

APE

AMERICAN BOSCH DIVISION

AMERICAN
BOSCH
ARMA
CORPORATION

SPRINGFIELD 7, MASS., U. S. A.

Supersedes Pages D3002/103A and D3002/103B Issued
September, 1952

ATTACHING "GV" TYPE GOVERNOR TO CALIBRATED "APE" PUMP (GOVERNOR ADJUSTMENTS)

These instructions are general in scope and are offered as an aid in proper governor servicing and adjusting.

1. The injection pump must first be calibrated as specified in the parts list. With the pump still mounted on the test stand, the governor should then be installed. Reference to full load delivery in the following instructions is the maximum control rack setting and delivery used for calibration purposes.
2. Move stop plate (A) or control rack stop (B) to prevent interference with torque cam (C) or control rack end (D). Also retract bumper spring (F) with screw (G) to prevent interference with fulcrum lever (E).

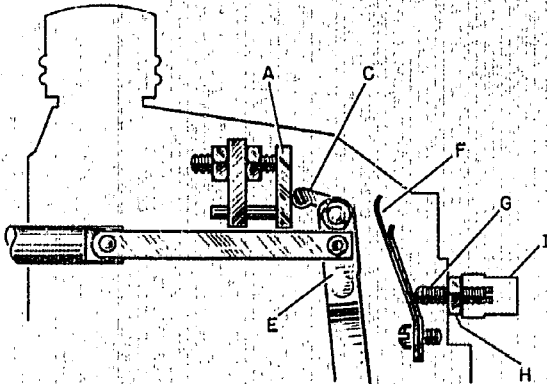


Figure 1

3. Operate test stand at maximum governed full load speed specified on governor nameplate; i.e., 250/750, holding operating lever in full load position.
4. Adjust operating lever full load speed screw until the desired full fuel quantity, as specified in the parts list, is obtained. Adjust screw upward for increased delivery and downward for reduced delivery.

NOTE: *When a governor is adjusted, there must be no rapid oscillations of the fulcrum lever assembly; when this occurs, cause*

of fluctuations must be found and corrected before proceeding further.

5. If Item 4 has been correctly established, then a slight increase in test stand RPM will start control rack moving toward the stop position, thus reducing the fuel delivery.
6. Again operate test stand at governed RPM and adjust stop plate (A) to just contact Cam (C). The inscribed line on the machined surface of governor housing and front face of stop plate should coincide. (See Note 1 for units which do not incorporate a stop plate).
7. Record fuel delivery taken at this setting and RPM.
8. If governor stop plate "A" is designed for torque control, then this feature can be checked by reducing RPM to 2/3 of full load speed (750 RPM reduced to 500 RPM). Holding operating lever in full load position, an increased fuel delivery will result.

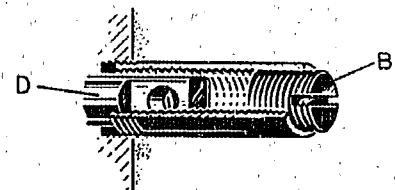


Figure 2

9. **NOTE: 1-**
For those units which do not incorporate a stop plate as described previously, the maximum fuel position is set by turning control rack stop "B" (Fig. 2) in toward pump housing until it just contacts control rack "D" at full load speed. With units of this type, no torque is provided in the governor.

10. With operating lever still in full load position, increase RPM. When percent speed regulation (5%-7% or 10%-12%) as specified in parts list is reached, the control rack should

have moved into decreased fuel delivery position and reduced fuel approximately 1/4-1/5 of full load quantity. Record delivery for same number of strokes as taken at rated full load RPM.

NOTE: Percent of regulation does not refer to full fuel cut-off.

11. With pump operating at RPM as set in Item 10 (and operating lever in full load position) turn in adjusting screw (G) until bumper spring (F) just contacts the fulcrum lever (E). In the event that slight oscillation are present in the fulcrum lever at this higher RPM, screw in bumper spring further until governor mechanism is reasonably steady. Lock bumper spring screw (G) in this position with lock nut (H) and cap (I).

12. The idle setting can only be approximated on the test stand, as the actual idle setting must be made on the engine. Set test stand RPM to approximately 20% above specified idle speed (250 RPM plus 20% equals 300 RPM). Adjust operating lever low idle screw with lever in idle position until fuel delivery just ceases. Check setting by reducing RPM to specified idle speed at which point fuel will again be delivered by the pump.

NOTE: Certain type pumps do not utilize the idle feature but use this idle screw as a stop to permit operating lever to move control rack into full stop position.

NOTE: If altitude adjustment referred to on page D3002/104 is to be made, it should not be attempted until after governor adjustments have been accomplished.

