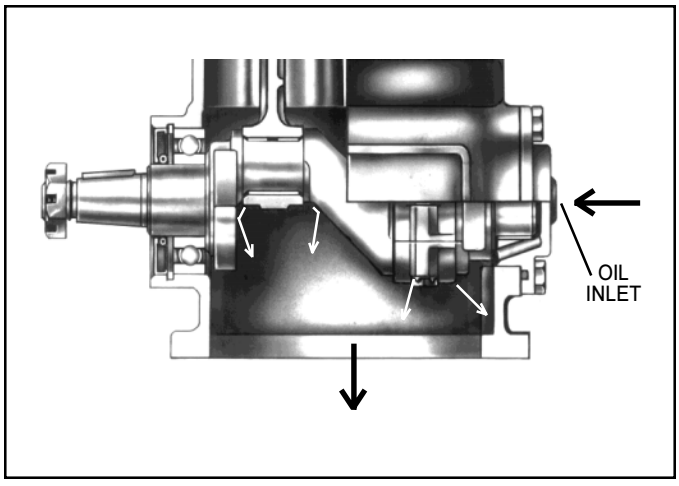



*FIGURE 7 -* ***LUBRICATION***

## 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 compressor. Coolant flowing from the engine's cooling system through connecting lines enters the head and passes through internal passages in the cylinder head and is returned to the engine. Proper cooling is important in maintaining discharge air temperatures below the maximum recommended 400 degrees Fahrenheit.

Figure 8 illustrates the various approved coolant flow connections. See the tabulated technical data in the back of this manual for specific requirements.

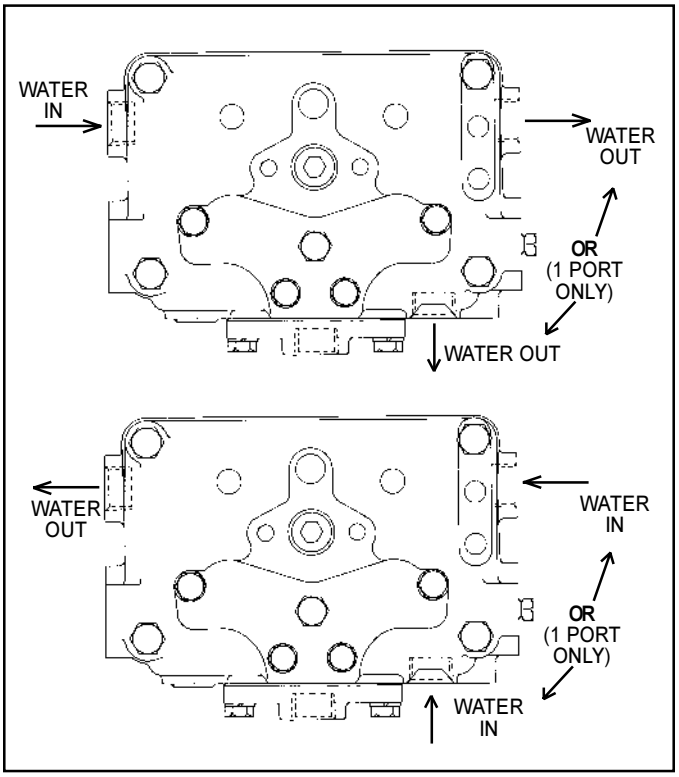



*FIGURE 8 - **COOLING***

## AIR INDUCTION

There are three methods of providing clean air to the Tu-Flo 550 compressor:

1. Naturally aspirated - Compressor utilizes its own attached air strainer (polyurethane sponge or pleated paper dry element).
2. Naturally aspirated - Compressor inlet is connected to the engine air cleaner or the vacuum side (engine air cleaner) of the supercharger or turbocharger.
3. Pressurized induction - Compressor inlet is connected to the pressure side of the supercharger or turbocharger.

See the tabulated technical data in the back of this manual for specific requirements for numbers 2 and 3 above.

If a previously unturbocharged compressor is being turbocharged, it is recommended that the inlet cavity screen (238948) be installed with an inlet gasket (291909) on both sides of the screen.

## COMPRESSOR TURBOCHARGING PARAMETERS

Air entering the compressor inlet during the loaded cycle must not exceed 250 degrees Fahrenheit (121 degrees Celsius). A metal inlet line is suggested to help meet this parameter.

The following compressor crankshaft rotative speed and inlet pressure relationships may not be exceeded.

| **Crankshaft R.P.M.** | **Maximum Compressor Inlet Pressure** |
|---|---|
| 2200 RPM | 30.0 psi (207 kPa) |
| 2600 RPM | 25.0 psi (172.5 kPa) |

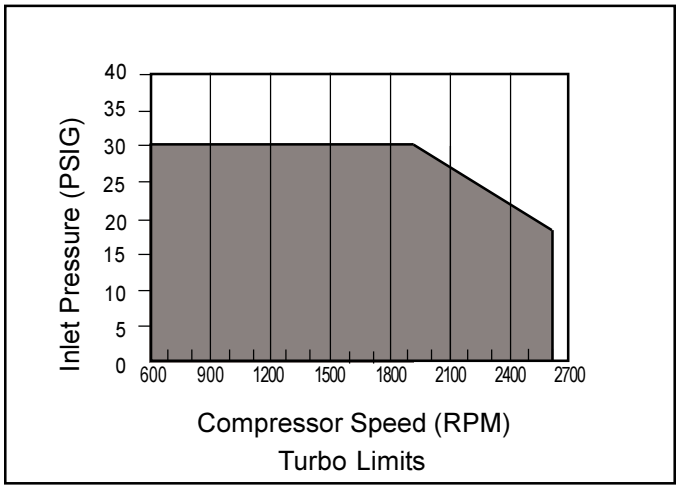



*FIGURE 9 - **TURBO LIMITS CURVE***

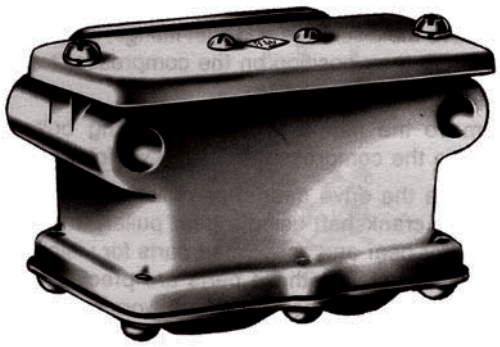
## PREVENTATIVE MAINTENANCE

**Important Note:** Review the warranty policy before performing any intrusive maintenance procedures. An extended warranty may be voided if intrusive maintenance is performed during this period.

