

GVB/D

SERVICE INSTRUCTIONS

FOR

GVB/D GOVERNORS WITH RETARD START & PUFF LIMITER PISTONS

SUBJECT: Servicing Governor Cover Assemblies with Retard Start and Puff Limiter Pistons.

In order to install the lube actuated and manifold pistons with piston rings assembled to them, it will be necessary to have the tools pictured in Figures 1 and 2 fabricated locally.

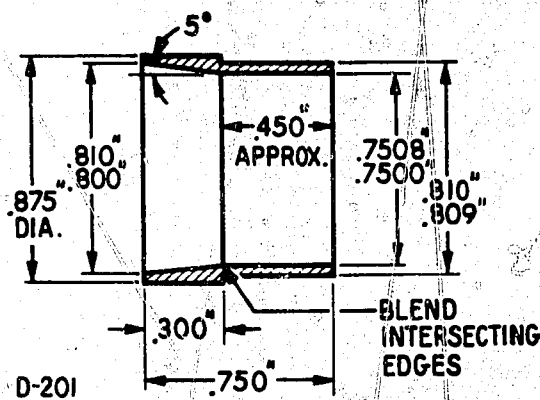


FIGURE 1
MANIFOLD PISTON
INSTALLATION TOOL

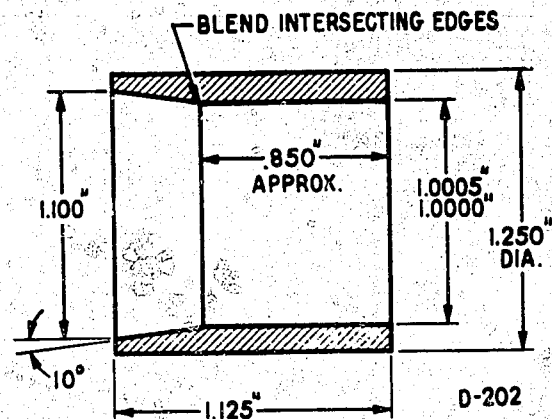


FIGURE 2
LUBE PISTON
INSTALLATION TOOL

NOTE: Use cold rolled steel and case harden to .003" - .005".

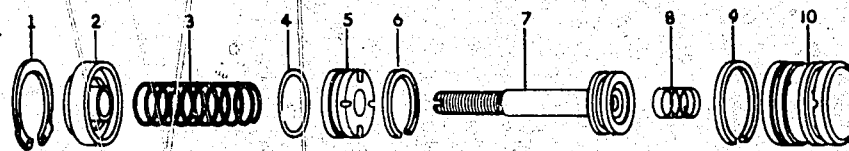


FIGURE 3

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EXPLODED VIEW OF RETARD START & PUFF LIMITER PISTON CONFIGURATION

NOTE: Unless otherwise noted, numbers in parentheses refer to illustration numbers in Figure 3.

1.1 - DISASSEMBLY :

- | | |
|--|--|
| <ol style="list-style-type: none"> 1) Remove nut, tab washer and stop plate assembly from threaded shaft of manifold piston (7). 2) Remove spring retaining ring (1) with a pair of No. 1 "Tru-Arc" pliers, Bacharach part number 72-5001. 3) Remove complete piston assembly (See Figure 3) from governor cover assembly.
CAUTION: Piston spring seat (5) manifold piston (7), lube actuated piston (10) and governor cover assembly are mated parts and must be kept together at all times. 4) Remove both piston rings (9) from lube actuated piston (10). | <ol style="list-style-type: none"> 5) Piston spring seat (5), manifold piston (7), manifold piston spring (8), or manifold piston spacer and spring shim can be removed from lube actuated piston (10) as follows: <ol style="list-style-type: none"> a. Install stop plate assembly on shaft of manifold piston (7). b. Clamp stop plate assembly in a vise with piston assembly in a horizontal position. c. Holding on to piston with one hand and using a rubber or plastic mallet, strike the vertical edge of piston (10) with a short, sharp, horizontal (20° to 30° angle) blow in direction away from the stop plate assembly. |
|--|--|

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NOTE : In some cases the piston ring (6) will catch in the undercut in the lube piston (10) during disassembly. Use two or three paper clips inserted through the air holes to compress the ring and release the manifold piston (7).

- 6) Remove "O" ring gasket (4) from piston spring seat (5), piston ring (6) from manifold piston (7), manifold piston spring (8) and spring shim (See Note) from lube actuated piston (10).

NOTE : For inactive puff limiter governors, spring shim and manifold piston spring (8) is replaced by a manifold piston spacer placed between piston spring seat (5) and manifold piston (7).

1.2 - CLEANING :

- 1) Wash (Clean) all parts in Varsol or an equivalent cleaning agent.

CAUTION :

- Piston spring seat (5), manifold piston (7), lube actuated piston (10) and governor cover assembly are closely fitted and should be washed separately to avoid damage.
- 2) Blow dry, filtered compressed air through air and lube oil ducts in governor cover assembly to make certain all ducts are clean and open.
- 3) Dry all parts thoroughly and place them on a clean cloth.

1.3 - INSPECTION :

PART	INSPECT FOR FOLLOWING CONDITION (S)	CORRECTIVE ACTION WHEN REQUIRED
1) Spring Retaining, Ring (1)	Loose, damaged	Replace ring
2) Piston Stop (2)	Damaged, cracked, scored	Replace stop
3) Piston Spring (3)	Broken, nicked or worn (flat spot on coils)	Replace spring
4) Spring Seat "O" ring, Gasket (4)	Not reusable	Always replace
5) Piston Spring, Seat (5)	Damaged, cracked, scored	Replace Governor Cover Assy
6) Manifold Piston Ring (6)	Scored, broken, damaged or worn	Replace ring
7) Manifold Piston (7)	Scored, bent, damaged threads cracked or worn	Replace Governor Cover Assy
8) Manifold Piston, Spring (8)	Broken, nicked or worn	Replace spring
9) Manifold Piston Spacer	Damaged	Replace spacer
10) Manifold Piston, Spring Shim	Damaged	Replace shim
11) Lube Piston (10)	Scored inside or outside, cracked or worn	Replace Governor Cover Assy
12) Governor Cover Assembly	Cracked, damaged, scored or worn piston bore, damaged lube oil or air pressure holes.	Replace Governor Cover Assy

1.4 REASSEMBLY

- 1) Dip all parts in clean test oil or lube oil.
- 2) With lube piston (10) in a vertical position, install manifold piston spring shim and then manifold piston spring (8) into small counterbore in center of piston bore. (See Note).