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Supersedes Page D3002/104 Issued December, 1951

**REDUCTION OF MAXIMUM FUEL DELIVERY
FOR
DIESEL ENGINE OPERATION AT
SPECIFIED ALTITUDES**

When diesel engines are to be operated for continuous service at higher than sea level altitudes, certain factors must be taken into consideration.

The sea level air pressure is 14.7 lbs./sq. in. and the volume of air drawn into the engine cylinder is capable of burning a definite MAXIMUM quantity of fuel oil. At the higher altitudes for example, 5000 ft. above sea level, the air pressure is only 12.25 lbs./sq. in. Therefore, if the same quantity of fuel is injected into the engine cylinder as at sea level, incomplete combustion and smoky exhaust will result because of the deficiency in available air.

Normally, the engine operates with an excess of air, performing satisfactorily up to 3000 ft. altitude and no reduction in fuel quantity is necessary. When this altitude is exceeded, a reduction in maximum fuel delivery of 3% per thousand feet elevation (above sea level) will suffice in most instances. This may vary slightly, depending upon local conditions and the particular engine involved.

Following are several specific engine manufacturer's instructions for altitude operation:

1. MACK MOTOR CORPORATION

Reduce maximum fuel delivery 2.5% for every 1000 ft. altitude above sea level.

2. BUDA ENGINE COMPANY

Reduce maximum fuel delivery 3% for every 1000 ft. altitude above sea level.

3. CONTINENTAL MOTORS CORPORATION

Reduce maximum fuel delivery 15% for every 4000 ft. altitude above sea level. (Approx. 3.5% per 1000 ft.)

4. HERCULES MOTOR COMPANY

Reduce maximum fuel delivery 1% for each 100 meters (327.5 ft.) altitude above sea level.

NOTE: Consult Engine Manufacturer's Manual for possible changes in injection pump timing to engine.

Supersedes Page D3002/210 Issued April, 1951

CALIBRATION

SECURING OF MACK FLANGE MOUNTED APE- "BB" SIZE PUMP ON TEST STAND TSE 7664D

Two methods can be employed for the subject operation. They are as follows:

METHOD I

Adapter flange TSE 76184 can be modified as illustrated in Figure 1. The pump can

then be mounted on the test stand as illustrated in Figure 2. Use a mounting block (TSE 7664-106) secured to base of the pump at the end opposite drive. Use the remachined adapter flange (TSE 76184), centering ring (TSE 7664-95), and mounting bracket (TSE 7664-90) at the drive end.

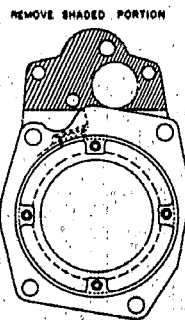


Figure 1

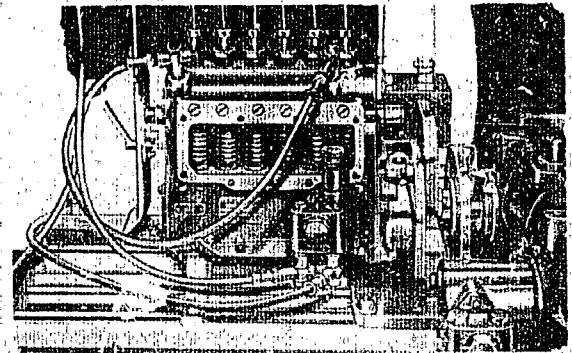


Figure 2

METHOD II

A hold down bracket consisting of parts dimensioned as in Figure 3 can be fabricated and attached to the drive end of the pump as illustrated in Figure 4. Use two mounting

blocks (TSE 7664-106). Secure one to the base of pump at the end opposite drive and the other as a support at the drive end.

NOTE: A small piece of leather must be placed between the cross bar and the pump housing.

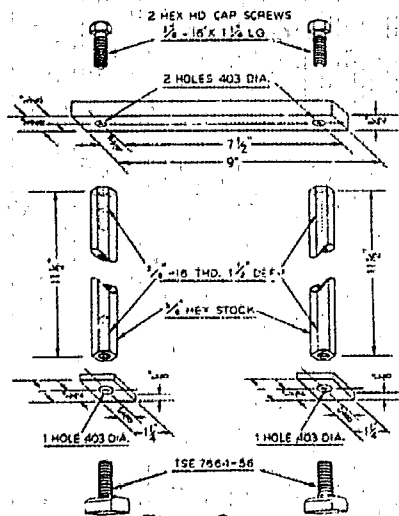


Figure 3

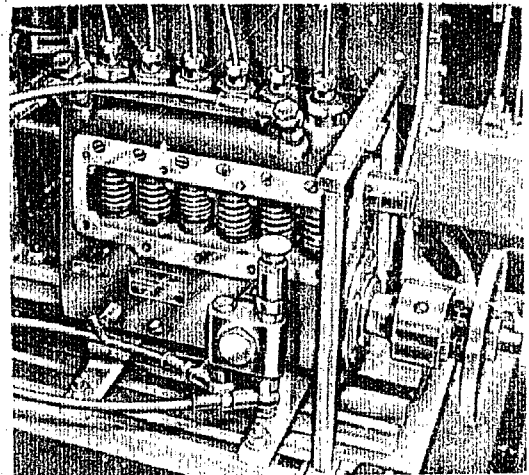


Figure 4

The calibration data will be found in the parts list for each specific pump.