## AIR INDUCTION

One of the single most important aspects of compressor preventive maintenance is the induction of clean air. The type and interval of maintenance required will vary depending upon the air induction system used.

The intervals listed under the headings below pertain to typical highway and street operation. More frequent maintenance will be required for operation in dusty or dirty environments.



POLYURETHANE SPONGE STRAINER

PAPER AIR STRAINER DRY ELEMENT-PLEATED

*FIGURE 10 -* ***STRAINERS***

## POLYURETHANE SPONGE STRAINER

**Every month, 150 operating hours or 5,000 miles, whichever occurs first,** 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 strainer is removed from the compressor intake.

## DRY ELEMENT - PLEATED PAPER STRAINER

**Every two months, 800 operating hours or 20,000 miles whichever occurs first,** loosen the spring clip from the unhinged side of the mounting baffle and open the cover. Replace the pleated paper filter and secure 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.

## INTAKE ADAPTER

**When the engine air cleaner is replaced:** Some compressors are fitted with compressor intake adapters, which allow the compressor intake to be connected to the engine air induction system. 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. Inspect the connecting line for ruptures and replace it if necessary.

## COMPRESSOR COOLING

**Every 6 months, 1800 operating hours or after each 50,000 miles whichever occurs first,** inspect the compressor discharge port, inlet cavity and discharge line for evidence of restrictions and carboning. If excessive buildup is noted, thoroughly clean or replace the affected parts and closely inspect the compressor cooling system. Check all compressor coolant lines for kinks and restrictions to flow. **Minimum** coolant line size is 3/8" I.D. Check coolant lines for internal clogging from rust scale. If coolant lines appear suspicious, check the coolant flow and compare to the tabulated technical data present in the back of this manual. Carefully inspect the air induction system for restrictions.

## LUBRICATION

**Every six months, 1800 operating hours or 50,000 miles which ever occurs first,** check external oil supply and return lines, if applicable, for kinks, bends, or restrictions to flow. Supply lines must be a minimum of 3/16" I.D. and return lines must be a minimum of 1/2" I.D. Oil return lines should slope as sharply as possible back to the engine crankcase and should have as few fittings and bends as possible. Refer to the tabulated technical data in the back of this manual for oil pressure minimum values

## COMPRESSOR DRIVE

**Every six months, 1800 operating hours or 50,000 miles, whichever occurs first,** check for noisy compressor operation, which could indicate a worn drive gear coupling, a loose pulley or excessive internal wear. Adjust and/or replace as necessary.

If the compressor is belt driven, check for proper belt and pulley alignment and belt tension. Check all compressor mounting bolts and retighten evenly if necessary. Check for leakage and proper unloader mechanism operation. Repair or replace parts as necessary.

**Every 24 months, 7200 operating hours, or after each 200,000 MILES,** perform a thorough inspection, and depend-

ing upon the results of this inspection or experience, disassemble the compressor, clean and inspect all parts thoroughly, replace all worn or damaged parts using only genuine Bendix replacements or replace the compressor with a genuine Bendix remanufactured unit.

## GENERAL SERVICE CHECKS

### 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 85-100 psi in 25 seconds or less. This test is performed with the engine operating at maximum recommended 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

Compressor leakage tests need not be performed on a regular basis. These tests should be performed when; it is suspected that discharge valve leakage is substantially affecting compressor build-up performance, or when it is suspected that the compressor is "cycling" between the load and unloaded modes due to unloader piston leakage.

These tests must be performed with the vehicle parked on a level surface, the engine not running, the entire air system completely drained to 0 P.S.I., and the inlet check valve detail parts removed, if applicable.

### UNLOADER PISTON LEAKAGE

The unloader pistons can be checked for leakage as follows: with the cylinder head removed from the compressor and the inlet flange securely covered, apply 120 psi of air pressure to the governor port. Listen for an escape of air at the inlet valve area. An audible escape of air should not be detected.

### DISCHARGE VALVE LEAKAGE

Unloader piston leakage must be repaired before this test is performed. Leakage past the discharge valves can be detected as follows: Remove the discharge line and apply shop air back through the discharge port. Listen for an escape of air at the compressor inlet cavity. A barely audible escape of air is generally acceptable.

If the compressor does not function as described above or if the leakage is excessive, it is recommended that it be returned to the nearest authorized Bendix distributor for a factory remanufactured compressor. If it is not possible, the compressor can be repaired using a genuine Bendix cylinder head maintenance kit. Retest the cylinder head after installation of the kit.

## REMOVAL AND DISASSEMBLY

### GENERAL

The following disassembly and assembly procedure is presented for reference purposes and presupposes that a major rebuild of the compressor is being undertaken. Several maintenance kits are available which do not require full disassembly. The instructions provided with these parts and kits should be followed in lieu of the instructions presented here.

### REMOVAL

These instructions are general and are intended to be a guide, in some cases additional preparations and precautions are necessary.

1. Block the wheels of the vehicle and drain the air pressure from all the reservoirs in the system.
2. Drain the engine cooling system and the cylinder head of the compressor. Identify and disconnect all air, water and oil lines leading to the compressor.
3. Remove the governor and any supporting bracketry attached to the compressor and note their positions on the compressor to aid in reassembly.
4. Remove the discharge and inlet fittings, if applicable, and note their position on the compressor to aid in reassembly.
5. Remove the flange or base mounting bolts and remove the compressor from the vehicle.
6. 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.

