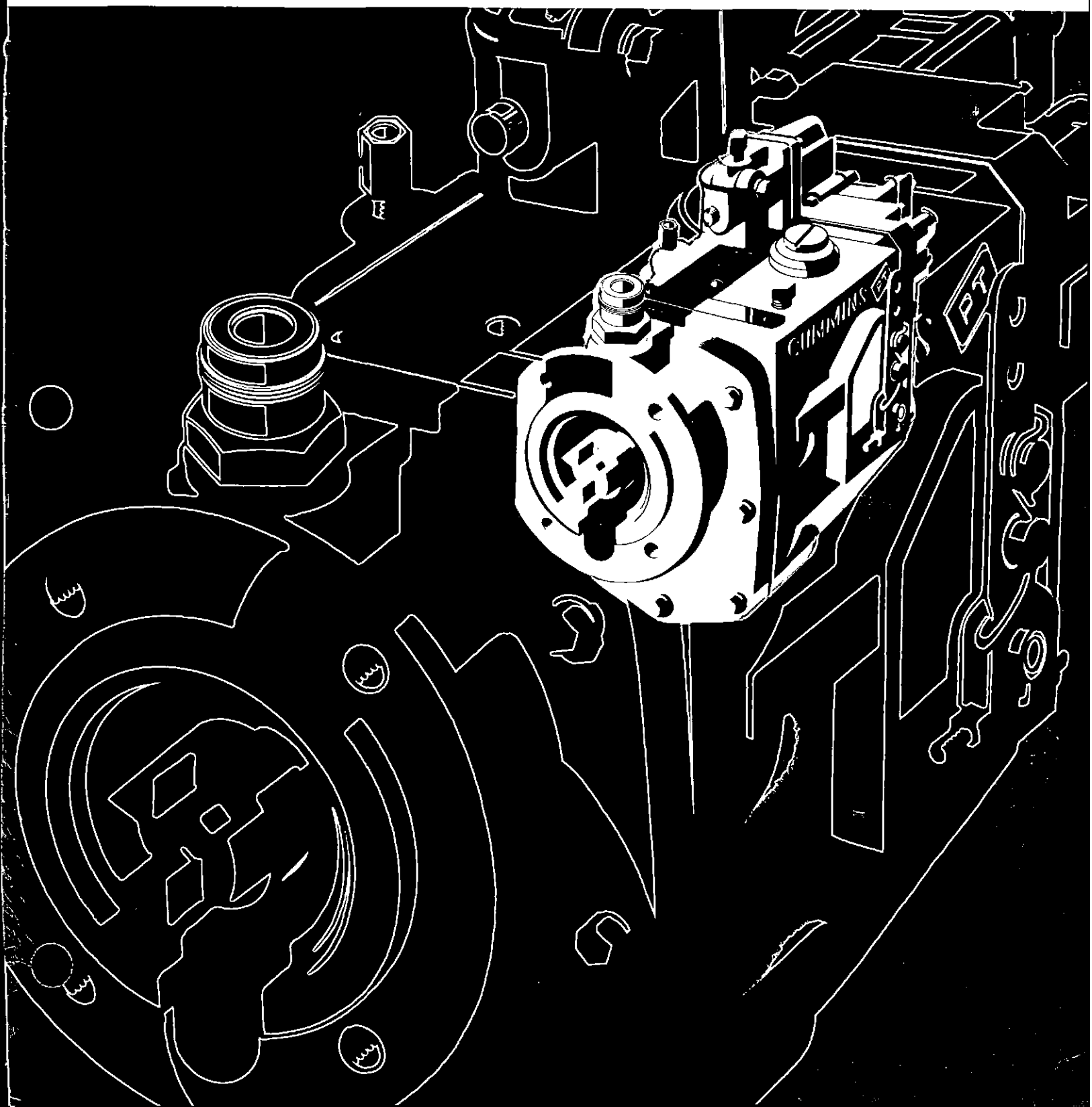
# PT Fuel Pump Rebuilding and Calibration Instructions



# Component Shop Manual

# Cummins PT Fuel Pump Rebuilding and Calibration Instructions



Bulletin No. 3379084-02, Printed 9-80

# Foreword

This manual contains the operating procedures, disassembly, inspection, repair and assembly of the PT (type G), and the PT (type H) fuel pumps.

Testing and calibration of the PT (type G and H) fuel pumps are in section ten of this manual.

The PT (type R) fuel pump rebuild and calibration procedures are in Bulletin No. 3379101.

A three ring hard back holder is available for your PT fuel pump manual. Order Bulletin No. 3379102.

Cummins Engine Company, Inc. is constantly making improvements to their product. Design changes can change the procedures in this manual. If differences are seen, check the information through a Cummins Distributor or Dealer.

This manual includes all Service Topic information on fuel pumps through July 1980. This publication replaces Bulletin No. 3379084-01.

# Table of Contents

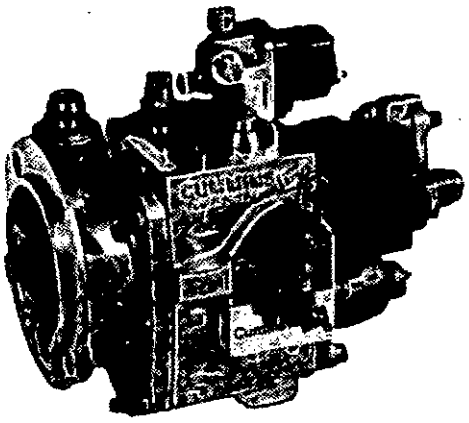


Fig. 1, (F5295). PT (type G) AFC fuel pump.

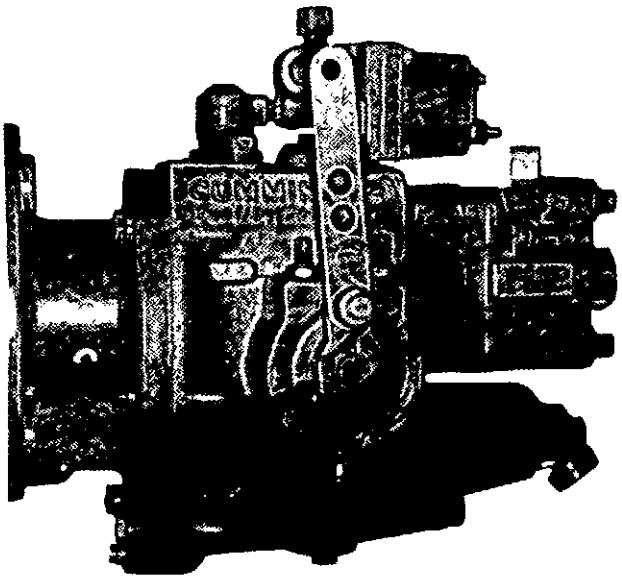


Fig. 2, (F5235). PT (type G) fuel pump.

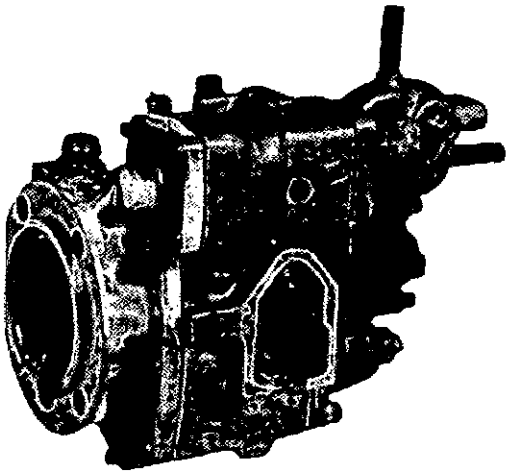


Fig. 3, (F5296). PT (type G) AFC fuel pump with a VS governor.