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Supersedes Manual Pages D3001/129
and D3001/129a Issued July, 1955

SPECIAL CALIBRATION INSTRUCTIONS
For
APE "BB" INJECTION PUMPS WITH GVB.../...C GOVERNORS
Used With
MACK END 673 Engines

Injection Pumps for the Mack END 673 Engines incorporating the GVB . . . / . . . C type governors, require special procedures for calibration and governor setting.

These instructions are set forth for two different conditions of injection pumps. Ascertain the correct set of instructions applicable to the degree of repair of the pump involved. (Paragraphs 3 to 15 or 17 to 30.)

MOUNTING PUMP ON TEST STAND

1. Mount injection pump on test stand using special adapter TSE 76184 with bracket TSE 7664-90 and the large centering ring TSE 7664-95. In addition, a mounting block (TSE 7664-106) should be used to support the rear of the pump. (See Page D3001/128.)

TIMING

2. Refer to the specific pump parts list for dimensions required to internally time the pump for Port Closing at Number One Plunger. Refer to Manual Page D3001/100d for detailed instructions and, after Number One Plunger has been properly adjusted, proceed to time the remaining pump plungers.

CALIBRATION

INJECTION PUMP WITH REPLACEMENT CONTROL RACK INSTALLED

3. Mount control rack securing device TSE 7664-29A on Test Stand.
4. Position the injection pump control rack with the securing device at a control rack extension, at right hand side of 1.218". This will be for full load delivery.
5. Operate pump at 1000 RPM and calibrate plungers for delivery as specified in pumps parts list.
6. Check idle fuel delivery at 250 RPM as per specification.
7. After pump has been correctly calibrated, install the governor.
8. With pump operating at 1050 RPM, set governor operating lever full load screw for delivery as obtained in paragraph 5.

9. With pump still running at 1050 RPM adjust cam nose to an approximate angle of 56° to the stop plate, with stop plate near cam nose.
10. Adjust the stop plate to touch the cam nose at 1050 RPM. Always recheck fuel delivery. (See paragraph 8.)
11. Increase speed to 1070 RPM at which point the cam should just leave the stop plate.
12. After this setting has been made, stop test stand (pump now at zero RPM). Hold operating lever in full load position and the cam nose should now be at an angle of 65° to the stop plate. See Figure 1. Readjust to 65° if necessary and recheck fuel delivery at 1050 RPM. (See paragraph 5.)

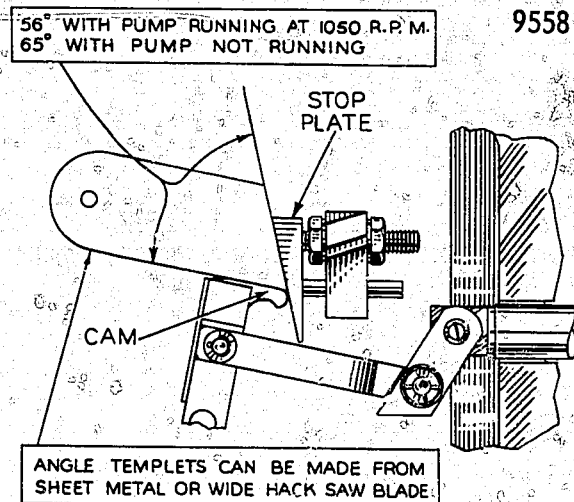


Figure 1.

13. With the governor operating lever in full load position and pump at zero RPM, and the linkage clearances taken up toward L. H. Side, shim extension screw to the 1.500" dimension. Always recheck extension by moving operating lever from idle to full load position several times. (See Figure 2.)
14. Drill thru hole in control rack into extension screw and pin both members.

15. This provides maximum fuel delivery as required when the Mack's number stamped on the name plate is 313GC490P1.

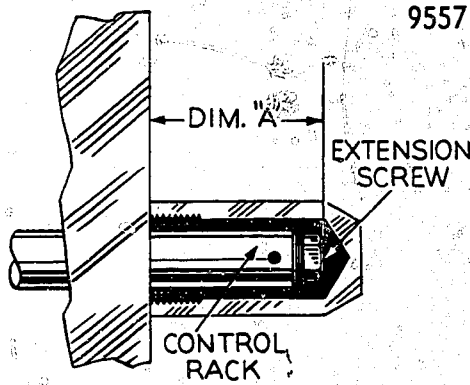


Figure 2.