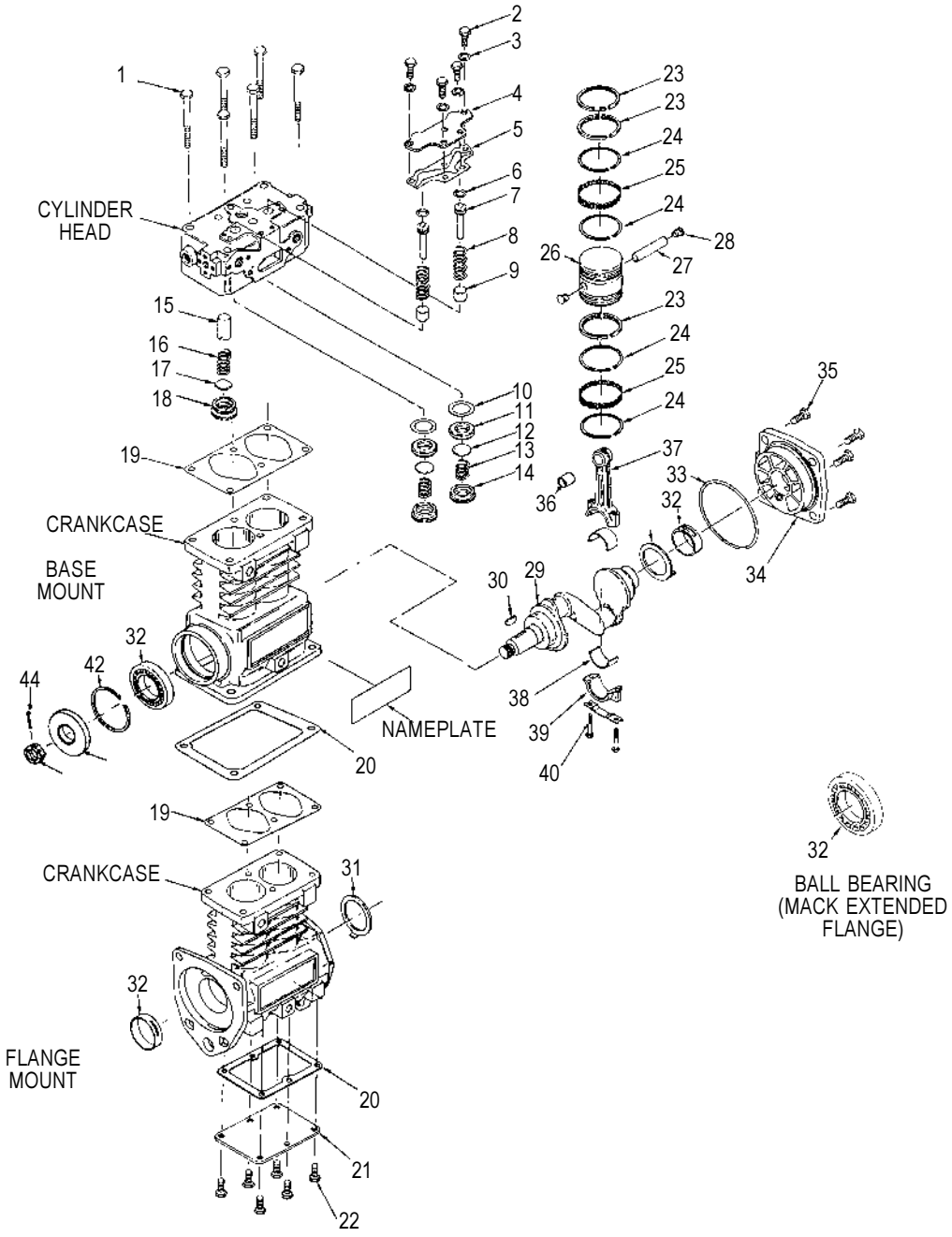
### PREPARATION FOR DISASSEMBLY

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 the rear end cover 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 marking methods such as chalk that can be wiped off or obliterated during rebuilding.

### CYLINDER HEAD

Remove the six cylinder head cap screws (1) and tap the head with a soft mallet to break the gasket seal. Remove




| ITEM | QTY | DESCRIPTION | ITEM | QTY | DESCRIPTION | ITEM | QTY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 1 | 6 | Cylinder Head Cap Screws | 16 | 2 | Discharge Valve Spring | 31 | 2 | Thrust Washer |
| 2 | 4 | Unloader Plate Cap Screws | 17 | 2 | Discharge Valve | 32 | 2 | Sleeve (or Ball) Bearing |
| 3 | 4 | Unloader Plate Lock Washers | 18 | 2 | Discharge Valve Stop | 33 | 1 | End Cover Seal |
| 4 | 1 | Unloader Plate | 19 | 1 | Cylinder Head Gasket | 34 | 1 | End Cover |
| 5 | 1 | Unloder Plate Gasket | 20 | 1 | Base Gasket | 35 | 4 | End Cover Cap Screws |
| 6 | 2 | O-ring | 21 | 1 | Base Plate | 36 | 2 | Wrist Pin Bushing |
| 7 | 2 | Unloader | 22 | 6 | Base Plate Cap Screws | 37 | 2 | Connecting Rod |
| 8 | 2 | Spring | 23 | 6 | Standard Piston Rings | 38 | 2 | Conn. RodInserts (Sets) |
| 9 | 2 | Unloader Bushing | 24 | 8 | Oil Ring | 39 | 2 | Connecting Rod Caps |
| 10 | 2 | Gasket | 25 | 4 | Expander Ring | 40 | 4 | Connecting Rod Bolts |
| 11 | 2 | Inlet Valve Seat | 26 | 2 | Pistion | 41 | 1 | Ball Bearing |
| 12 | 2 | Inlet Valve | 27 | 2 | Wrist Pin | 42 | 1 | Retaining Ring |
| 13 | 2 | Inlet Valve Spring | 28 | 4 | Wrist Pin Button | 43 | 1 | Seal |
| 14 | 2 | Inlet Valve Stop | 29 | 1 | Crankshaft | 44 | 1 | Cotter Pin |
| 15 | 2 | Discharge Valve Stop | 30 | 1 | Crankshaft Key | 45 | 1 | Locknut |

the unloader cover plate cap screws (2), lockwashers (3) and the unloader cover plate (4). Scrape off any gasket material (5) from the cover plate, cylinder head and crankcase.