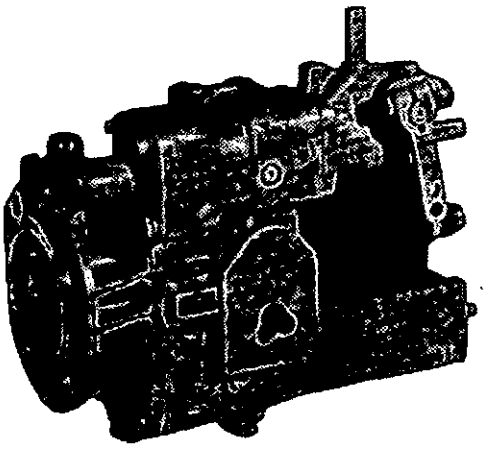


Fig. 4, (F5371). PT (type H) fuel pump.

# PT Fuel Pump

The PT fuel system is used only on Cummins Diesels. The identification "PT" is an abbreviation for "pressure-time."

The description PT (type G) is for a "Governor-Controlled" fuel pump. This description will be used to describe both the fuel system and the fuel pump.

# Fuel Pump Disassembly

This section contains the disassembly of the Cummins PT fuel pumps. The PT (type G) fuel pump is used as the basic unit. Inspect the parts at all times during the rebuild work.

**Note:** The PT (type R) fuel pump rebuild is in Bulletin No. 3379101-02.

## Service Tools

The following service tools are used in disassembly, inspection and assembly of the fuel system.

**Service Tools (Or Equivalent) Required**

| Tool Number | Tool Name |
|---|---|
| ST-302 | Ball Joint Vise |
| ST-709 | Puller |
| ST-1032 | Tachometer Drive Seal Driver (In Housing) |
| ST-1231 | Weight Carrier Gear Removal Block |
| ST-1241 | Weight Assist Plunger Protrusion Checking Tool |
| ST-1249 | Spline Drive Coupling Puller |
| 3375133 | Front Cover Mounting Plate |
| 3375146 | AFC Plunger O-Ring Tool |
| 3375148 | AFC Needle Valve O-Ring Tool |
| 3375175 | Front Cover and Main Shaft Assembly Kit |
| 3375271 | Tachometer Cup Plug Driver (In Cover) |
| 3375355 | Throttle Lever Travel Template |
| 3375372 | Air Cylinder Assembly Tool |
| 3375599 | AFC Barrel Puller |
| 3375703 | Road Speed Governor Piston Installation Sleeve |
| 3375855 | Throttle Travel Gauge |
| 3375932 | Pressure Gauge |
| 3375934 | ASA, AFC Aneroid Test Stand |
| 3375959 | Gear Pump Pressure Valve Tool |
| 3375981 | Idle Adjustment Tool |
| 3376035 | AFC No Air Seat Insert Tool |
| 3376136 | Barrel Lock Pin Driver |

**Desirable (Or Equivalent) Tools**

| | |
|---|---|
| ST-419 | Main Shaft Oil Seal Assembly Sleeve |
| ST-422 | Throttle Shaft (5/8 inch) O-Ring Assembly Tool |
| ST-490 | Drive Shaft Bushing Reaming Fixture |
| ST-537 | Dial Depth Gauge |
| ST-667 | Dowel Puller |
| ST-835 | Throttle Shaft (1/2 inch) O-Ring Assembly Tool |
| ST-1175 | Countersink Drill |
| ST-1250 | VS Pump Pressure Valve Driver |
| ST-1326 | Tachometer Shaft Puller |
| 3375498 | AFC-ASA Drill Fixture |

**Standard Tools — Obtain Locally**

Dial Indicator (like Starrett No. 196-B)
Torque Wrenches (inch pound and foot pound)
Arbor Press
90° Block with Steel Puller
V Block with Steel Puller
Oven, 500° F Maximum
Cleaning Solvent
.750 inch Reamer

## Clean and Mount

1. Clean the outside of the fuel pump with an approved solvent. Remove the lockwires and seals if used.

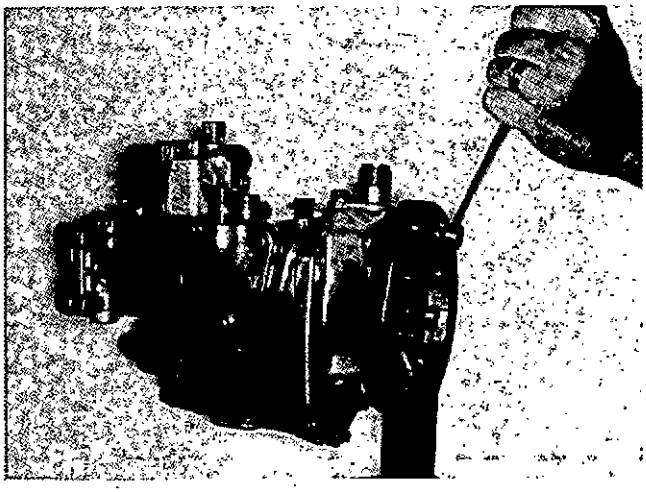


Fig. 1-1, (F5298). Mount the AFC type of fuel pump to the 3375133 Mounting Plate.

**Note:** Many solvent cleaners will damage aluminum. Make sure your cleaner is approved before using it on aluminum.

2. Mount the fuel pump on 3375133, 3375537 or ST-546 Mounting Plate and a ST-302 Swivel Vise, Fig. 1-1.

**Note:** Always use the front cover mounting plate on the AFC type of fuel pumps.

## PT (type G) Fuel Pump Service Cooling Kit

1. Remove the check valve assembly from the gear pump.

**Note:** The old type of fuel pumps have the check valve in the bottom or on the back of the pump.

2. Clean the parts in clean fuel oil and dry with compressed air.

**Note:** The seat in the check valve is rubber. Cleaning the valve in solvent will destroy the valve.

## Shutoff Valve, Pulsation Damper and Gear Pump

1. Remove the shutoff valve from the top of the housing and discard the O-ring.

**Note:** The shutoff valve can be disassembled on the fuel pump.

2. Remove the damper from the gear pump and discard the O-ring.

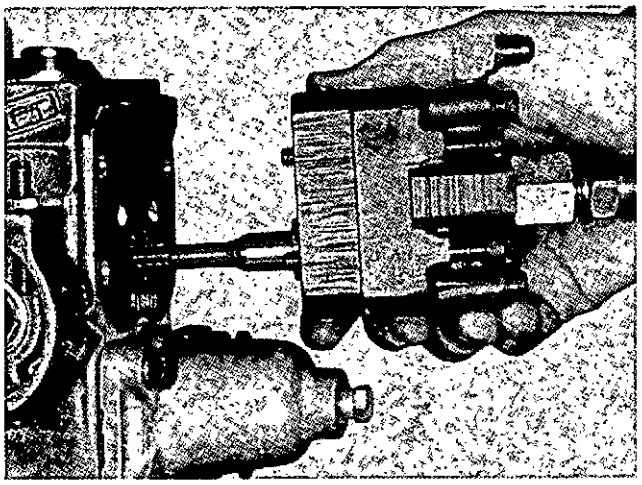


Fig. 1-2, (F508). Remove the gear pump.

3. Remove the gear pump from the main housing. Hit the sides of the gear pump with a plastic hammer to loosen it from the ring dowel. Remove the gear pump and discard the gasket, Fig. 1-2.