16. If other than this Mack's number is stamped on the name plate, it will be necessary to readjust the stop plate to obtain the required dimension "A" (See Figure 2) for the control rack. This will result in a reduction of the full load fuel delivery, but it is not necessary to check for actual fuel delivery quantities. (Do not disturb the control rack shimming to obtain dimension "A".) The code table will be found at the end of these instructions.

INJECTION PUMP WITH NON-REPLACED AND SHIMMED CONTROL RACK INSTALLED

17. The injection pump must be correctly timed as outlined on Manual Page D3001/100d.

18. Mount control rack securing device TSE 7664-29A on Test Stand.

19. Position the injection pump control rack with the securing device for a control rack extension at the right hand side of 1.218" to the unshimmed portion of the rack, do not include shims or screw head. (See Figure 3.)

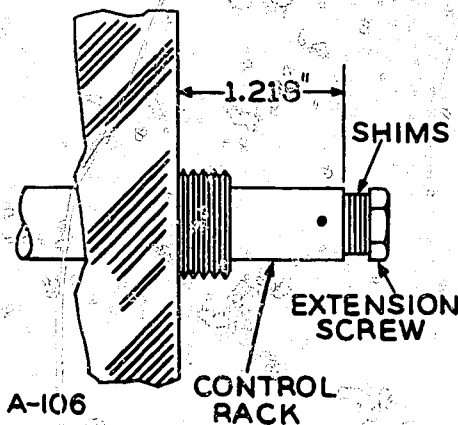


Figure 3.

20. Operate pump at 1000 RPM and calibrate plungers for delivery as specified in pumps parts list.

21. Check idle fuel delivery at 250 RPM as per specification.

22. After pump has been correctly calibrated, install the governor.

23. With pump operating at 1050 RPM, set governor operating lever full load screw for delivery as obtained in paragraph 20.

24. With pump still running at 1050 RPM adjust cam nose to an approximate angle of 56° to the stop plate.

25. Adjust the stop plate to touch the cam nose at 1050 RPM. Always recheck fuel delivery. (See paragraph 19.)

26. Increase speed to 1070 RPM at which point the cam should just leave the stop plate.

27. After this setting has been made, stop test stand (pump now at zero RPM). Hold operating lever in full load position and the cam nose should now be at an angle of 65° to the stop plate. See Figure 1. Readjust to 65° if necessary and recheck fuel delivery at 1050 RPM.

28. With the governor operating lever in full load position and pump at zero RPM and the linkage clearances taken up toward L. H. Side the control rack extension on the R. H. Side should be 1.500" to end of screw. (See Figure 2.) If this dimension does not conform it will be necessary to recheck setting of stop plate and cam angle for possible error.

29. The injection pump is now set to provide maximum fuel delivery as required when the Mack Co. number stamped on the name plate is 313GC-490P1.

30. If other than this Mack's number is stamped on the name plate, it will be necessary to readjust the stop plate to obtain the required dimension "A" (See Figure 2) for the control rack. This will result in a reduction of full load fuel delivery, but it is not necessary to check for actual fuel delivery quantities. (Do not disturb the control rack shimming to obtain dimension "A".)

CODE TABLE

Mack Part Number	Dimension "A" Figure 2
#313GC490 P1	1.500"
#313GC490 P5	1.479"
#313GC490 P2	1.465"
#313GC490 P6	1.448"
#313GC490 P3	1.430"
#313GC490 P4	1.395"
#313GC490 P7	1.387"

SERVICE INSTRUCTIONS

For AMERICAN BOSCH APE FUEL INJECTION PUMPS (Supplement)

**SUBJECT: "PLE" (PUFF LIMITER EXTENSION) DIMENSION
For The MACK TRUCKS PUFF LIMITER SYSTEMS**

1. INFORMATION

- 1.1 APE 6BB and APE 8V fuel injection pumps applied to Mack ENDT (B) 675, 676, 865 and 866 engines equipped with Mack Puff Limiter Systems require a "PLE" (Puff Limiter Extension) dimension.
- 1.2 The Mack Puff Limiter System uses an air cylinder that is threaded into the fuel injection pump control rack protection cap. The movement of the air cylinder piston is controlled by a reversing relay on the engine.
- 1.3 The "PLE" dimension is used to determine the shim pack dimension required between the air cylinder and the control rack cap.
- 1.4 The "PLE" dimension is determined at a given fuel delivery and pump speed (300 RPM for APE 6BB and 400 RPM for APE 8V).
- 1.5 Figures 1 and 2 illustrate the "PLE" dimension and control rack protection cap for APE 6BB and APE 8V pumps.