1. Remove the unloader pistons (7), o-rings (6) and springs (8).
2. Inspect the unloader piston bushings (9) for nicks, wear, corrosion and scoring. It is recommended that the compressor be replaced if it is determined that the unloader bushing is damaged or worn excessively.

Before disassembling the discharge valve mechanism, measure and record the discharge valve travel (from closed to completely open).

3. If the measured discharge valve travel **exceeds** .046 inches, the compressor should be replaced. If the discharge valve travel does not exceed .046, using a 9/16" Allen wrench, remove the discharge valve seats (18), valves (17) and valve springs (16).
4. Remove the inlet valve stops (14), valves (17), valve seats (11), valve springs (12) and gaskets (10). It is recommended that a tool such as a J-25447-B, produced by Kent Moore Tool Division Roseville, Michigan phone 1-800-328-6657, be used to remove the inlet valve stop.

### CRANKCASE BOTTOM COVER OR ADAPTER DISASSEMBLY

1. Remove the cap screws (22) securing the bottom cover or adapter (21). Tap with a soft mallet to break the gasket seal. Scrape off any gasket material (20) from the crankcase and bottom cover or adapter.

### CONNECTING ROD DISASSEMBLY

Before removing the connecting rod, mark the connecting rods (37) and their caps (39) to ensure correct reassembly. The connecting rod and cap are a matched set therefore the caps must not be switched or rotated end for end.

1. Remove the connecting rod bolts (40) and bearing caps (39).
2. Push the pistons (26) with the connecting rods (37) attached out the top of the cylinder bore of the crankcase. Replace the bearing caps on the connecting rods.
3. Remove the piston rings (23-25) from the piston. If the piston is to be removed from the connecting rod, remove the wrist pin teflon plugs (28) and press the wrist pin (27) from the piston and connecting rod.
4. If the piston is removed from the rod, inspect the wrist pin bore in the piston and bronze wrist pin bushing (36) in the connecting rod. If excessive wear is noted or suspected, replace the connecting rod and piston.

### COMPRESSOR CRANKCASE DISASSEMBLY

1. Remove the key or keys (30) from the crankshaft (29) 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.)
2. Remove the four cap screws (35) and lockwashers or nuts and lockwashers that secure the rear end cover (34) to the crankcase.
3. Remove the rear end cover (34), thrust washer (31) and end cover oil seal ring (33), taking care not to damage the bearing if present in the end cover.
4. If the compressor has ball type main bearings, press the crankshaft (29) and ball bearings from the crankcase, then press the ball bearings from the crankshaft.
5. Press the oil seal out of the compressor crankcase, if so equipped.

### CLEANING OF PARTS GENERAL

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

### CYLINDER HEAD

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

### OIL PASSAGES

Thoroughly clean all oil passages through the crankshaft, crankcase, end covers, 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. With the cylinder head and head gasket secured to a flat surface or crankcase, 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 compressor.

### END COVERS

Check for cracks and external damage. If the crankshaft main bearing (32) is installed in the end cover (34), check for excessive wear and flat spots and replace if necessary.

## 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 .0003 in. tight to .0023 in. loose. This is to maintain the correct fit. The compressor 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 .005 in. If the clearance is greater than .005 in. the bearing must be replaced.

The cylinder bores should be checked with inside micrometers or calipers. Cylinder bores which are scored or out of round by more than .0005 in. or tapered more than .0005 in. should be rebored or honed oversize. Oversized pistons and piston rings are available in .010 in., .020 in. and .030 in. oversizes. Cylinder bores must be smooth, straight and round. Clearance between the cast iron pistons and cylinder bores should be between .002 in. minimum and .004 in. maximum.

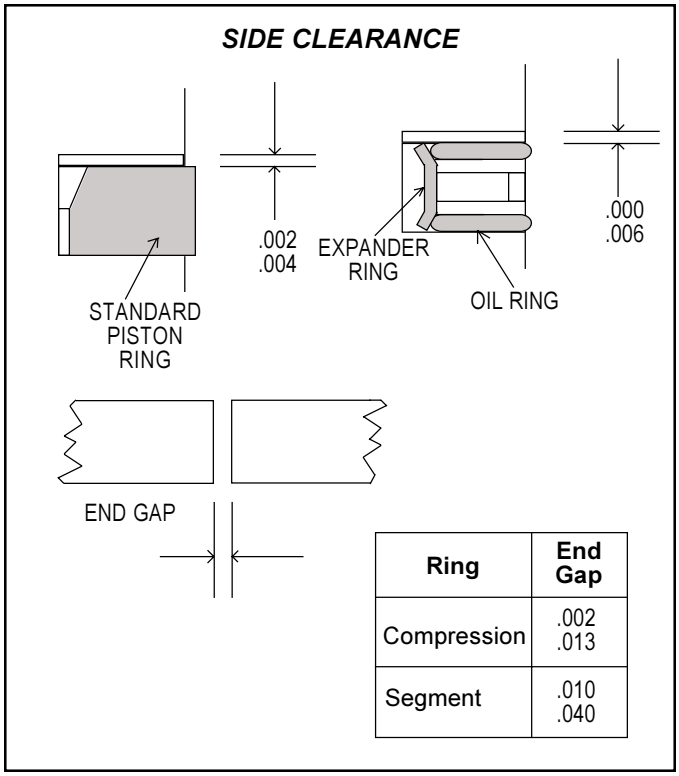
## PISTON RINGS

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 diametrical clearance is between .002 in. minimum and .004 in. 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 .0007 in. Replace the connecting rod and cap assembly which includes the wrist pin bushings if excessive clearance is found. Check the fit of the rings in the piston ring grooves. Check the ring gap with the rings installed in the cylinder bores. Refer to Figure 12 for correct gap and groove clearances.