## Front Drive Cover and Governor Plunger

If the fuel pump housing is mounted to the vise, remove the front cover now. If the front cover is mounted to the vise, remove it last.

1. Remove the drive cover capscrews from the housing. Loosen the cover by hitting the edge with a plastic hammer. Lift the cover off of the dowels and discard the gasket, Fig. 1-3.

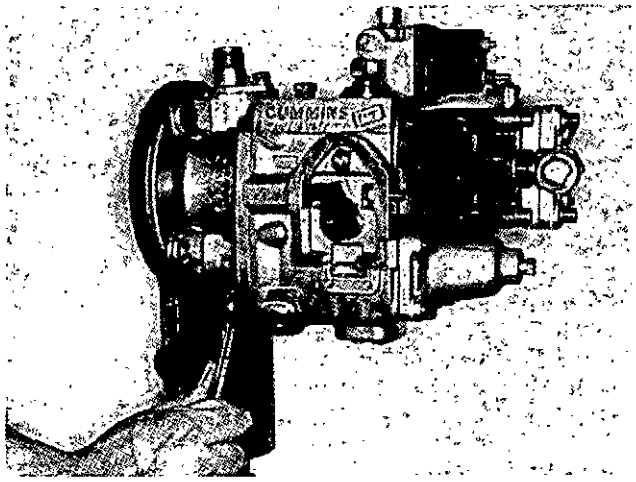



Fig. 1-3, (F5306). Remove the front drive cover from the AFC pump.

**Note:** The AFC breather capscrew is not used now. The AFC cavity is drained to the fuel tank.

2. Discard the special breather capscrew in the AFC front cover. Use sealing capscrew, Part No. 3018682, in this location. See Section Eight. The AFC cavity must be drained to the fuel tank.

**Note:** Never use a steel hammer on aluminum or on a smooth surface, it can cause damage.

3. Remove the weight assist plunger, spring and shims from the weight carrier assembly. Pull the governor plunger from the barrel.

**Caution: Put the plunger where it will not be damaged. The plunger surface can be easily damaged.**

## Throttle Assembly — Drive Screw Cover Plate Type

1. Remove the retaining ring from the inside of the housing, Fig. 1-4. Remove the drive screws holding the cover plate. Pull the throttle assembly from the housing. Remove the O-ring and discard.

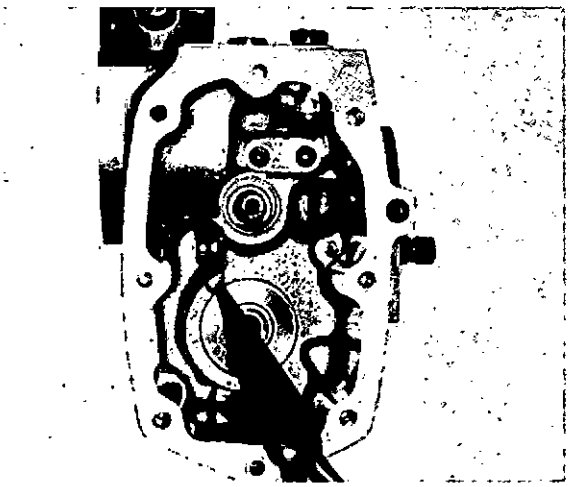


Fig. 1-4, (F5299). Remove the retaining ring from the throttle shaft.

**Note:** The throttle shafts that were in shipments after March 1977, will have a "soft" steel ball. This ball can be removed with a drill.

2. If the throttle shaft sleeve is damaged replace the housing.

3. Loosen the jam nut, remove the "no air" AFC fuel adjustment screw. Discard the O-ring.

## Throttle Assembly — Retaining Ring Type

Compress the retaining ring of the throttle plate and remove it from the groove. Pull the throttle assembly from the housing. Discard the O-ring.

**Note:** Do not damage the throttle shaft.

## Governor Spring Pack Cover

The Automotive or idle and high speed governor is standard on all PT fuel pumps. Auxiliary governors can also be used. See the Governor Spring Assembly in Section Four for the other governors.

1. Remove the spring pack cover from the main housing. Lift off the cover and discard the gasket.

2. For the disassembly of the spring assembly, see the Spring Assembly in Section Four.

## Filter Screen

1. Use a screwdriver to remove the filter screen cover on top of the main housing. Lift the cap, spring and filter screen assembly from the main housing. Discard the O-ring.

2. On the VS governed pumps, remove the retaining ring from the bottom of the housing. Pull out the retainer. Remove the spring and screen.

3. The PT (type G) MVS pumps have two filter screens. The top screen is a fine filter to protect the MVS governor plunger.

4. Use a screwdriver to remove the PT (type H) filter screen plug.

## Tachometer Drive

1. Remove the tachometer housing that screws in or remove the capscrew(s) that hold(s) the tachometer drive housing.

2. Lift the drive housing from the pump housing or the front cover. Discard the gasket, when in use.

3. Remove the tachometer drive assembly from the pump with a brass punch and hammer, Fig. 1-5. Use ST-667-10 collet with ST-667

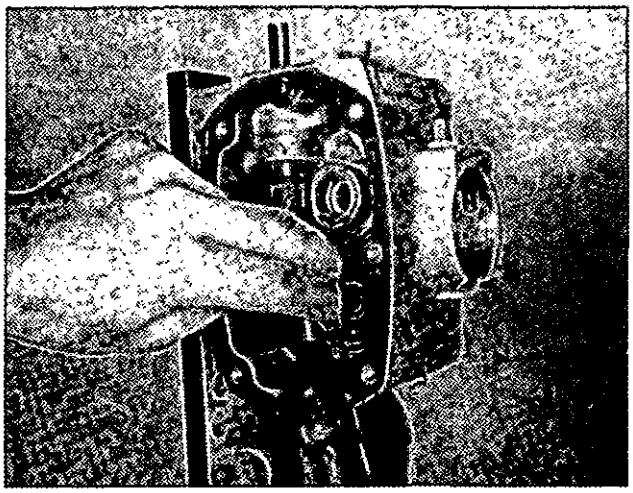


Fig. 1-5, (F513). Remove the tachometer drive assembly from the housing.

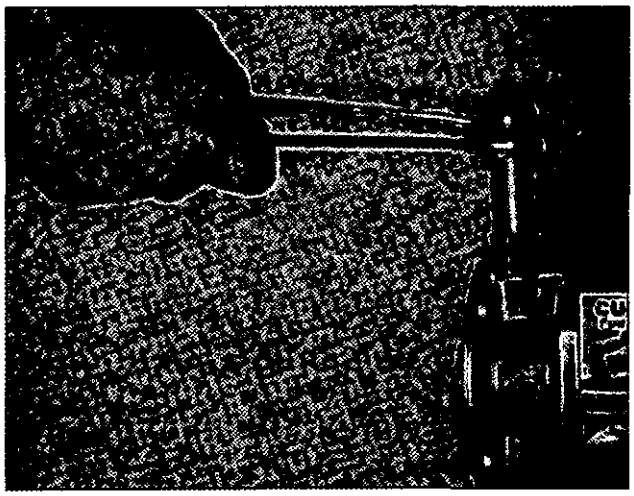


Fig. 1-6, (F5300). Remove the tachometer drive assembly with the ST-1326.