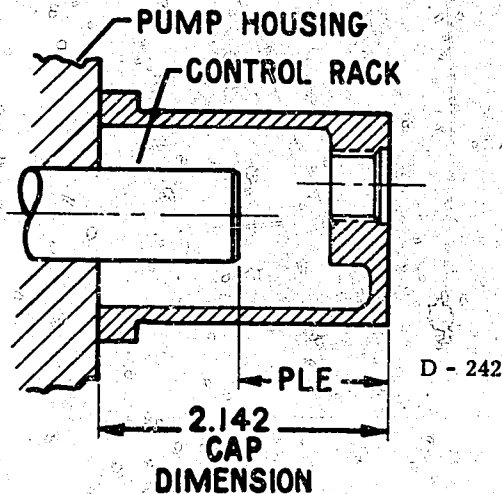


FIGURE 1 - APE 6BB

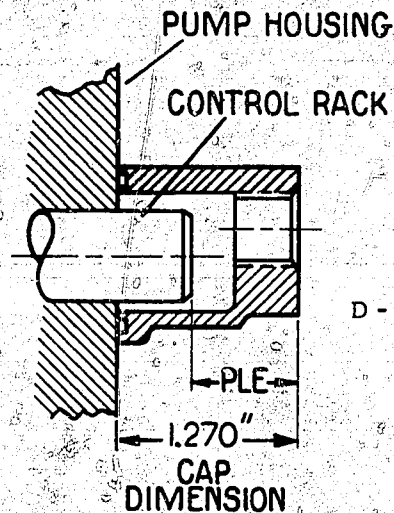


FIGURE 2 - APE 8V

- 1.6 Early APE 6BB pumps had the "PLE" dimension stamped below the caution nameplate; when changing the dimension it should be relocated to the top of the pump next to No. 1 outlet (See Figure 3).

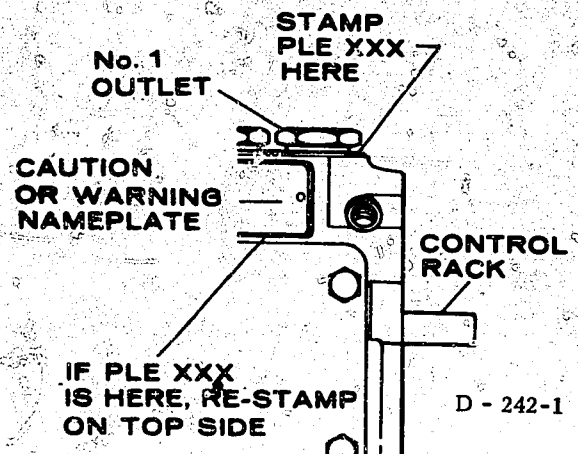


FIGURE 3 - APE 6BB

1.7 APE 8V pumps have the "PLE" dimension stamped as indicated in Figures 4A or 4B, depending on the location of the rack cap that has the threaded hole for the Mack air cylinder.