## CRANKSHAFT

Check the crankshaft threads, keyways, tapered ends and all machined and ground surfaces for wear, scores, or damage. Standard crankshaft journals are 1.1242 in. - 1.1250 in. in diameter. If the crankshaft journals are excessively scored or worn or out of round and cannot be reground, the compressor must be replaced. Connecting rod bearing inserts are available in .010 in., .020 in. and .030 in. undersizes for compressors with reground crankshafts. Main bearing journals must be maintained so the ball bearings are a snug fit or so that no more than .005 in. clearance exists between the precision sleeve main bearing and the main bearing journals on the crankshaft. Check to be sure the oil passages are open through the crankshaft.




| Ring | End Gap |
|---|---|
| Compression | .002<br>.013 |
| Segment | .010<br>.040 |

*FIGURE 12 - **RING CONFIGURATION***

## CONNECTING ROD BEARINGS

Used bearing inserts must be replaced. The connecting rod and cap are a matched set and therefore the caps must not be switched or rotated end for end. Make sure the locating tangs on the inserts engage with the locating notches in the rod and cap. Clearance between the connecting rod journal and the connecting rod bearing must not be less than .0003 in. or more than .0021 in. after rebuilding.

# REPAIRS

## UNLOADER

A new cylinder head maintenance kit should be used when rebuilding. **Note: The entire contents of this kit must be used. Failure to do so may result in compressor failure.** The unloader pistons in the kit are prelubricated with a special lubricant piece number 239379 and need no additional lubrication. Install the springs and unloader pistons in their bores being careful not to cut the o-rings. Install the unloader cover gasket and unloader cover and secure the cover cap screws. Tighten the cap screws to 175-225 in. lbs. in a crossing pattern after first snugging all screws.

## 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 however it is recommended that a cylinder head maintenance be used. Install new discharge valve springs and valves. Screw in the discharge valve seats, and tighten to 70-90 ft.-lbs. Discharge valve travel should be between .030 in. to .046 in. To test for leakage by the discharge valves, apply 100 psi to the cylinder head discharge port and apply a soap solution to the discharge valve and seats. 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 stop on the top of the cylinder head casting. No leakage is permitted.

## INLET VALVES AND SEATS

Inlet valves and springs should be replaced. However, 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.

## ASSEMBLY

**General Note:** All torques specified in this manual are assembly torques and typically can be expected to fall off after assembly is accomplished. **Do not retorque** after initial assembly torques fall unless instructed otherwise. A compiled listing of torque specifications is presented at the end of this manual.

To convert inch pounds of torque to foot pounds of torque, divide in pounds by 12.

inch pounds ÷ 12 = foot pounds

To convert foot pounds of torque to inch pounds of torque, multiply foot pounds by 12.

foot pounds x 12 = inch pounds

## INSTALLING CRANKSHAFT

Press new sleeve bearings in the end cover and crankcase. Ensure that the slot in the bearings line up with the oil passages in the end cover or crankcase. If you have a model with no oil passage present in the crankcase, press the sleeve bearing into the crankcase with the slot located 90 degrees from vertical.

Install the front thrust washer with the tang inserted in the slot toward the flange. Insert the crankshaft and the rear thrust washer with the tang toward the rear of the compressor.

Place the oil seal ring on the boss of the rear end cover and install the end cover making sure not to pinch the seal ring. Ensure the tang of the thrust washer is inserted in the slot of the end cover. Fasten the end cover to the crankcase with the four cover cap screws. Torque the cap screws to 175-225 inch pounds in a cross pattern.

## PISTONS AND CONNECTING RODS

If the pistons are to be replaced ensure that the correct pistons are being installed. Note that the pistons for the Tu-Flo 550 compressor are similar to those of other Bendix compressor models but may be identified by the piston diameter and the distance to the center of the wrist pin from the top of the piston as shown in Figure 13.

## PISTON RINGS

Check each ring end gap in a cylinder bore before installation. Place the ring in the top of the cylinder bore and using the piston, push the ring to the midpoint of the cylinder bore and check the ring gap. If the end gaps are incorrect either the wrong repair size has been purchased or the compressor is worn beyond specification and should be replaced.

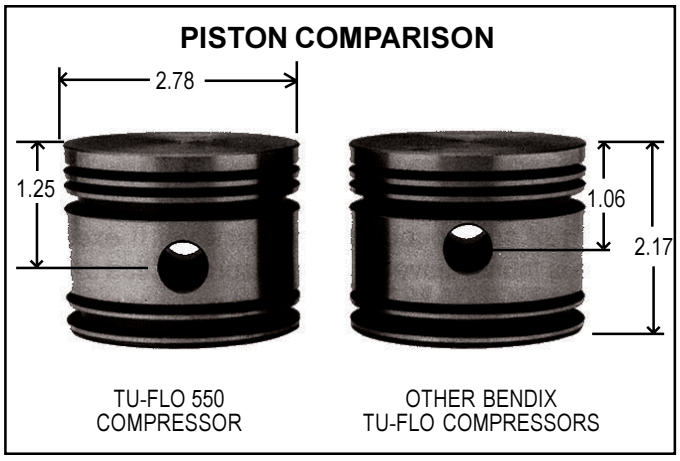



*FIGURE 13 - **PISTON COMPARISON***

Install the rings on the pistons per the following instructions starting at the center of the piston and moving outward.