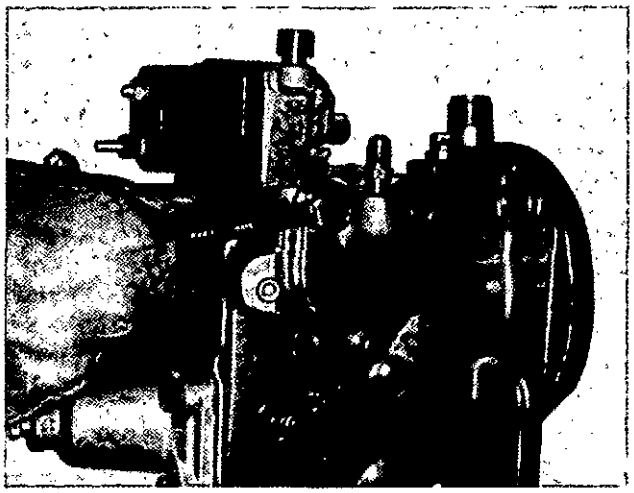


Fig. 1-7, (F5301). Remove the AFC side cover plate.

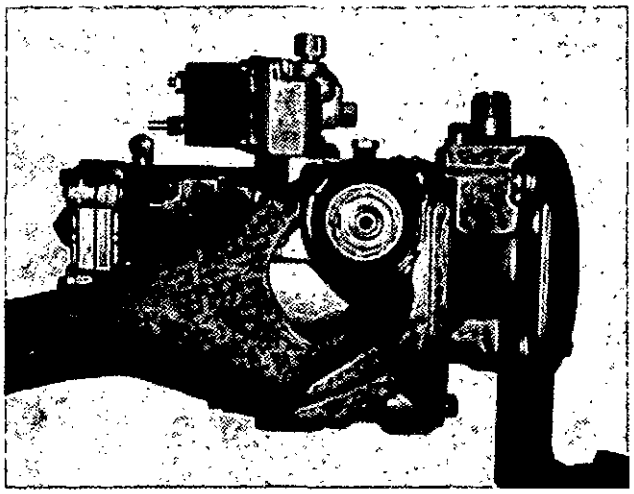


Fig. 1-8, (F5302). Remove the AFC bellows and piston assembly.

Dowel Puller or use ST-1326 to pull the tachometer seal, shaft and bushing when the fuel pump is on the engine, Fig. 1-6.

4. Remove the oil seal and the dust retaining pad, when in use, from the shaft and discard.

## Air Fuel Control (AFC)

1. Remove the flow valve in the AFC cover plate.
2. Remove the AFC cover plate, Fig. 1-7.
3. Carefully lift the bellows away from the sealing surface around the AFC cavity and pull the bellows, piston and plunger assembly from the AFC barrel, Fig. 1-8.
4. Remove the AFC bellows spring and the steel washer between the spring and the fuel pump housing, Fig. 1-9.
5. Remove the retaining ring of the AFC barrel, Fig. 1-10.
6. Use 3375599 puller to remove the AFC barrel, discard the barrel O-rings.
7. Remove the plunger jam nut and screw out the plunger from the center bolt.
8. Remove the jam nut of the center bolt, washer, and gasket; remove the bellows from the piston.

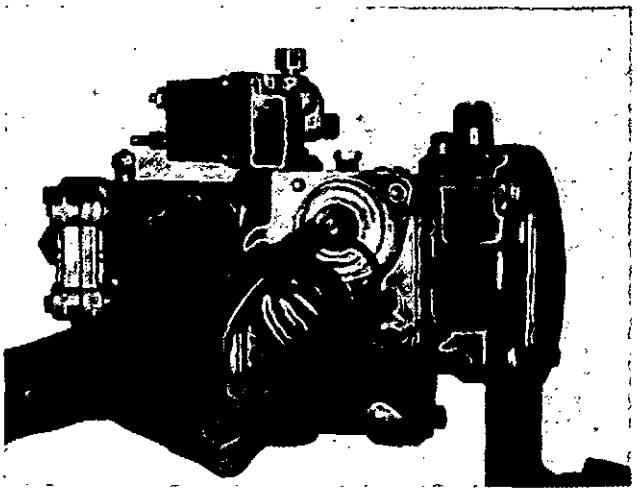


Fig. 1-9, (F5303). Remove the AFC bellows spring and washer.

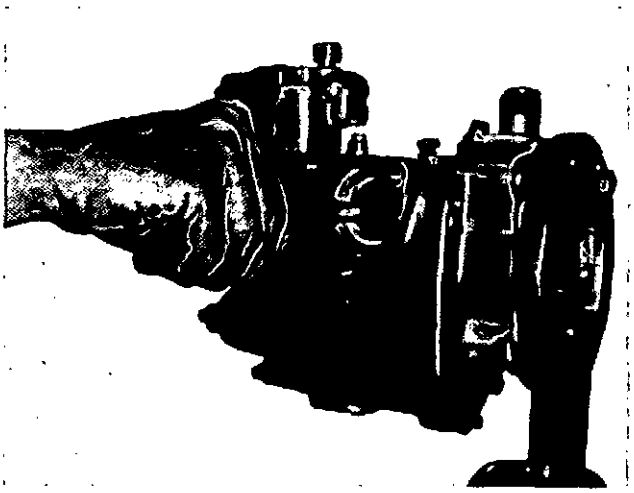


Fig. 1-10, (F5304). Remove the AFC barrel retaining ring.

9. Remove the "Glyd" ring and the O-ring from the AFC control plunger, if required.

**Note:** The no air needle valve seat repair is in the Fuel Pump Housing section Two.

## General

The fuel pump assembly repair, cleaning, inspection and rebuild instructions are in the following sections.

The usable replacement limits are there to help you to know when to replace the parts. The limits will also tell you when to use the parts that still have many hours or miles of service life.

The parts that are worn beyond the replacement limits must not be used again.

### Cleaning

A clean shop, clean tools and good cleaning procedures are necessary for good quality in fuel pump repair. Use caution in selecting a solvent to clean the aluminum alloy parts. Some solvents used to clean will damage the aluminum. Most fuel pump failures occur because of dirt. Clean all parts before rebuild or assembly.

### Inspection

Good inspection can keep many parts in working condition and also prevent the failure of the rebuilt pump.

Complete the inspection of all of the parts. The correct tools are necessary to do a good job of inspection.

# NOTES

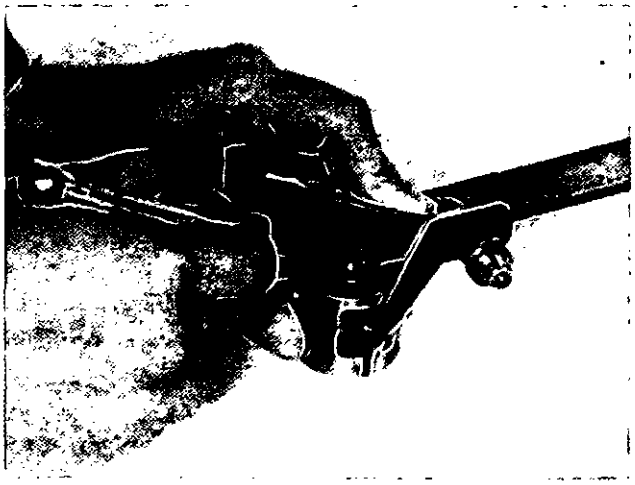


Fig. 2-4, (F516). Mark a center line on the governor barrel.