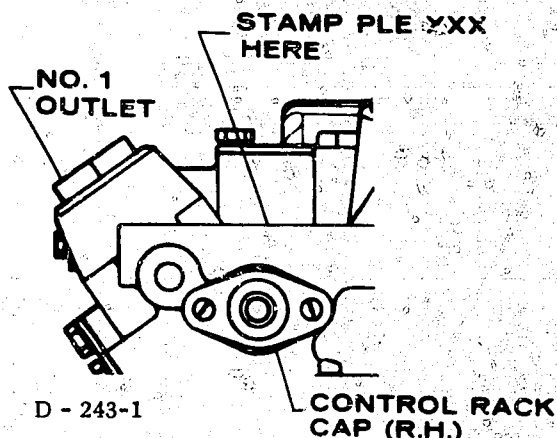


FIGURE 4A - APE SV

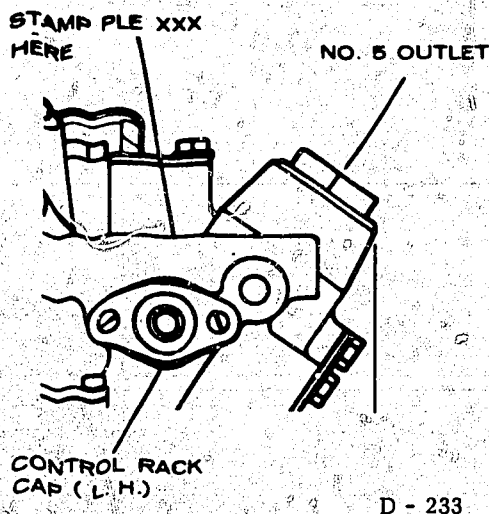


FIGURE 4B - APE 8V

2. EQUIPMENT REQUIRED

2.1 To obtain the APE 6BB pump "PLE" dimension, a tool must be fabricated per Figures 5 through 7.

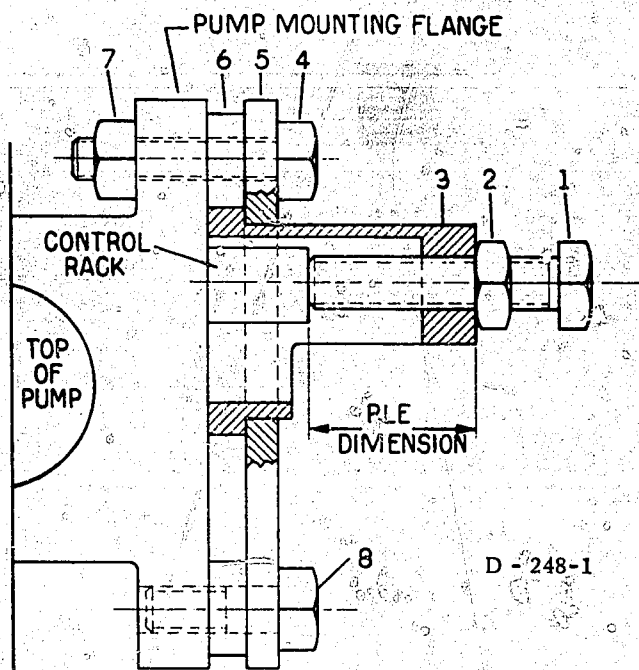


FIGURE 5 - APE 6BB "PLE" TOOL

Ill. No.	Description
5-1	Hex Head Bolt - 1/2" - 20 UNF Thread - 2-1/4" long (2" Full Thread)
5-2	Hex Jam Nut - 1/2" - 20 UNF Thread
5-3	Control Rack Cap CP 7625 machined per Fig. 6
5-4	Hex Head Bolt - 3/8" - 16 UNC Thread - 1-3/4" long (1" Full Thread)
5-5	Clamping Plate machined per Figure 7
5-6	Spacer - WMS 2163/1X - Qty. 2 or .750 O.D. x .406 I.D. x .265 thick "CRS".
5-7	Hex Nut 3/8" - 16 UNC Thread
5-8	Hex Head Bolt - 3/8" - 16 UNC Thread - 1" long (3/4" Full Thread)