NOTE : For inactive puff limiter governors, spring shim and manifold piston spring (8) is replaced by a manifold piston spacer placed between piston spring seat (5) and manifold piston (7).

- 3) Install piston ring (6) in groove on manifold piston (7)
- 4) Insert small end of manifold piston tool (See Fig. 1) into lube piston (10) bore, until seated.
- 5) Insert manifold piston (7) with piston ring (6) in - stalled into bore of tool and press piston all the way in until it bottoms in bore of lube piston (10)
- 6) Remove manifold piston tool from lube piston (10)
- 7) Install "O" ring gasket (4) in groove on piston spring seat (5) O. D.
- 8) Apply a film of grease, LU 3003 or equivalent to "O" ring gasket (4).
- 9) With the four notches on face of piston spring seat (5) toward lube piston (10), slide piston spring seat (5) over manifold piston (7) shaft and press into lube piston (10) until firmly seated.

- 10) Install both lube piston rings (9) into grooves on lube piston (10) O. D.
- 11) Insert lube piston (10) with piston rings (9) in - stalled solid end first into tapered end of lube piston tool (See Fig. 2) until piston just clears other end of tool.
- 12) Place lube piston tool over piston bore in governor cover assembly and press lube piston (10) through piston tool into bore until seated.
- 13) With piston bore in governor cover assembly in a vertical position, install lube piston spring (3) over threaded shaft of manifold piston (7) and seat in circular groove in spring seat (5).
- 14) Slide piston stop (2) with circular groove side toward piston spring (3) over threaded shaft of manifold piston (7) making sure spring lines up with circular groove in spring stop.
- 15) With piston stop (2) pressed below groove in governor cover bore, insert retaining ring (1) in groove with a pair of No. 1 "Tru - Arc" pliers, Bacharach part number 72-5001.

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**SERVICE INFORMATION AND TESTING PROCEDURES
FOR
GVB/D GOVERNORS WITH RETARD START AND PUFF LIMITER
CONFIGURATION**

APPLICATION:

APE 6BB and APE 8VBB Fuel Injection Pumps used on MACK Turbocharged Diesel Engines.

INFORMATION:

Since government controls are becoming more and more severe in restricting the visible as well as the invisible emissions from diesel engines, a PUFF LIMITER DEVICE has been incorporated into the design of the Retard Start GVB/D governors installed on APE 6BB and APE 8VBB Fuel Injection Pumps. This feature will enable turbocharged engines to meet Federal smoke level regulations required for engine certification.

DESCRIPTION:

The term PUFF LIMITER identifies a new type GVB/D governor with automatic stop plate position control. This device is sensitive to and operated by boost pressure developed by the turbocharger. It is designed to operate automatically to reduce full load fuel delivery during acceleration and shifting, until boost pressure reaches a predetermined value, reducing the level of smoke puff characteristic of the turbocharged engines.

The PUFF LIMITER consists of a piston and a spring assembled into the existing Retard Start Device, and an external air line running from the top of the governor to the engine intake manifold. PUFF LIMITER operation is controlled by inlet manifold pressure, while the Retard Start Device is controlled by engine oil pressure.

OPERATION:

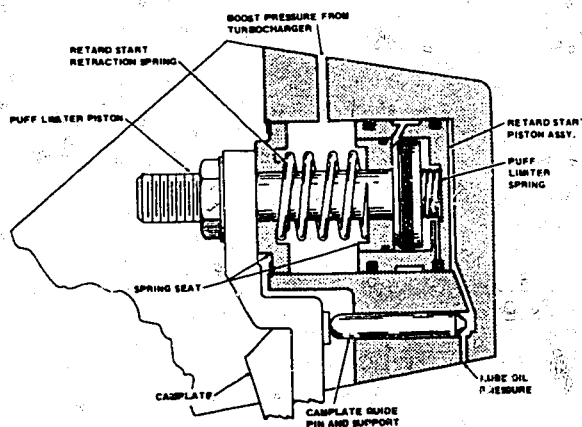


FIGURE 1
STATIC POSITION PRIOR TO STARTING

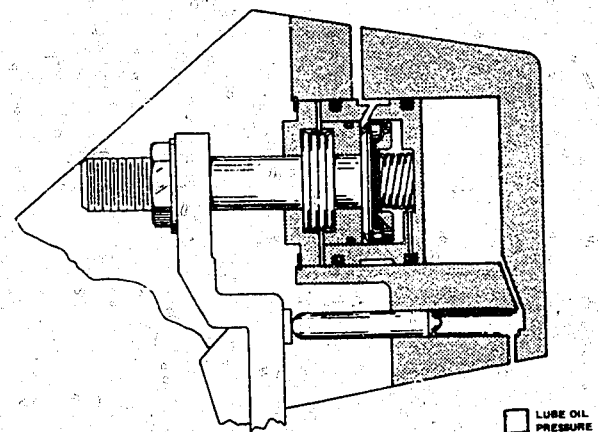


FIGURE 2
INITIAL NO LOAD OPERATING POSITION

Figure 1 illustrates the static position of all component parts prior to starting the engine. Note the Retard Start retraction spring and PUFF LIMITER spring are both fully extended and the PUFF LIMITER piston resting against its internal spring seat. The stop plate guide pin is fully retracted and the stop plate assembly rests in the Retard Start position.