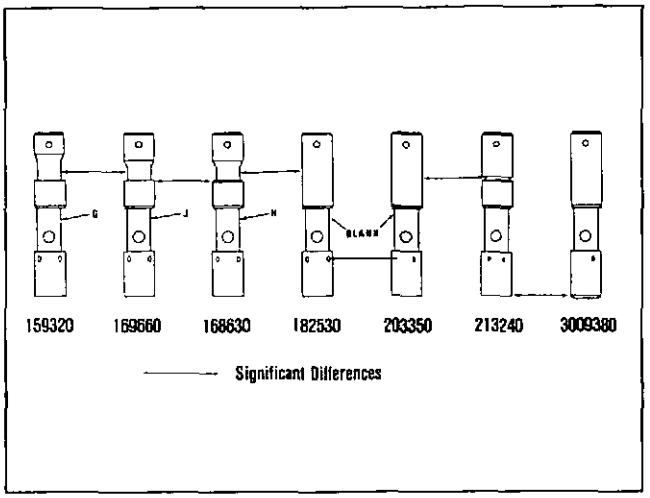



Fig. 2-6, (F5253). PT (type G) governor plungers.

**Table 2-1: PT (type G) Governor Plungers**

| Code Size | Red 0 | Blue 1 | Green 2 | Yellow 3 | Orange 4 | Black 5 | Gray 6 | Purple 7 | Usage Usage | Code Letter |
|---|---|---|---|---|---|---|---|---|---|---|
| Part No. | 169660 | 169661 | 169662 | 169663 | 169664 | 169665 | 169666 | 169667 | | |
| Part No. | 182530 | 182531 | 182532 | 182533 | 182534 | 182535 | 182536 | 182537 | | |
| Part No. | 159320 | 159321 | 159322 | 159323 | 159324 | 159325 | 161586 | 161587 | JT | |
| Part No. | 168630 | 168631 | 168632 | 168633 | 168634 | 168635 | 168636 | 168637 | V12, H, J, V6, V8 | H |
| Part No. | 203350 | 203351 | 203352 | 203353 | 203354 | 203355 | 203356 | 203357 | Lower VS | |
| Part No. | 213240 | 213241 | 213242 | 213243 | 213244 | 213245 | 213246 | 213237 | V-378, V-555 | |
| Part No. | 212350 | 212351 | 212352 | 212353 | 212354 | 212355 | | | Upper VS | |
| Part No. | 213610 | 213611 | 213612 | 213613 | 213614 | 213615 | | | Upper VS | |
| Part No. | 3009380 | 3009381 | 3009382 | 3009383 | 3009384 | 3009385 | 3009386 | 3009387 | AFC-5° End | |
| Part No. | 3015487 | 3015488 | 3015489 | 3015490 | 3015491 | 3015492 | | | Upper VS | |
| Part No. | 3015243 | 3015244 | 3015245 | 3015246 | 3015247 | 3015248 | 3015249 | 3015250 | PT-H Lower | |

Fig. 2-5, (F5136). Mark a center line on the fuel pump housing.

5. Select a new Class 2 (green color code) plunger and try to fit it in the barrel. If the plunger enters, try a Class 3 (yellow). Keep trying larger sizes until one will not enter the barrel. Then select a plunger two sizes smaller than the last plunger which did enter. Put some test oil on the plunger. The plunger must slowly drop into the bore without any help. Mark the governor barrel with the class size of the plunger that is in use. See Table 2-1 for the class sizes and the color codes. For the plunger differences see Fig. 2-6.

6. Install the spring dowel into the bottom of the barrel with ST-853 or 3376136 driver. The slot of the dowel must be to the front of the housing.

### VS Governor Barrel Replacement

The VS governor barrel and sleeve assembly is replaced in the same way as the standard governor barrel. The barrel location setscrew is above the standard throttle shaft on the side of the housing. A roll pin under a pipe plug is in use on some pumps.

The identification of the sleeve in the VS governor barrel is an "X" or "W" marked on the front surface. The four hole sleeve, Part No. 212148, is marked with an X. The five hole sleeve, Part No. 213514, is marked with a W.

The governor barrels are available in .010 inch [0.25 mm] and .020 inch [0.51 mm] oversize.

## Pressure Valve in the PT (type G) VS Housing

1. The PT (type G) VS fuel pumps can have a pressure valve.
2. Remove the valve with long thin pliers.

**Note:** In 1980 the pressure valve can be in the gear pump. When the valve is in the gear pump, do not put the valve in the VS housing.

3. Drive the new pressure valve into the VS housing with the ST-1250 Mandrel. Let 0.030 to 0.090 inch [0.76 to 2.29 mm] of protrusion out of the housing. The open end is assembled toward the outside of the housing. This lets the gear pump gasket touch the end of the valve when the gear pump is assembled. Fig. 2-7

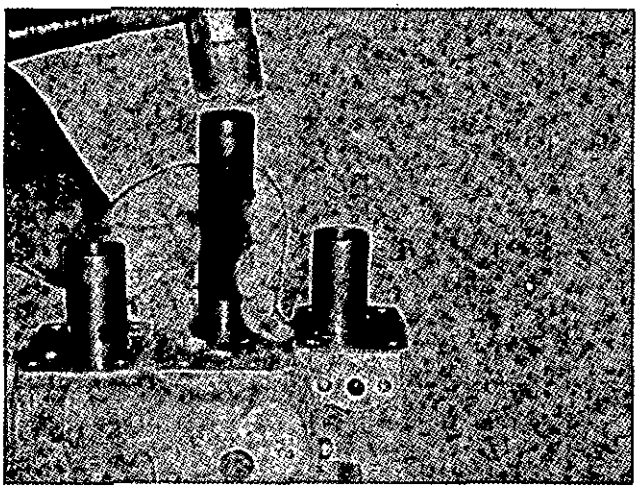


Fig. 2-7, (F5269). Drive the pressure valve into the PT (type G) VS housing.

## Governor Plunger

1. Remove the torque spring, if necessary, by twisting the spring off of the plunger shoulder. Do not pull off the spring. This will expand the spring beyond its elastic limnit so it has to be replaced, Fig. 2-8.
2. If the outside diameter or the length of the governor plunger is worn, replace it with a new plunger. The new plunger must be the same size as market on the barrel face. Check the fit of the new plunger in the barrel. If a larger plunger is required, see Table 2-1.
3. If only the thrust washer is worn, drive the retainer pin from the plunger. Pull the governor punger drive tang from the plunger.

**Note:** The chamfer on the small diameter of the thrust washer fits the fillets of the plunger driver.

4. If it is necessary to remove the stop sleeve, press the stop sleeve off of the shaft.

### Assembly

1. If the stop sleeve was removed, press the stop sleeve on the plunger. The notches go toward the governor barrel.
2. Assemble the plunger driver through the thrust washer and press it onto the plunger. The driver must have a tight fit in the plunger.

**Note:** Protect the plunger surface by putting the plunger in a copper jaw vise or on a V-block. This will prevent damage to the surface when installing the pin.

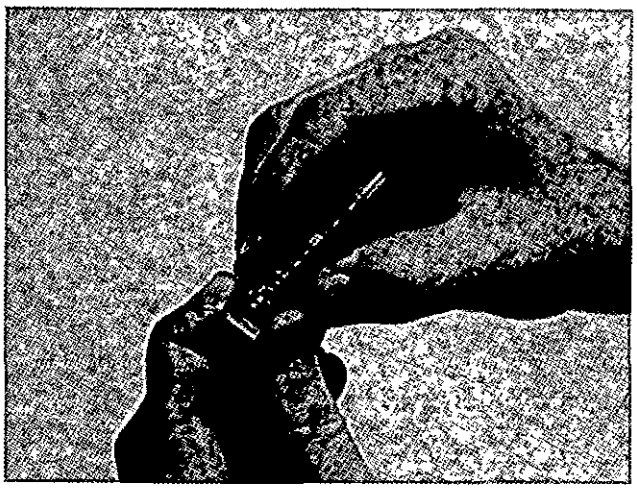


Fig. 2-8, (F5139). Remove the torque spring.