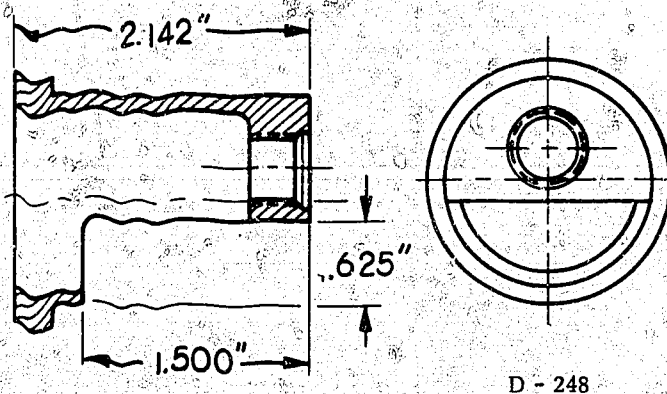


FIGURE 6 - REWORKED CP 7625

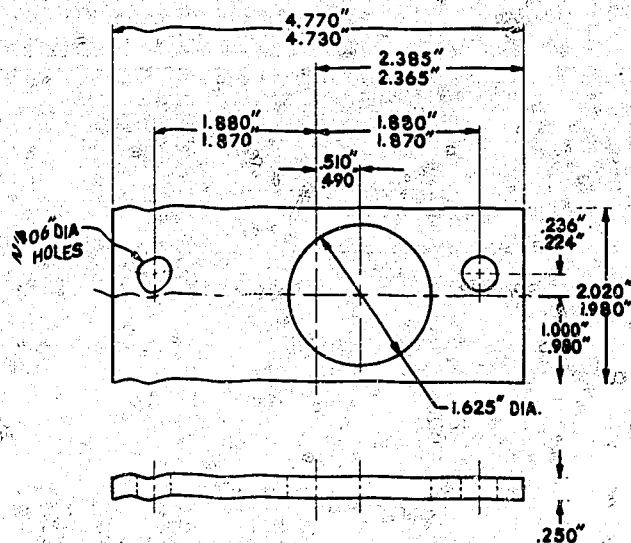


FIGURE 7 - CLAMPING PLATE

2.2 To obtain the APE 8V "PLE" dimension, a tool must be fabricated per Figures 8 and 9.

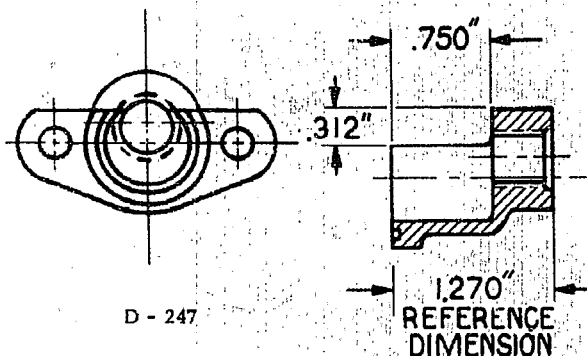


FIGURE 8 - REWORKED CP 7626

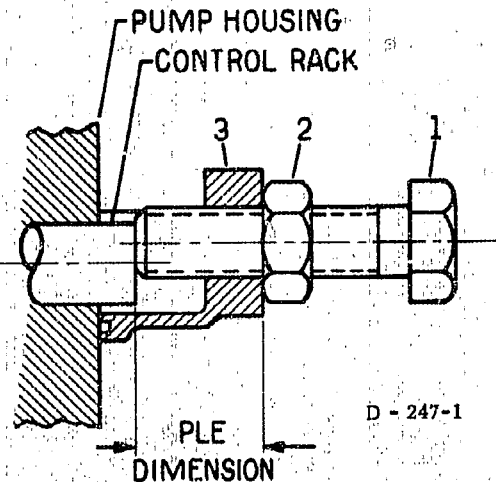


FIGURE 9 - APE 8V "PLE" TOOL

Ill. No.	Description
9-1	Hex Head Bolt - 1/2" - 20 UNF Thread - 2 - 1/4" long (2" Full Thread)
9-2	Hex Jam Nut - 1/2" - 20 UNF Thread
9-3	Control Rack Cap CP 7626 machined per Fig. 8 (Use 2 SC 1953 screws for mounting on pump)

3. INSTRUCTIONS

3.1 After service checking or recalibrating pump, use the following steps to obtain the "PLE" dimension:

3.1.1 APE 6BB PUMPS

1. Check stamped "PLE" dimension per Figure 3.
2. Thread jam nut (5-2) on hex bolt (5-1) and install in reworked CP 7625 (See Figure 6).
3. Subtract the given "PLE" dimension from 2.142" (the height of CP 7625).
 EXAMPLE: 2.142" - 1.020" = 1.122"
4. Measuring in from mounting flange of CP 7625, set end of hex bolt (5-1) to dimension obtained in step 3 and lock in place with jam nut (5-2).
5. Install CP 7625 (5-3) in clamping plate (5-5) and assemble to pump per Figure 5.
6. At 300 RPM, with oil pressure on and operating lever in full load position, check for specified fuel delivery per pump specification.
7. If fuel delivery is to pump specification, do not change the stamped "PLE" dimension.
8. If fuel delivery is not to pump specification, adjust hex bolt (5-1) until specified delivery is obtained and lock with jam nut (5-2).
9. Remove CP 7625 (5-3) and measure dimension from mounting flange to end of hex bolt (5-1), subtract this from the height of CP 7625 (2.142"), the answer is the new "PLE" dimension.
 EXAMPLE: 2.142" - 1.132" = 1.010" new "PLE" dimension
10. Restamp "PLE" dimension per Figure 3.

3.1.2 APE 8V PUMPS

1. Check stamped "PLE" dimension per Fig. 4A or 4B.
2. Thread jam nut (9-2) on hex bolt (9-1) and install in reworked CP 7626 (9-3) (See Figure 8).
3. Subtract the given "PLE" dimension from 1.270" (the height of CP 7626 (9-3)).
 EXAMPLE: 1.270" - 1.052" = .218"
4. Measuring in from mounting flange of CP 7626 (9-3) set end of hex bolt (9-1) to dimension obtained in step 3 and lock in place with jam nut (9-2).
5. Assemble CP 7626 (9-3) to pump with 2 screws SC 1953.
6. At 400 RPM, with oil pressure on and operating lever in full load position, check for specified fuel delivery per pump specification.
7. If fuel delivery is to pump specification, do not change the stamped "PLE" dimension.
8. If fuel delivery is not to pump specification, adjust hex bolt (9-1) until specified delivery is obtained and lock with jam nut (9-2).
9. Remove CP 7626 (9-3) and measure dimension from mounting flange surface to end of hex bolt (9-1), subtract this from the height of CP 7626 (1.270"), the answer is the new "PLE" dimension.
 EXAMPLE: 1.270" - .250" = 1.020" new "PLE" dimension
10. Restamp "PLE" dimension per Figure 4A or 4B.