Figure 2 illustrates the initial operating NO-LOAD position. This condition exists prior to turbocharger boost pressure build up. This same condition also exists during the transient conditions when the engine is being shifted through the gears. Note the position of the Retard Start piston assembly and PUFF LIMITER piston. The extended position is the result of the engine lubricating oil pressure. As the engine lubricating oil enters the

OPERATION:

Retard Start position chamber, it also enters the stop plate guide pin chamber. This action forces the guide pin out, providing the necessary support to prevent cocking of the stop plate.

Figure 3 illustrates the normal operating position with engine under load. The turbocharger boost pressure has increased and enters a chamber inside the Retard Start piston between the spring seat and the head of the PUFF LIMITER piston through special porting. This pressure overcomes the PUFF LIMITER spring pressure, causing the PUFF LIMITER piston to retract, pulling the stop plate assembly and stop plate guide pin forward toward pump enabling the injection pump rack to assume the normal running position.

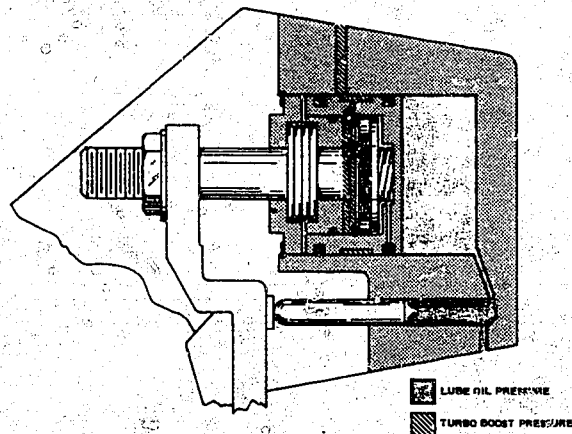


FIGURE 3
NORMAL LOAD OPERATING POSITION OF THE
PUFF LIMITER PISTON AND RETARD START PISTON

TESTING

Procedure for determining retard start (lube oil) piston "pop-out" pressure and PUFF LIMITER (air) piston "pop-in" on calibrated pump.

RETARD START DEVICE:

Operating lever in idle position.

1. Connect lube oil line to injection pump and slowly increase lube oil pressure until stop plate begins to move outward - this is oil piston "pop-out" and pressure must not exceed 35 PSI. Visually check to assure that lower stop plate guide pin moves outward with the plate.

NOTE: After the oil piston reaches the end of its stroke, the oil pressure will increase as much as 10 PSI. This final pressure is not to be confused with the "pop-out" pressure.

PUFF LIMITER:

- A. Pump at zero RPM and operating lever in idle position.
 1. Remove governor cover and attach dial indicator in position to contact stop plate or end of stop plate screw (See Figure 5). Indicator should be zeroed with no air to the PUFF LIMITER.
 2. Continue to maintain lube oil pressure at 35 PSI and connect air supply line with filter and regulator to air inlet hole at top side section of governor cover assembly. Apply air pressure slowly until reaching 25 PSI and read the stroke on the indicator to determine air piston travel which must be between 0.093" - 0.105".

- B. Pump at peak torque RPM (600 RPM for APE 6BB and 700 RPM for APE 8VBB) and operating lever in full load position.
 1. With lube oil pressure at 35 PSI, set dial indicator at zero (As in A1).
 2. At zero PSI, slowly release air pressure until indicator stops moving and record pressure on air gage.
 3. Air pressure gage should read between 7-12 PSI.

EQUIPMENT REQUIRED:**AIR SUPPLY:**

1. Air pressure supply - filtered and regulated at 25 PSI.
2. Pressure regulator for 0-25 PSI range installed near pump air inlet at front (top) of governor cover.
3. Air filter installed ahead of pressure regulator. (See Figure 4).

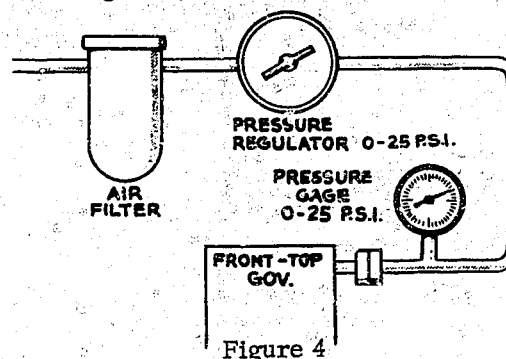


Figure 4

4. Air lines must be 1/8" or 3/16" I.D.

LUBE OIL SUPPLY:

1. Pressure lube oil supply capable of providing filtered and regulated lube oil pressure of 50 PSI at pump lube inlet.
2. Pressure gage for lube oil located close to pump inlet.
3. Lube oil inlet lines must be 1/8" - 3/16" I.D.

MISCELLANEOUS:

Dial indicator with .001" subdivisions. Indicator to be provided with an adjustable bracket for longitudinal positioning. (See Figure 5)

**DIAL INDICATOR
.001" DIV.**

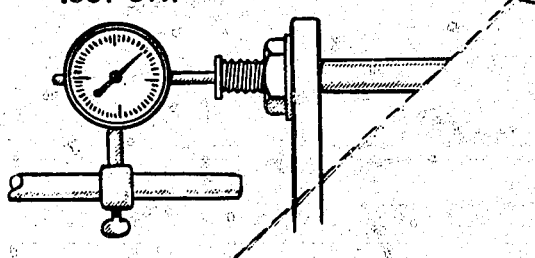


Figure 5

TROUBLESHOOTING HINTS

1. Piston inoperative.
 - a. Scored housing, piston or shaft
 - b. Damaged piston ring
 - c. Damaged "O" ring - low lube pressure
 - d. Worn piston bore
 - e. Foreign particles
 - f. Stuck guide pin (restricting lube oil flow)
2. Excessive lube oil leakage.
 - a. Piston rings damaged
 - b. Worn piston bore
3. Excessive oil in governor.
 - a. Damaged "O" ring on lube tube
 - b. Damaged lube tube
 - c. Damaged lube tube lower gasket
4. Inoperative (travel) puff limiter (less than .090" - .110")
 - a. Scoured or bent shaft
 - b. "O" ring damaged (piston spring seat)
 - c. Damaged puff limiter piston ring
 - d. Insufficient air pressure
 - e. Restricted air passage
 - f. Damaged or broken spring