3. Press the retainer pin through the plunger and the plunger driver.

**Note:** The chamfered side of the thrust washer must be installed next to the driver. There must be at least 0.002 to 0.005 inch [0.05 to 0.13 mm] clearance between the washer face and the driver. The washer must not be tight.

4. Install the torque spring and shims as required. Put the small diameter of the spring on the stop sleeve of the plunger with a twisting motion.
5. If the torque spring is replaced with new spring, see the fuel pump calibration data in Bulletin No. 3379182, 3379068, 3379077 or 983533, "PT (type G) Fuel Pump Calibration," and Table 2-2.
6. One type of plunger failure is caused by heat between the stop collar and the sleeve. This occurs during long periods of overspeeding. Plunger stop collars that are machined from teflon prevent this type of failure.
   a. Because of the large outside diameter of the teflon stop collar you can not use a torque control spring. Use the teflon stop collar only in PT (type G) fuel pumps that do not require a torque control spring. Use

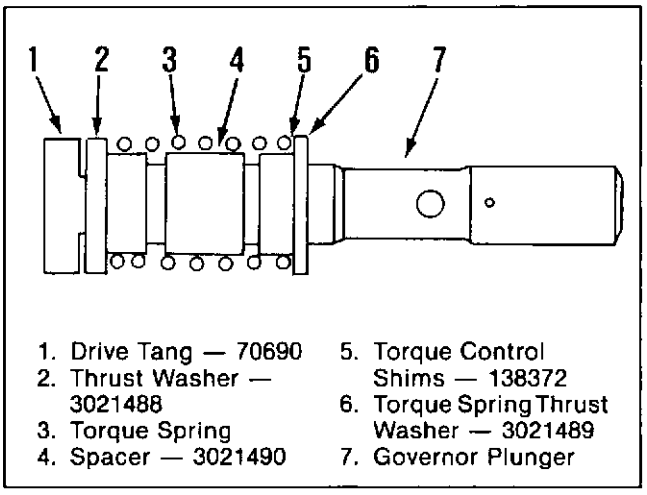
**Table 2-2: Torque Springs and Specifications**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Pounds Load [kg] | Inches [mm] @ Length | Free Length Inches [mm] |
|---|---|---|---|---|---|---|
| 138768 | Red | .044 [1.12] | 6.5 | 3.00/3.20 [1.4/1.5] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138769 | Blue | .044 [1.12] | 5.7 | 3.60/3.84 [1.6/1.7] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138780 | Green | .044 [1.12] | 5.2 | 4.20/4.48 [1.9/2.0] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138781 | Yellow | .047 [1.19] | 5.6 | 4.80/5.12 [2.2/2.4] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138782 | Red/Blue | .047 [1.19] | 5.2 | 5.40/5.76 [2.5/2.6] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138783 | Red/Green | .051 [1.30] | 5.9 | 6.00/6.40 [2.7/2.9] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138784 | Red/Yellow | .051 [1.30] | 5.5 | 6.60/7.04 [3.0/3.2] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138785 | Red | .044 [1.12] | 6.5 | 2.50/2.70 [1.1/1.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138786 | Blue | .044 [1.12] | 5.7 | 3.00/3.24 [1.4/1.5] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138787 | Green | .044 [1.12] | 5.2 | 3.50/3.78 [1.6/1.7] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138788 | Yellow | .047 [1.19] | 5.6 | 4.00/4.32 [1.8/1.9] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138789 | Red/Blue | .047 [1.19] | 5.2 | 4.50/4.86 [2.0/2.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138790 | Red/Green | .051 [1.30] | 5.9 | 5.00/5.40 [2.3/2.4] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138791 | Red/Yellow | .051 [1.30] | 5.5 | 5.50/5.94 [2.3/2.7] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138792 | Blue/Green | .051 [1.30] | 5.2 | 6.00/6.48 [2.7/2.9] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138793 | Red | .044 [1.12] | 6.5 | 2.00/2.20 [0.9/1.0] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138794 | Blue | .044 [1.12] | 5.7 | 2.40/2.64 [1.1/1.2] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138795 | Green | .044 [1.12] | 5.2 | 2.80/3.08 [1.3/1.4] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138796 | Yellow | .047 [1.19] | 5.6 | 3.20/3.52 [1.4/1.6] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138797 | Red/Blue | .047 [1.19] | 5.2 | 3.60/3.96 [1.6/1.8] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138798 | Red/Green | .051 [1.30] | 5.9 | 4.00/4.40 [1.8/2.0] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138799 | Red/Yellow | .051 [1.30] | 5.5 | 4.40/4.84 [2.0/2.2] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138800 | Blue/Green | .051 [1.30] | 5.2 | 4.80/5.28 [2.2/2.4] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138801 | Blue/Yellow | .051 [1.30] | 4.7 | 5.20/5.72 [2.4/2.6] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138802 | Green/Yellow | .054 [1.37] | 5.4 | 5.60/6.16 [2.5/2.8] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138803 | Red | .044 [1.12] | 6.5 | 1.50/1.70 [.67/.77] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138804 | Blue | .044 [1.12] | 5.7 | 1.80/2.04 [.81/.91] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138805 | Green | .044 [1.12] | 5.2 | 2.10/2.38 [.94/1.1] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138993 | Yellow | .047 [1.19] | 5.6 | 2.40/2.72 [1.1/1.2] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138994 | Red/Blue | .047 [1.19] | 5.2 | 2.70/3.06 [1.2/1.4] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138995 | Red/Green | .051 [1.30] | 5.9 | 3.00/3.40 [1.4/1.5] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138996 | Red/Yellow | .051 [1.30] | 5.5 | 3.30/3.74 [1.5/1.7] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138997 | Blue/Green | .051 [1.30] | 5.2 | 3.60/4.08 [1.6/1.8] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138998 | Blue/Yellow | .051 [1.30] | 4.7 | 3.90/4.42 [1.8/2.0] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138999 | Green/Yellow | .054 [1.37] | 5.4 | 4.20/4.76 [1.9/2.1] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 139584 | Blue/Green | .051 [1.30] | 5.2 | 7.20/7.68 [3.3/3.5] | @ .340 [8.64] | .640/.660 [16.26/16.76] |