1. Install the spacer and segment rings as follows. Place the spacer ring (25) in the piston groove, the ends of the spacer must butt and not overlap. Install the top segment (24) by inserting one end above the spacer in the ring groove, 120 degrees from the spacer ends and wind the segment into position. Install the bottom segment in the same manner beneath the spacer making sure the gap is staggered 120 degrees from both the top ring segment and the spacer end gaps. Before using be sure

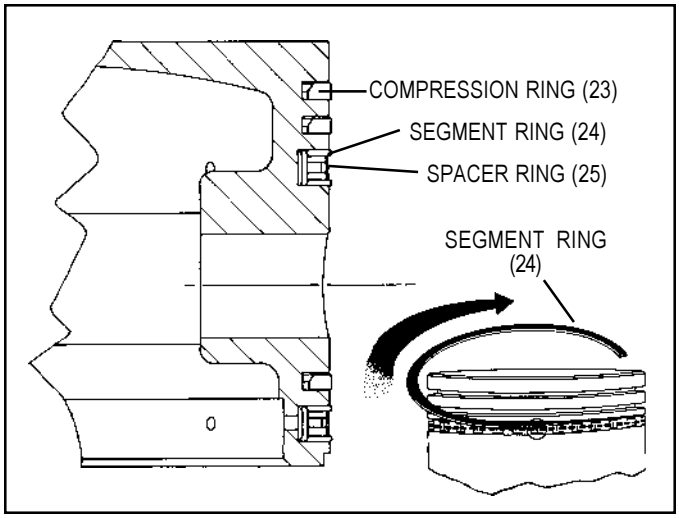



*FIGURE 14 - **PISTON & RINGS***

both painted ends of the spacer are visible and butted. (Refer to Figure 14.)

2. Install the compression rings (23) in the proper grooves with the bevel or "pip" mark (if any) toward the top of the piston. (Refer to Figure 14.)

Check the ring side clearance of each ring in the piston ring groove. (Refer to Figure 12.) If the side clearance is too large, the piston ring groove is worn beyond specifications and the piston must be replaced.

Rotate the piston rings in their respective groove so that each end gap is at least 90 degrees from the previous ring's end gap.

Lubricate the wrist pin (22) and wrist pin bushing in the connecting rod with engine oil. Assemble the upper portion of the connecting rods and the pistons with the wrist pins. Insert the wrist pin buttons (28) in the ends of the wrist pin. Lubricate the pistons and rings with engine oil. Using a ring compression tool return the piston to the cylinder bore.

Turn the crankshaft so that one of its connecting rod journals is in the downward, center position. Install the crankshaft journal bearing segments (38) on the connecting rod (37) and connecting rod cap (39). Tighten the connecting rod bolts (40) evenly and torque to 150 - 170 inch pounds. Install the other connecting rod and piston in the same manner. It is recommended that new connecting rod cap screws be used.

Before replacing the cylinder head on the crankcase ensure the correct pistons have been used by turning the crankshaft one complete revolution such that each piston moves to its maximum upward stroke. At the maximum upward stroke position each piston should move to the top of the crankcase. If the piston does not approach the top of the crankcase the piston is incorrect and if not replaced could result in compressor damage.

## BASE PLATE OR BASE ADAPTER

Position the base plate or base adapter gasket (20) on the crankcase and install the base plate or base adapter (21) as marked before disassembly. Tighten the six cap screws (22), securing the cast iron base adapter evenly to a torque of 175-225 inch pounds for base plate or cover in a crossing pattern after first snugging all 6 screws.

## CYLINDER HEAD

Place the cylinder head gasket (19) and cylinder head on the compressor crankcase and install the six cylinder head cap screws. If the cylinder head gasket has a bead on one side, install the gasket on the crankcase with the beaded side up. Snug the cylinder head cap screws prior to torquing the cap screws to 440-500 in. lbs. in a cross pattern. Retorque the unloader cover cap screws to 170-225 in. lbs.

## FINAL COMPRESSOR ASSEMBLY

Install all crankshaft keys making certain to support the crankshaft to avoid bearing damage. Install the crankshaft nut where applicable. When installing drive couplings or gears, **do not exceed 120 foot pounds torque** on the crankshaft nut.

Use covers, plugs, or masking tape to protect all ports if compressor is not to be installed immediately. Protect the ends of the crankshaft against damage by wrapping with masking tape or friction tape.

## 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 P.S.I. pressure 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 cubic inches, including the volume of the connecting line. With the compressor operating at 2100 R.P.M., the time required to raise the reservoir(s) pressure from 85 psi to 100 psi should not exceed 7 seconds. During this test, the compressor should be checked for gasket leakage and noisy operation, as well as unloader operation and leakage.

If the compressor functions as indicated reinstall on the vehicle connecting all lines as marked in the disassembly procedure.

## TU-FLO 550 SPECIFICATIONS

Average weight ..... 53
Number of cylinders ..... 2
Bore size ..... 2.78 In.
Stroke ..... 1.50 In.
Displacement at 1250 RPM ..... 13.2 CFM
CFM Maximum recommended RPM ..... 3000 RPM
Minimum coolant flow (water cooled) at
Maximum RPM ..... 2.5 GPM
Minimum RPM ..... 5 GPM
Approximate horsepower required at
1250 RPM at 120 PSIG (naturally aspirated) ..... 2.5
Turbocharge limits
See Compressor Turbocharging Parameters
Maximum inlet air temperature ..... 250°F
Maximum discharge air temperature ..... 400°F
Minimum pressure required to unload
(naturally aspirated) ..... 60 PSIG
Minimum oil pressure required at
engine idling speed ..... 15 PSIG
Minimum oil pressure required at
maximum governed engine speed ..... 15 PSIG
Minimum discharge-line size ..... 1/2" I.D.
Minimum coolant-line size ..... 3/8" I.D.
Minimum oil-supply line size ..... 3/16" I.D.
Minimum oil-return line size ..... 1/2" I.D.
Minimum air-inlet line size ..... 5/8" I.D.
Minimum unloader-line size ..... 3/16" I.D.

## TORQUE SPECIFICATIONS

**Bolt, Nut or Screw ..... Assembly Torque (in. lbs.)**

Cylinder Head ..... 440 - 500
Unloader Cover Plate ..... 175 - 225
Discharge Valve Seat ..... 840 - 1080 (70-90 ft. lbs.)
Inlet Valve Stop ..... 840 - 1080 (70-90 ft. lbs.)
End Cover ..... 175 - 225
Connecting Rod ..... 150 - 170
Bottom Cover ..... 175 - 225
Air Strainer ..... 125 - 150
Inlet Fitting ..... 175 - 225
Discharge Fitting ..... 175 - 225
Governor or Governor Adapter ..... 175 - 225
Pipe Plugs
1/16 ..... 35 - 50
1/8 ..... 85 - 105
1/4 ..... 130 - 170
3/8 ..... 160 - 200
1/2 ..... 200 - 270
Pipe Bushing
1/2 ..... 175 - 225
Crankshaft Nut:
Marsden or Castle ..... 1200 - 1400 (100-120 ft. lbs.)
P/N 298125
(Metric Thread) ..... 2640 - 3048 (220-254 ft. lbs.)