**SERVICE INFORMATION AND TESTING PROCEDURES
FOR
GVB/D GOVERNORS WITH RETARD-START, COLD START VALVE
AND PHASE II PUFF LIMITERS WITH TEFLON PISTON RINGS**

APPLICATION:

APE 6BB and APE 8VBB Fuel Injection Pumps used on MACK Turbocharged Diesel Engines.

INFORMATION:

Since government controls are becoming more and more severe in restricting the visible as well as the invisible emissions from diesel engines, a PUFF LIMITER DEVICE has been incorporated into the design of the Retard Start GVB/D governors installed on APE 6BB and APE 8VBB Fuel Injection Pumps. This feature will enable turbocharged engines to meet Federal smoke level regulations required for engine certification.

DESCRIPTION:

The term PUFF LIMITER identifies a type GVB/D governor with automatic stop plate position control. This device is sensitive to and operated by boost pressure developed by the turbocharger. It is designed to operate automatically to reduce full load fuel delivery during acceleration and shifting, until boost pressure reaches a predetermined value, reducing the level of smoke puff-characteristic of the turbocharged engines.

The PUFF LIMITER consists of a piston and a spring assembled into the existing Retard Start Device, and an external air line running from the top of the governor to the engine intake manifold. PUFF LIMITER operation is controlled by inlet manifold pressure, while the Retard Start Device is controlled by engine oil pressure.

OPERATION:

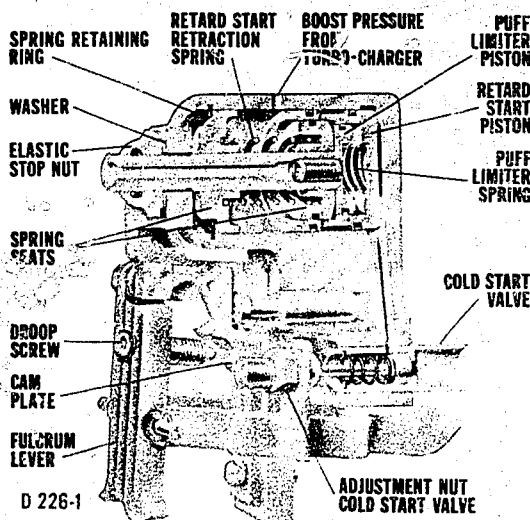


FIGURE 1 - Starting Position - Retard Start Cranking RFM

Figure 1 illustrates the static position of all component parts prior to starting the engine. Note the Retard Start retraction spring and PUFF LIMITER spring are both fully extended and the PUFF LIMITER piston resting against its internal spring seat. The stop plate guide pin is fully retracted and the stop plate assembly rests in the Retard Start position.

The latest GVB/D Governors have a Cold Start Valve Assembly (See Figure 1) installed in the governor housing where the pump lube tube connects to the housing.

When engine is not running, the valve's spring loaded piston closes off the lube oil duct from the pump and allows oil trapped in the retard start piston chamber to drain into the governor area. While starting the engine, the valve piston is held closed by a stop on the control rack link (See Figure 1), this keeps the lube oil pressure from activating the retard start piston until engine has started.

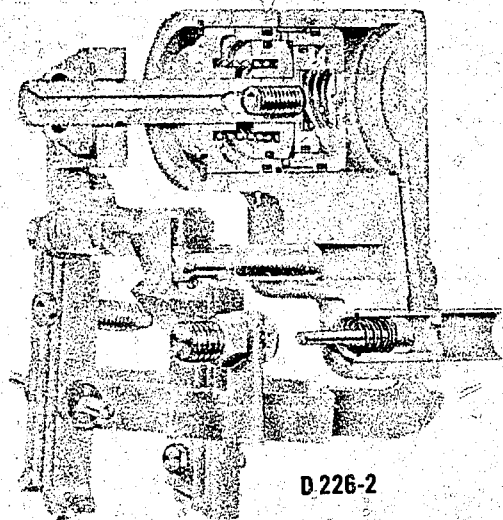


FIGURE 2 - No-Load Operating Position

Figure 2 illustrates the initial operating NO-LOAD position. This condition exists prior to turbocharger boost pressure build up. This same condition also exists during the transient conditions when the engine is being shifted through the gears. Note the position of the Retard Start piston assembly and PUFF LIMITER piston. The extended position is the result of the engine lubricating oil pressure. The outward movement of the fulcrum lever and control link stop permit the cold start valve to open, allowing the lube oil to flow through the ducts to the retard start piston thus moving the piston to the required operating position. The stop plate guide pin is directly connected to the stop plate hanger and adjustable stop plate thus providing the necessary support to prevent cocking of the stop plate.