**Table 2-2: Torque Springs and Specifications (Cont'd.)**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Pounds Load [kg] | Inches [mm] @ Length | Free Length Inches [mm] |
|---|---|---|---|---|---|---|
| 139585 | Blue/Yellow | .051 [1.30] | 4.7 | 7.80/8.33 [3.5/3.8] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 139586 | Green/Yellow | .054 [1.37] | 5.4 | 8.40/8.96 [3.8/4.0] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 139587 | Blue/Yellow | .051 [1.30] | 4.7 | 6.50/7.02 [2.9/3.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 139588 | Green/Yellow | .054 [1.37] | 5.4 | 7.00/7.56 [3.2/3.4] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 142696 | White/Blue | .041 [1.04] | 6.3 | 2.32/2.48 [1.0/1.1] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142697 | White/Yellow | .041 [1.04] | 7.7 | 1.74/1.86 [.77/.84] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142698 | White/Green | .035 [0.89] | 6.7 | 1.16/1.24 [.49/.54] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142699 | White/Blue | .041 [1.04] | 6.3 | 1.92/2.08 [.86/.94] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142700 | White/Yellow | .041 [1.04] | 7.7 | 1.44/1.56 [.63/.70] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142701 | White/Green | .035 [0.89] | 6.7 | 0.96/1.04 [.41/.45] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142702 | White/Blue | .041 [1.04] | 6.3 | 1.52/1.68 [.67/.75] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142703 | White/Yellow | .041 [1.04] | 7.7 | 1.14/1.26 [.49/.54] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142704 | White/Green | .035 [0.89] | 6.7 | 0.76/0.84 [.34/.38] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142705 | White/Blue | .041 [1.04] | 6.3 | 1.12/1.28 [.49/.54] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142706 | White/Yellow | .041 [1.04] | 7.7 | 0.84/0.96 [.38/.41] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142707 | White/Green | .035 [0.89] | 6.7 | 0.56/0.64 [.25/.29] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142843 | White/Blue | .041 [1.04] | 6.3 | 3.92/4.08 [1.7/1.8] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142844 | Red | .044 [1.12] | 6.5 | 4.90/4.10 [2.2/2.3] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142845 | Blue | .047 [1.19] | 6.8 | 5.88/6.12 [2.7/2.8] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142846 | Green | .047 [1.19] | 6.1 | 6.86/7.14 [3.1/3.2] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142850 | White/Blue | .041 [1.04] | 6.3 | 3.52/3.68 [1.6/1.7] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142851 | Red | .044 [1.12] | 6.5 | 4.40/4.60 [2.0/2.1] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142852 | Blue | .047 [1.19] | 6.8 | 5.28/5.52 [2.4/2.5] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142853 | Green | .047 [1.19] | 6.1 | 6.16/6.44 [2.8/2.9] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142854 | Yellow | .047 [1.19] | 5.6 | 7.04/7.36 [3.2/3.3] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142855 | Red/Blue | .051 [1.30] | 6.3 | 7.92/8.28 [3.6/3.7] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142857 | White/Blue | .041 [1.04] | 6.3 | 3.12/3.28 [1.4/1.5] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142858 | Red | .044 [1.12] | 6.5 | 3.90/4.10 [1.7/1.8] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142859 | Blue | .047 [1.19] | 6.8 | 4.68/4.92 [2.1/2.2] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142860 | Green | .027 [1.19] | 6.1 | 5.46/5.74 [2.5/2.6] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142861 | Yellow | .047 [1.19] | 5.6 | 6.24/6.56 [2.8/2.9] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142862 | Red/Blue | .051 [1.30] | 6.3 | 7.02/7.38 [3.2/3.3] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142863 | Red/Green | .051 [1.30] | 5.9 | 7.80/8.20 [3.5/3.7] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142864 | White/Blue | .041 [1.04] | 6.3 | 2.72/2.88 [1.2/1.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142865 | Red | .044 [1.12] | 5.5 | 3.40/3.60 [1.5/1.6] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142866 | Blue | .047 [1.19] | 6.8 | 4.08/4.32 [1.8/1.9] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142867 | Green | .047 [1.19] | 6.1 | 4.76/5.04 [2.1/2.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142868 | Yellow | .047 [1.19] | 5.6 | 5.44/5.76 [2.4/2.6] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142869 | Red/Blue | .051 [1.30] | 6.3 | 6.12/6.48 [2.8/2.9] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142870 | Red/Green | .051 [1.30] | 5.9 | 6.80/7.20 [3.1/3.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 3002047 | White | .054 [1.37] | 5.2 | 8.74/9.27 [3.97/4.21] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002048 | White/Red | .054 [1.37] | 5.0 | 9.31/9.89 [4.23/4.49] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002049 | Brown | .054 [1.37] | 4.8 | 10.08/10.71 [4.58/4.86] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002050 | Brown/Red | .059 [1.50] | 5.6 | 10.48/11.12 [4.76/5.05] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002051 | Brown/Blue | .059 [1.50] | 5.5 | 11.06/11.73 [5.03/5.33] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002052 | Brown/Green | .059 [1.50] | 5.3 | 11.63/12.36 [5.28/5.61] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002053 | White | .054 [1.37] | 5.2 | 7.28/7.72 [3.31/3.50] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002054 | White/Red | .054 [1.37] | 5.0 | 7.76/8.24 [3.52/3.74] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002055 | Brown | .054 [1.37] | 4.8 | 8.24/8.76 [3.74/3.98] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002056 | Brown/Red | .054 [1.37] | 4.6 | 8.73/9.27 [3.96/4.21] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002057 | Brown/Blue | .059 [1.50] | 5.5 | 9.22/9.78 [4.19/4.44] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002058 | Brown/Green | .059 [1.50] | 5.3 | 9.70/10.30 [4.40/4.68] | @ .350 [8.89] | .590/.610 [14.99/15.49] |

7. Vehicle overspeed can cause seizure of the governor plunger in the barrel. This occurs when the operator does not control the overspeed by the correct use of gearing and braking. This is more likely to occur in the V/VT-903 engines.
   a. This governor plunger uses a thrust washer on the barrel side of the torque spring, Fig. 2-9.
   b. When overspeeding occurs, the thrust washer will contact the barrel sleeve. The sleeve has a smooth surface in this area.
   c. The torque spring of this assembly is a press fit on the torque spring thrust washer. The normal torque spring is a press fit on the plunger sleeve.




1. Drive Tang — 70690
2. Thrust Washer — 3021488
3. Torque Spring
4. Spacer — 3021490
5. Torque Control Shims — 138372
6. Torque Spring Thrust Washer — 3021489
7. Governor Plunger

Fig. 2-9, (F5394). Special overspeed type of governor plunger.

## Checking the Air Signal Attenuator (ASA) in the AFC Cover

1. Remove the ASA from the fuel pump.
2. Use the service tool 3375934 to check the air flow through the ASA. The 3375934 tool is a small test stand for testing the ASA, AFC and the aneroid.
3. The 3375934 comes with two different flow meters. Some flow meters are marked 0-150. Leave off the last number on the 0-150 scale to make it the same as the 0-15 scale. Use the checking values shown below.
4. Attach the ASA to the service tool. Check the position of the two way valve on 3375934.
5. Adjust the air pressure to 8 psi [55 kPa].
6. The ASA must have a flow value between 8.0 and 10.4 units. Replace the ASA valve if it is out of this range.
7. A low valve flow can cause slow acceleration. A high flow can cause slow transmission shifting.

## Parts Required when the ASA is in the Top of the Fuel Pump Housing

This valve can be called the hydraulic ASA. When this valve is in use, the following parts must be in the AFC.

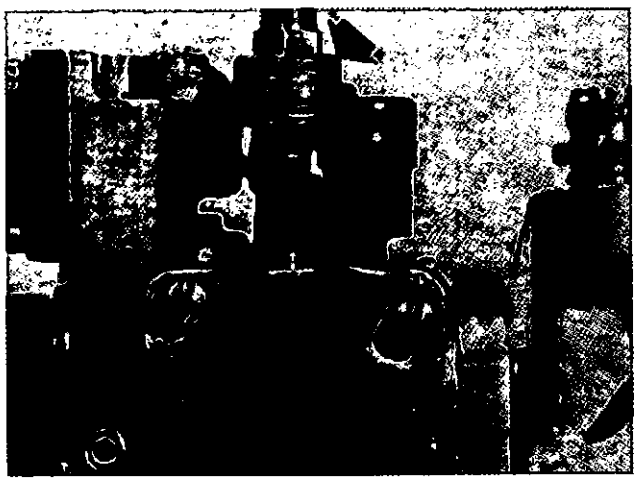


Fig. 2-10, (F5401). ASA and flow valve in the AFC cover.