## DIMENSIONAL DATA

Port Sizes
Water inlet ..... 1/2 - 14 NPT
Water outlet ..... 1/2 - 14 NPT
Air discharge ..... 1/2 - 14 NPT
Governor ..... 1/8 - 27 NPT
Oil inlet (end cover) ..... 1/8 - 27 NPT
Oil return: Base mount ..... 1/2 - 14 NPT
Piston
(standard) ..... 2.77825 in.
(.010 oversize) ..... 2.78825 in.
(.020 oversize) ..... 2.79825 in.
(.030 oversize) ..... 2.80825 in.
Cylinder bore
(standard) ..... 2.7810 in.
(.010 oversize) ..... 2.7910 in.
(.020 oversize) ..... 2.8010 in.
(.030 oversize) ..... 2.8110 in.

## MAINTENANCE KITS AND AVAILABLE SERVICE PARTS

Cylinder Maintenance Kit.

Piston Ring Kit (standard and oversizes.)

Piston and Rod Kit (standard and oversizes.)

Crankshaft Bearing Kit.

**IMPORTANT! PLEASE READ:**

**When working on or around a vehicle, the following general precautions should be observed:**

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels.**
2. **Stop the engine when working around the vehicle.**
3. **If the vehicle is equipped with air brakes, make certain to drain the air pressure from all reservoirs before beginning any work on the vehicle.**
4. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that removes all electrical power from the vehicle.**
5. **When working in the engine compartment the engine should be shut off. Where circumstances require that the engine be in operation, extreme caution should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated, or electrically charged components.**
6. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
7. **Never exceed recommended pressures and always wear safety glasses.**
8. **Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**
9. **Use only genuine Bendix replacement parts, components, and kits. Replacement hardware, tubing, hose, fittings, etc. should be of equivalent size, type, and strength as original equipment and be designed specifically for such applications and systems.**
10. **Components with stripped threads or damaged parts should be replaced rather than repaired. Repairs requiring machining or welding should not be attempted unless specifically approved and stated by the vehicle or component manufacturer.**
11. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**

# COMPRESSOR TROUBLESHOOTING CHART

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| 1. Compressor passes excessive oil as evidenced by presence of oil at exhaust ports of valving or seeping from air strainer. | A. Restricted air intake. | A. Check engine or compressor air cleaner and replace if necessary. Check compressor air inlet for kinks, excessive bends and be certain inlet lines have the minimum specified inside diameter. Recommended minimum inlet line inside diameter is 5/8". Recommended maximum air inlet restriction is 25" of water. |
| | B. Restricted oil return (to engine) | B. Oil return to the engine should not be in any way restricted. Check for excessive bends, kinks and restrictions in the oil return line. Minimum recommended oil return line size is 5/8" O.D. tubing or equivalent I.D. (1/2" minimum). **Return line must constantly descend** from the compressor to the engine crankcase. Make certain oil drain passages in the compressor and mating engine surfaces are unobstructed and aligned. Special care must be taken when sealants are used with, or instead of, gaskets. |
| | C. Poorly filtered inlet air. | C. Check for damaged, defective or dirty air filter on engine or compressor. Check for leaking, damaged or defective compressor air intake components (e.g. induction line, fittings, gaskets, filter bodies, etc.). The compressor intake should not be connected to any part of the exhaust gas recirculation (E.G.R.) system on the engine. |
| | D. Insufficient compressor cooling (compressor runs hot). | D. *For air-cooled portions of the compressor:*<br>1. Remove accumulated grease, grime or dirt from the cooling fins. Replace components found damaged.<br>2. Check for damaged cooling fins. Replace components found damaged.<br>*For water-cooled compressor or water-cooled portions of the compressor:*<br>1. Check for proper coolant line sizes. Minimum recommended size is 1/2" O.D. tubing.<br>2. Check the coolant flow through the compressor. Minimum allowable flow is 2.5 gallons per minute at engine governed speed. If low coolant flow is detected, inspect the coolant lines and fittings for accumulated rust scale, kinks and restrictions.<br>3. Water temperature should not exceed 200 degrees Fahrenheit.<br>4. Optimum cooling is achieved when engine coolant flows, as shown in Figure 8 of this manual. |

# COMPRESSOR TROUBLESHOOTING CHART (Continued)

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| 1. (Continued.) | E. Contaminants not being regularly drained from system reservoirs. | E. Check reservoir drain valves to insure that they are functioning properly. It is recommended that the vehicle should be equipped with functioning automatic drain valves, or have all reservoirs drained to zero (0) psi daily, or optimally to be equipped with a desiccant-type air dryer prior to the reservoir system. |
| | F. Compressor runs loaded an excessive amount of time. | F. Vehicle system leakage should not exceed industry standards of 1 psi pressure drop per minute without brakes applied and 3 psi pressure drop per minute with brakes applied. If leakage is excessive, check for system leaks and repair. |
| | G. Excessive engine crankcase pressure. | G. Test for excessive engine crankcase pressure & replace or repair ventilation components as necessary. (An indication of crankcase pressure is a loose or partially lifted dipstick.) |
| | H. Excessive engine oil pressure. | H. Check the engine oil pressure with a test gauge and compare the reading to the engine specifications. Bendix does not recommend restricting the compressor oil supply line because of the possibility of plugging the restriction with oil contaminants. Minimum oil supply line size is 3/16" I.D. tubing. |
| | I. Faulty compressor. | I. Replace or repair the compressor only after making certain none of the preceding installation defects exist. |
| 2. Noisy compressor operations. | A. Loose drive gear or pulley. | A. Inspect the fit of the drive gear on pulley on the compressor crankshaft. The pulley on gear must be completely seated and the crankshaft nut must be tight. If the compressor crankshaft surface or its keyway are damaged, it is an indication of loose drive components. If damage to the compressor crankshaft is detected, replace the compressor. When installing the drive gear or pulley, torque the crankshaft nut to the appropriate torque specifications. **Do not back off the crankshaft nut to align the cotter pin and castellated nut.** (Some compressors do not use castellated nuts.) **Do not use impact wrenches.** |