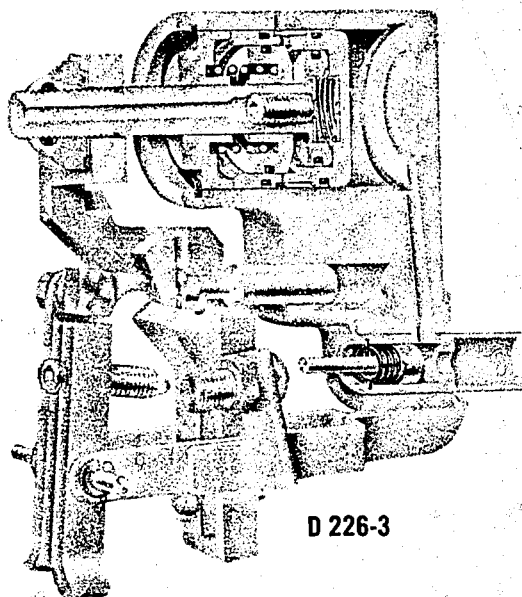


FIGURE 3 - Full Load Position

Puff Limiter and Retard Start Pistons
in Normal Run-Position

Figure 3 illustrates the normal operating position with engine under load. The turbocharger boost pressure has increased and enters a chamber inside the Retard Start piston (lube actuated) between the spring seat and the head of the PUFF LIMITER (manifold) piston through special porting. This pressure overcomes the PUFF LIMITER spring pressure, causing the PUFF LIMITER piston to retract, pulling the stop plate assembly and stop plate guide pin forward toward pump enabling the injection pump rack to assume the normal running position.

The longitudinal movement of the PUFF LIMITER (manifold) piston is controlled by an internal spring adjusting screw and spacer. Section D330/520 V, page 29.

All final settings MUST BE TO EXACT SPECIFICATIONS PER ENGINE REQUIREMENTS.

TESTING

Procedure for determining retard start (lube oil) piston "pop-out" pressure and PUFF LIMITER (air) piston "pop-in" on calibrated pump.

RETARD START DEVICE:

Operating lever in idle position.

1. Connect lube oil line to injection pump and slowly increase lube oil pressure until stop plate begins to move outward - this is oil piston "pop-out" and pressure must not exceed 35 PSI. Visually check to assure that lower stop plate guide pin moves outward with the plate.

NOTE: After the oil piston reaches the end of its stroke, the oil pressure will increase as much as 10 PSI. This final pressure is not to be confused with the "pop-out" pressure.

PUFF LIMITER:

- A. Pump at zero RPM and operating lever in idle position.
 1. Remove governor cover and attach dial indicator in position to contact stop plate or end of stop plate screw (See Figure 5). Indicator should be zeroed with no air to the PUFF LIMITER.
 2. Continue to maintain lube oil pressure at 35 PSI and connect air supply line with filter and regulator to air inlet hole at top side section of governor cover assembly. Apply air pressure slowly until reaching 25 PSI and read the stroke on the indicator to determine air piston travel (see pump specifications for specific travel distance).
- B. Pump at peak torque RPM (600 RPM for APE 6BB and 700 RPM for APE 8VBB) and operating lever in full load position.
 1. With lube oil pressure at 35 PSI, set dial indicator at zero (as in A1).
 2. At zero PSI, slowly release air pressure until indicator stops moving and record pressure on air gage.
 3. See pump specifications for specific air pressure reading.

EQUIPMENT REQUIRED:

AIR SUPPLY:

1. Air pressure supply - filtered and regulated at 25 PSI.
2. Pressure regulator for 0-25 PSI range installed near pump air inlet at front (top) of governor cover.
3. Air filter installed ahead of pressure regulator. (See Figure 4).
4. Air lines must be 1/8" or 3/16" I.D.

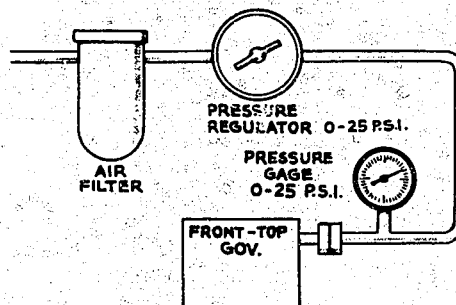


FIGURE 4

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LUBE OIL SUPPLY:

1. Pressure lube oil supply capable of providing filtered and regulated lube oil pressure of 50 PSI at pump lube inlet.
2. Pressure gage for lube oil located close to pump inlet.
3. Lube oil inlet lines must be 1/8" - 3/16" I. D.

MISCELLANEOUS:

Dial indicator with .001" subdivisions. Indicator to be provided with an adjustable bracket for longitudinal positioning (See Figure 5).

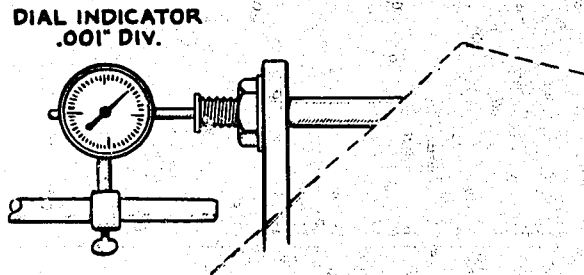


FIGURE 5

TROUBLESHOOTING HINTS

1. Piston inoperative.
 - a. Scored housing, piston or shaft
 - b. Damaged piston ring
 - c. Damaged "O" ring - low lube pressure
 - d. Worn piston bore
 - e. Foreign particles
 - f. Stuck guide pin
2. Excessive lube oil leakage.
 - a. Piston rings damaged
 - b. Worn piston bore
3. Excessive oil in governor.
 - a. Damaged "O" ring on lube tube
 - b. Damaged lube tube
 - c. Damaged lube tube lower gasket
4. Inoperative (travel) puff limiter (less than pump specification).
 - a. Scoured or bent shaft
 - b. "O" ring damaged (piston spring seat)
 - c. Damaged puff limiter piston ring
 - d. Insufficient air pressure
 - e. Restricted air passage
 - f. Damaged or broken spring

CAUTION: These instructions are subject to change by the individual pump or governor specifications.

SERVICE INSTRUCTIONS FOR GVB/D GOVERNORS

WITH RETARD START & PUFF LIMITER PHASE II ("TEFLON" RINGS) PISTONS

SUBJECT: Servicing Governor Cover/Housing Assemblies with Retard Start and Puff Limiter Piston using "Teflon" Piston Rings.