SERVICE INSTRUCTIONS
For
APE 6BB/T And APE 8VBB/Q
FUEL INJECTION PUMPS (With GVB/C GOVERNORS)
(SUPPLEMENT)

SUBJECT: New "K" dimension required for fuel injection pumps applied to 1975 MACK Trucks ENDT 675, 676, 865 & 866 engines.

1. INFORMATION

- 1.1 The "K" dimension is the horizontal measurement between the upper vertical face of the adjustable stop plate and inner (machined-vertical) surface of the governor housing (see Figure 1).
- 1.2 A change in the "K" dimension, at the time a pump is received for service, indicates that fuel delivery of the pump has been tampered with. Warranty is VOIDED when seals are broken and tampering occurs.
- 1.3 Following recalibration of a pump, the "K" dimension is to be measured, recorded and stamped on the governor housing.
- 1.4 For record purposes, both the old and new "K" dimension should be referenced on the work order.
- 2.5 Push footed pin until it touches upper vertical face of adjustable stop plate making certain that eccentric foot of pin is touching only the UPPER STOP PLATE FACE (see Figure 3).

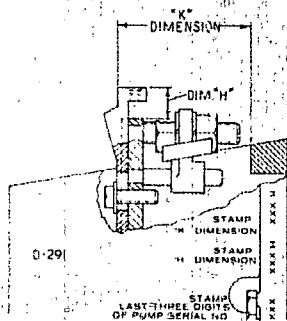


Figure 1 - "K" Dimension

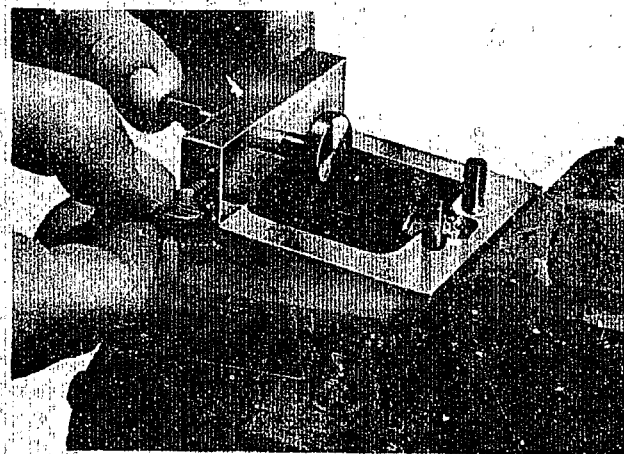


Figure 3 - Locating "K" Dimension With TSE 79100 Tool

2. INSTRUCTIONS

- 2.1 Remove governor top cover.
- 2.2 Move fulcrum lever to shutoff position.
- 2.3 Loosen thumb screw of "K" dimension tool (TSE 79100) and pull knurled end of footed pin outward.
- 2.4 Install tool over stop plate with dowel pins on pump side (front) of stop plate assembly and press tool against machined inner surface in governor housing (see Figure 2).
- 2.6 Lock footed pin with thumb screw.
- 2.7 With a suitable depth micrometer (2" spindle), measure the distance between top front side of dowel pins and footed pin (see Figure 4).

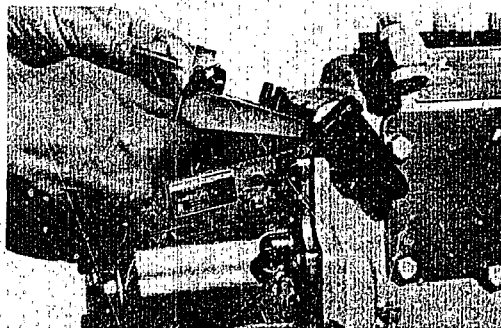


Figure 2 - Installing "K" Dimension-Tool TSE 79100

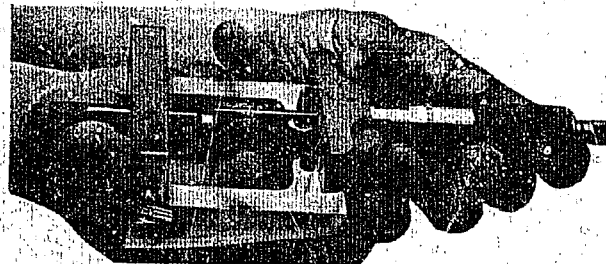


Figure 4 - Measuring TSE 79100 For "K" Dimension

- 2.8 If the obtained dimension recorded does not agree with the stamped dimension on edge of governor housing flange (see Figure 1), remove old dimension and stamp new dimension.