# COMPRESSOR TROUBLESHOOTING CHART (Continued)

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| 2. (Continued.) | B. Excessively worn drive couplings or gears. | B. Inspect drive gear and couplings and engine for excessive wear. Replace as necessary. (Nonmetallic gears should be replaced when the compressor is changed.) |
| | C. Compressor cylinder head or discharge line restrictions. | C. Inspect the compressor discharge port and discharge line for carbon build-up. If carbon is detected, check for proper cooling to the compressor. (See Cause and Remedy (D) under Symptom #1.) Inspect the discharge line for kinks and restrictions. Replace discharge line as necessary. |
| | D. Worn or burned out bearings. | D. Check for proper oil pressure in the compressor. Minimum required oil pressure; 15 psi engine idling, 15 psi maximum governed engine rpm. Check for excessive oil temperature—should not exceed 240 degrees Fahrenheit. |
| | E. Faulty compressor. | E. Replace or repair the compressor after determining none of the preceding installation defects exist. |
| 3. Excessive build-up and recover time. Compressor should be capable of building air system from 85-100 psi in 40 seconds with engine at full governed rpm. Minimum compressor performance is certified to meet Federal requirements by the vehicle manufacturer. Do not downsize the original equipment compressor. | A. Dirty induction air filter. | A. Inspect engine or compressor air filter and replace if necessary. |
| | B. Restricted induction line. | B. Inspect the compressor air induction line for kinks and restrictions and replace as necessary. |
| | C. Restricted discharge line or compressor discharge cavity. | C. Inspect the compressor discharge port and line for restrictions and carbon build-up. If a carbon build-up is found, check for proper compressor cooling. Replace faulty sections of the discharge line. |
| | D. Slipping drive components. | D. Check for faulty drive gears and couplings and replace as necessary. Check the condition of drive belts and replace or tighten, whichever is appropriate. |
| | E. Excessive air system leakage. | E. Test for excessive system leakage and repair as necessary. Use the following as a guide: Build system pressure to governor cutout and allow the pressure to stabilize for one minute. Using the dash gauge, note the system pressure and the pressure drop after two minutes.<br>The pressure drops should not exceed:<br>1. 2 psi in each reservoir for a single vehicle.<br>2. 6 psi in each reservoir for a tractor and trailer.<br>3. 8 psi in each reservoir for a tractor and 2 trailers. |

# COMPRESSOR TROUBLESHOOTING CHART (Continued)

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| 3. (Continued.) | F. Sticking unloader pistons. | F. Check the operation of the unloading mechanism. Check the proper operation of the compressor air governor. If the governor is operating properly, replace the unloader mechanism. Inspect for bent, linked or blocked tubing leading to or from the governor. |
| | G. Faulty compressor. | G. Replace or repair the compressor after determining none of the preceding installation defects exist. |
| 4. Compressor fails to unload. | A. Faulty governor or governor installation. | A. Test the governor for proper operation and inspect air lines to and from the governor for kinks or restrictions. Replace or repair the governor or its connecting air lines |
| | B. Faulty or worn unloader pistons or bores. | B. Inspect for worn, dirty or corroded unloader pistons and their bores. Replace as necessary. |
| 5. Compressor leaks oil. | A. Damaged mounting gasket. | A. Check the compressor mounting bolt torque. If the mounting bolt torque is low, replace the compressor mounting gasket before retorquing the mounting bolts. |
| | B. Cracked crankcase or end cover. | B. Visually inspect the compressor exterior for cracked or broken components. Cracked or broken crankcases or mounting flanges can be caused by loose mounting bolts. The end cover can be cracked by overtorquing fitting or plugs installed in the end cover. Replace or repair the compressor as necessary. |
| | C. Loose end cover cap cover. | C. Check the cap screw torques and tighten as necessary. |
| | D. Loose oil supply or return line fittings. | D. Check the torque of external oil line fittings and tighten as necessary. |
| | E. Porous compressor casting. | E. Replace the compressor if porosity is found. |
| | F. Mounting flange or end cover, o-ring or gasket - missing, cut or damaged | F. Replace as necessary. |
| 6. Compressor constantly cycles (compressor remains unloaded for a very short time). | A. Leaking compressor unloader pistons. | A. Remove the compressor inlet air strainer or fitting. With the compressor unloaded (not compressing air), check for air leakage. Replace as necessary. |
| | B. Faulty Governor. | B. Test the governor for proper operation and repair or replace as necessary. |

# COMPRESSOR TROUBLESHOOTING CHART (Continued)

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| 6. (Continued.) | C. Excessive system leakage. | C. Test for excessive system leakage as instructed in Symptom #3 Remedy E. Reduce leakage wherever possible. |
| | D. Excessive reservoir contaminants. | D. Drain reservoirs. |
| 7. Compressor leaks coolant. | A. Improperly installed plugs and coolant line fittings. | A. Check torque of fittings and plugs and tighten as necessary. Overtorqued fittings and plugs can crack the head or block casting. |
| | B. Freeze cracks due to improper antifreeze strength. | B. Test antifreeze and strengthen as necessary. Check coolant flow through compressor to assure the proper antifreeze mixture reaches the compressor. |
| | C. Faulty compressor (porous castings). | C. If casting porosity is detected, replace the compressor. |
| 8. Compressor head gasket failure. | | A. Clear restriction or replace line. |
| | B. Loose head bolts | B. Tighten evenly to a torque of 25-30 foot pounds. |
| | C. Faulty compressor or head gasket. | C. Check for rough or poorly machined head or block surfaces. Replace compressor as necessary. |