When installing the lube and manifold actuated pistons with "Teflon" rings into governor covers/housings, the service tools in Figures 1 thru 4 are required.

NOTES

1. Manifold Piston Installation Tool TSE 7992 (See Figure 1) is the same as Phase I Tool (See Figure 1 in Section D 330/3001).
2. Lube Piston Installation Tool TSE 7993 (See Figure 2) MUST be used for assembling pistons with "Teflon" rings. The "thin walled" end of the tool pilots in the recessed diameter incorporated in Phase II governor cover/housings. NOTE: This tool can also be used for installing Phase I pistons with cast iron rings (Ref. Fig. 2-Section D330/3001).
3. **IMPORTANT:** The "Teflon" rings must be cautiously assembled to the respective pistons to prevent damage such as rolled edges, stretching or indentations. Use service tools TSE 7994 and TSE 7997 (Figures 3 & 4) to properly assemble Teflon rings according to service instructions . (Ref. par. 1. 4 - this section).

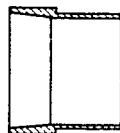


FIGURE 1
TSE 7992
MANIFOLD PISTON
INSTALLATION TOOL

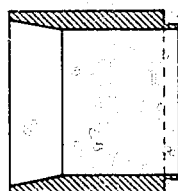


FIGURE 2
TSE 7993
LUBE PISTON
INSTALLATION TOOL



FIGURE 3
TSE 7994
MANIFOLD PISTON
RING INSTALLATION
TOOL

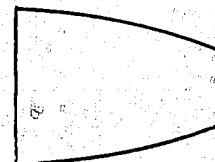
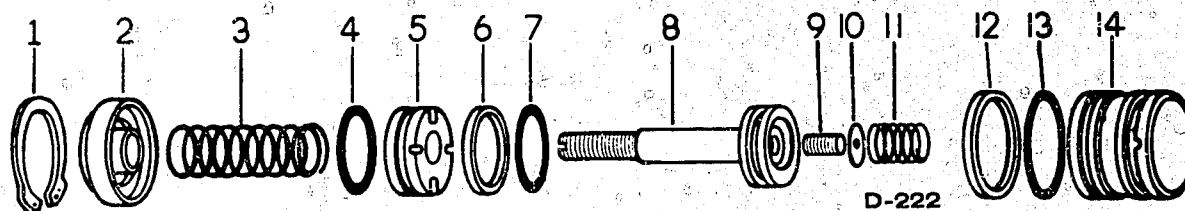


FIGURE 4
TSE 7997
LUBE PISTON
RING INSTALLATION
TOOL

NOTE: All four (4) tools are available from American Bosch, Springfield, Mass.



Retard Start & Puff Limiter Piston
Phase II Configuration
Figure 5

EXPLODED VIEW OF RETARD START & PUFF LIMITER PISTON PHASE II CONFIGURATION

NOTE: Unless otherwise noted, numbers in parentheses refer to illustration numbers in Figure 5.

1.1 - DISASSEMBLY:

- 1) Remove nut, tab washer and stop plate hanger from threaded shaft of manifold piston (8).
- 2) Remove spring retaining ring (1) with a pair of No. 1 "Tru-Arc" pliers.
- 3) Remove complete piston assembly (See Figure 5) from governor cover assembly.
- 4) Remove lube piston stop (2) and lube piston spring (3) from threaded shaft of manifold piston (8).
- 5) Remove piston rings (12) and "O" ring gaskets (13) from lube actuated piston (14).
- 6) Piston spring seat (5) manifold piston (8), manifold piston spring spacer (10) and manifold piston spring (11) can be removed from lube actuated piston (14) as follows:

CAUTION: Piston spring seat (5), manifold piston (8), lube actuated piston (14) and governor cover/housing assembly should be kept together.

- a. Install stop plate hanger on threaded shaft of manifold piston (8).
- b. Clamp hanger in a vise with piston assembly in a horizontal position.
- c. Holding on to piston with one hand and using a rubber or plastic mallet, strike the vertical edge of piston (14) with a short, sharp horizontal (20° to 30° angle) blow in direction away from stop plate hanger.

- 7) Remove "O" ring gasket (4) from piston spring seat (5), piston ring (6) and "O" ring gasket (7) from manifold piston (8), manifold piston spring (11) and spring spacer (10) from lube actuated piston (14).
NOTE: For inactive puff limiter governors, spring spacer (10) and manifold piston spring (11) is replaced by a manifold piston spacer placed between piston spring seat (5) and manifold piston (8).

1.2 - CLEANING:

- 1) Wash (Clean) all parts in Varsol or an equivalent cleaning agent.
CAUTION: Piston spring seat (5) manifold piston (8) lube actuated piston (14) and governor cover or housing assembly are closely fitted and should be washed separately to avoid damage.
- 2) Blow dry, filtered compressed air through air and lube oil ducts in governor cover or housing assembly to make certain all ducts are clean and open.
- 3) Dry all parts thoroughly and place them on a clean dry surface.

1.3 - INSPECTION:

PART	INSPECTION FOR FOLLOWING CONDITION(S)	CORRECTIVE ACTION WHEN REQUIRED.
1) Spring Retaining Ring (1)	Loose, damaged	Replace ring
2) Lube Piston Stop (2)	Damaged, cracked, scored	Replace stop
3) Lube Piston Spring (3)	Broken, nicked or worn (Flat spot on coils)	Replace spring
4) Spring Seat "O" ring Gasket (4)	Not reusable	Always replace
5) Piston Spring Seat (5)	Damaged, cracked, scored	Replace seat
6) Manifold Piston Ring (6)	Not reusable	Always replace
7) Manifold Piston "O" ring Gasket (7)	Not reusable	Always replace
8) Manifold Piston (8)	Scored, bent shaft, damaged threads, cracked or worn	Replace piston
9) Manifold Spring Adjusting Screw(9)	Missing plastic locking element or damaged threads	Replace screw
10) Manifold Piston Spring Spacer (10)	Damaged	Replace spacer
11) Manifold Piston Spring (11)	Broken, nicked or worn	Replace spring
12) Lube Piston Ring (12)	Not reusable	Always replace
13) Lube Piston "O" ring Gasket (13)	Not reusable	Always replace
14) Lube Actuated Piston (14)	Scored inside or outside, cracked or worn	Replace piston
15) Governor Cover or Housing Assy	Cracked, damaged, scored or worn piston bore, damaged lube oil or air pressure holes	Replace assembly

1.4 - REASSEMBLY:

- 1) Dip all parts in clean test oil or lube oil.
- 2) Install manifold "O" ring gasket (7) on manifold piston ring installer TSE 7994 (See Fig. 3) small end first.
- 3) Place end of manifold piston (8) against large end of installer (TSE 7994) and slide "O" ring gasket (7) into groove in piston (8).
- 4) Repeat steps 2 and 3 with manifold piston ring (6) making sure it's seated in piston groove on top of "O" ring gasket (7).
- 5) Install manifold adjusting screw (9) into threaded hole in manifold piston (8), Allen socket end inward-towards small threaded (slotted) end of shaft. End of adjusting screw (9) must be set flush or just below bottom of counterbore in manifold piston (8).
- 6) With lube piston (14) in a vertical position, install manifold piston spring (11) into small counterbore in center of piston bore.

AMERICAN BOSCH MARKETING**AMBAC**
INDUSTRIES**SPRINGFIELD, MASS. 01107****1.4 - REASSEMBLY (Con't)****NOTE:**

For inactive puff limiter governors, spring spacer (10) and manifold piston spring (11) is replaced by a manifold piston spacer placed between piston spring seat (5) and manifold piston (8).

- 7) Insert small end of manifold piston tool TSE 7992 (See Fig. 1) into lube piston (14) bore, until seated.
- 8) Apply small amount of purple grease, LU 3003 or equivalent to manifold spring spacer (10) and place in counterbore of manifold piston (8). (Grease will hold spacer in place).

IMPORTANT: Dip all remaining parts in clean test or lube oil.

- 9) Insert manifold piston (8) with "O" ring gasket (7) and piston ring (6) installed into bore of tool (TSE 7992) and press piston downward until it bottoms in bore of lube piston (14). Use a 5/8" deep well socket or hollow tubing for pressing tool when assembling pistons. Remove manifold piston tool from lube piston.
- 10) Install lube piston "O" ring gasket (13) on lube piston ring installer TSE 7997 (See Fig. 4) small end first.
- 11) Place end of lube piston (14) against large end of installer (TSE 7997) and slide "O" ring gasket (13) into groove in piston (14).

CAUTION: Always reverse piston (14) (end for end) when installing second "O" ring gasket (13).

- 12) Repeat Steps 10 and 11 with lube piston rings (12), assuring that rings are seated properly in piston groove on top of "O" ring gaskets (13).
- 13) Install "O" ring gasket (4) in groove on piston spring seat (5) O. D.

- 14) Apply a film of grease, LU 3003 or equivalent to "O" ring gasket (4).
- 15) With the four notches on face of piston spring seat (5) inward, toward lube piston (14), slide piston spring seat (5) over manifold piston shaft (8) and press into lube piston (14) until firmly seated.
- 16) Insert lube piston (14), with piston rings (12) and "O" ring gaskets (13) installed, solid end first, into tapered end of hole in lube piston tool TSE 7993 (See Fig. 2) until piston is flush with other end of tool.
- 17) Insert lube piston tool (TSE 7993) into piston chamber of governor housing (the thin walled lip of the tool must be seated in the counterbore of the piston bore).

NOTE:

The thin walled lip of lube piston tool (TSE 7993) allows the piston rings (12) free movement pass the snap ring groove when installing the lube piston (14).

- 18) Press lube piston (14) through piston tool into governor housing or cover bore until seated.
- 19) With piston bore in governor housing or cover in a vertical position, install lube piston spring (3) over threaded shaft of manifold piston (8) and seat in circular groove in spring seat (5).
- 20) Slide piston stop (2) with circular groove side toward piston spring (3) over threaded shaft of manifold piston (8), making sure spring lines up with circular groove in spring stop.
- 21) With piston stop (2) pressed below snap ring groove in bore, insert retaining ring (1) (flat side facing outward) in groove with a pair of No. 1 "Tru-Arc" pliers.

SERVICE INFORMATION And INSTRUCTIONS

For

GVB/D GOVERNORS WITH COLD START VALVE FITTING

APPLICATION:

APE 6BB and APE 8VBB Fuel Injection Pumps used on MACK Turbocharged Diesel Engines.

INFORMATION:

The latest GVB/D Governors have a Cold Start Valve Assembly (See Figure 1) installed in the governor housing where the pump lube tube connects to the housing.

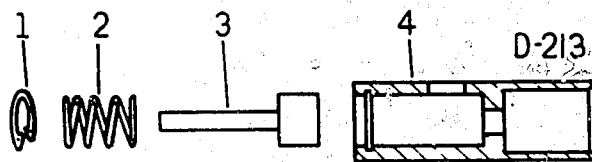


FIGURE 1
COLD START VALVE

When engine is not running, the valve's spring loaded piston closes off the lube oil duct from the pump and allows oil trapped in the retard start piston chamber to drain into the governor area. While starting the engine, the valve piston is held closed by a stop on the control rack link (See Figure 2), this keeps the lube oil pressure from activating the retard start piston until engine has started.

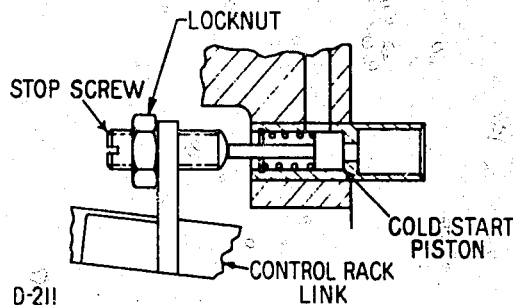


FIGURE 2
COLD START VALVE AND LINK STOP

INSTRUCTIONS:

1. INSPECTIONS

- 1.1 Replace valve assembly if spring is broken.
- 1.2 Replace valve assembly if piston shaft is broken or damaged.
- 1.3 Replace valve assembly if piston is inoperative.

2. DISASSEMBLY

- 2.1 With governor disassembled, heat housing area around valve assembly to about 150° F. in order to soften the "LOCTITE" adhesive that retains the valve and remove from housing.

3. CLEANING

- 3.1 Clean valve cavity in housing with "OAKITE #156" or equivalent.

4. REASSEMBLY

- 4.1 Measure I. D. of valve hole in housing.
- 4.2 If hole measures .375" it must be reamed with a .3901"-.3911" (.3906") diameter reamer. NOTE: Hole may have already been reamed.
- 4.3 If hole is reamed make sure all chips are removed with air hose.
- 4.4 Lightly coat valve assembly from piston end to within one-half inch of other end with "LOCTITE RC 601".
- 4.5 Position the "V" groove on valve body at 12:00 o'clock and install valve assembly into housing until it extends .490"-.500" from gasket face of housing to end of valve assembly.

NOTE: When groove is at 12:00 o'clock, small hole on O.D. of valve body will line up with oil duct to piston chamber.

CAUTION: Stand governor housing upright while "LOCTITE" is drying, so valve assembly will stay in place.

SERVICE INFORMATION And TESTING PROCEDURES
For
BRAKE SWITCH INCORPORATED INTO GVB/D GOVERNOR
TOP COVERS

CAUTION: These Brake Switch Covers **CAN NOT** be used on GVB/C (Hi-Profit-Retard Start) Governors.

APPLICATION:

APE 6BB and 8VBB pumps with GVB/D retard start governors used on Mack Diesel Engines incorporating the "DYNATARD ENGINE BRAKE SYSTEM".

INFORMATION:

A circuit switch assembled into the GVB/D Governor Top Cover (See Figure 1), when closed, energizes the solenoid control valve in the "Dynatard Brake System" of the engine. The circuit is closed when the governor fulcrum lever moving into high speed shut off or zero fuel position comes in contact with the flat spring of the switch adapter (2).

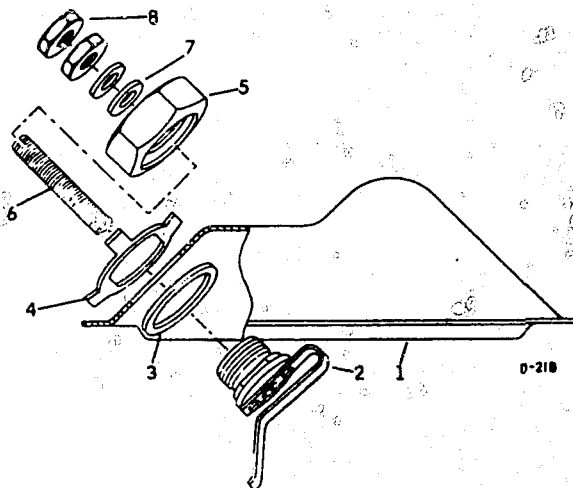


FIGURE 1
BRAKE SWITCH COVER

DESCRIPTION OF PARTS:

Illustration No.	Part Description
1	Top Cover
2	Spring and Adapter Assembly
3	Gasket
4	Tab Washer
5	Securing Nut

Illustration No.	Part Description
6	Adjusting Screw
7	Terminal Washers (2)
8	Lock Nuts (2)

ASSEMBLY:

- Assemble brake switch parts as shown in Figure 1, making sure the flat spring on the adapter assembly (2) is assembled with long end down. Make sure tab on washer (4) is bent against flat on nut (5).
- Adjusting screw (6) must be turned out so that it "Does Not" touch the flat spring.

TEST EQUIPMENT:

- Control rack clamp or holder.
- Depth micrometers.
- Power source of 6 volts (AC or DC) with socket and lamp of same rating for use in the circuit.
- Leads (wires) with alligator clamps or equivalent for making connection to pump housing and the brake switch in series with power source and lamp.

INSTRUCTIONS:

NOTE: Brake Switch setting can be performed either statically (on bench or engine) or dynamically (on test stand). Setting to be made after pump is calibrated.

- STATIC SETTING:** (Performed on Bench or Engine)
 - Operating lever locked in low idle position.
 - Move control rack to "full off" travel as limited by control rack securing screw.
 - Move control rack to obtain .075"-.080" extension from "full off" position and lock in place.
 - Install brake switch cover assembly and gasket on governor.
 - Connect one lead (wire) from test equipment power source to a convenient location on pump or governor housing.

INSTRUCTIONS: (Cont'd)

- 1.6 Connect the other lead (wire) from power source, thru lamp, to the exposed end of brake switch-adjusting screw (6).
 - 1.7 Turn adjusting screw (6) inward until lamp lights up indicating a closed circuit, i. e., brake switch spring (2) in contact with back face of fulcrum lever.
 - 1.8 Tighten lock nuts (8) to secure adjusting screw in adjusted position.
2. DYNAMIC SETTING:
- 2.1 Lock operating lever in low idle position.
 - 2.2 Install brake switch cover and gasket on governor.
 - 2.3 Run test stand at 400 RPM.
 - 2.4 Follow steps 1.5 thru 1.8 under static setting 1.