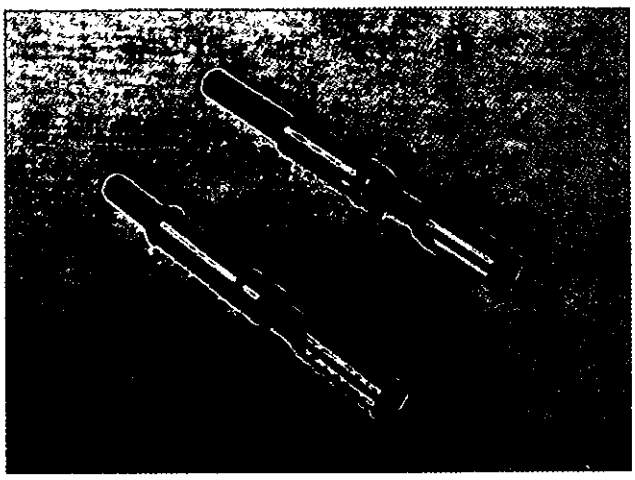
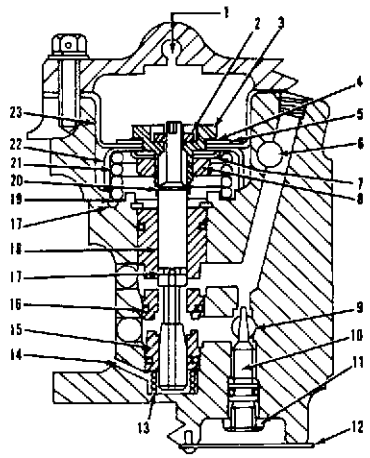


Fig. 2-11, (F5395). New and old AFC plungers.



1. Air Manifold Pressure
2. Plunger Jam Nut
3. Center Bolt
4. Sealing Washer
5. Flat Washer
6. Fuel to Shutoff Valve
7. Mounting Spacer
8. Piston Jam Nut
9. Fuel from Throttle Shaft
10. No Air Adjustment Valve
11. No Air Jam Nut
12. Throttle Cover
13. Barrel Spring
14. Fuel Vent to Housing
15. Barrel
16. Barrel O-Ring Seals
17. Fuel Drain Passages
18. Control Plunger
19. Washer
20. Plunger O-Ring Seal
21. Spring
22. Piston
23. Diaphragm or Bellows

Fig. 2-12, (F5353). Cross section of the AFC when the ASA is in the housing.

1. The AFC plunger must have a hole down the center of the shaft for a fuel vent.
2. The AFC plunger will have an O-ring near the threads, Fig. 2-11.
3. The AFC center bolt is longer. This will seal against the plunger O-ring to stop the leakage of air through the threads.
4. The AFC plunger will not have an O-ring and glyd ring seal.
5. The AFC barrel is harder, it is a tighter fit and it does not have a plunger lead in chamfer. The hardened barrels will have two grooves or an "H" marking on the face of the barrel.
6. Do not use a new type of plunger in an old barrel.

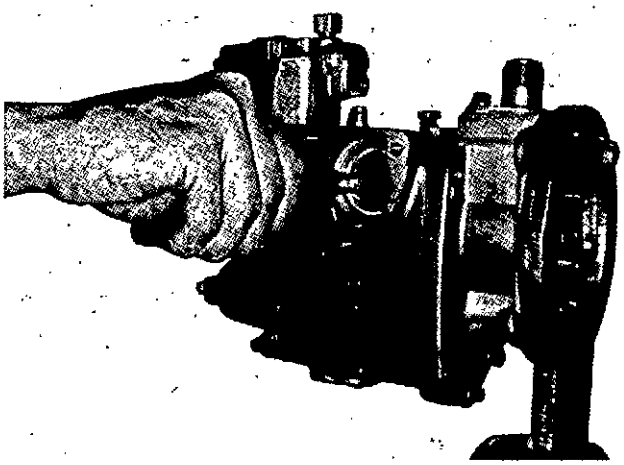


Fig. 2-13, (F5304). Install the AFC barrel retaining ring.

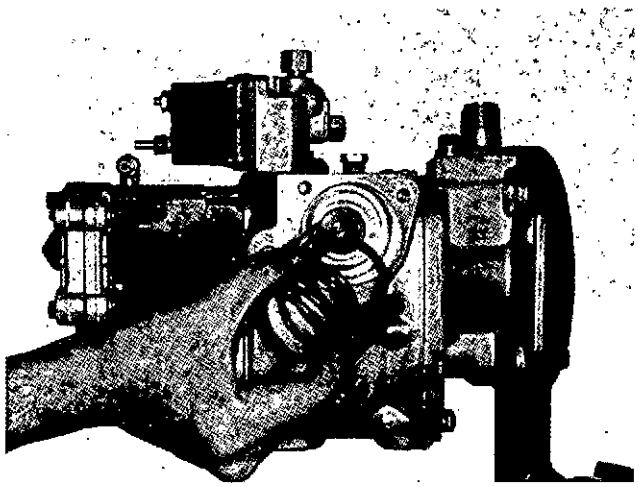


Fig. 2-14, (F5303). Install the AFC bellows spring and shim.

### AFC Assembly Installation

Several field rebuild procedures, for the AFC/ASA, have been sent out.

The AFC can be assembled to one of the field rebuild procedures or it can be assembled according to the factory procedure.

The following instructions are equivalent to the factory assembly procedures.

1. Install the small spring in the rear of the barrel cavity.
2. Put a coating of lubricating oil on the barrel O-rings. Install the O-rings on the barrel.

**Note:** Put a light coating of a 50-50 mixture of a lubricating oil additive (like STP) and clean lubricating oil on all O-rings just before installation.

3. Press the barrel into the housing. Install the flat retaining ring, Fig. 2-13.
4. Check the bellows spring, Table 2-3.
   a. All of the AFC bellows springs are 1.140 to 1.260 inch [28.95 to 32.00 mm] long without a load.
   b. Put load "A" on the spring.
   c. Compress the spring 0.300 inch [7.62 mm] more than the dimension of step "b".
   d. The spring must be in the limits of load "B".
5. Put the spring shim in the seat groove of the bellows spring. Install the spring, Fig. 2-14.
6. Put a light coating of lubricating oil on the plunger O-ring. Install the O-ring on the plunger in the groove just below the threads.

**Note:** When the AFC drain is in the top of the housing, the plunger glyd ring and O-ring are not required. If the fuel pump does not have an ASA, a new style AFC plunger that does not have a vent hole can be used.

7. Clean all of the oil off of the piston.

**Note:** The rounded edge of the flat washer must be against the bellows when it is assembled. If the bellows has a part number, it must be toward the piston.

8. Assemble the center bolt sealing washer, flat washer, bellows, piston, mounting spacer and the piston jam nut.
9. Hold the assembly by the hexagon on the center bolt.
10. Align the bellows, piston and the washers.
11. Do not twist the bellows. Tighten the piston jam nut to 30 to 40 in. lb. [3.4 to 4.5 N•m] torque.
12. Make sure the parts are aligned.
13. Apply teflon tape to the old type of plunger threads. The new plunger, with the O-ring described in step 6, does not require teflon tape. Install the plunger in the center bolt. The theaded end of the plunger will be even with the outer edge of the center bolt.
14. Install the plunger jam nut finger tight.
15. Install the plunger/piston assembly into the barrel. The bellows tab goes up, Fig. 2-15.

**Table 2-3: AFC Springs and Specifications (see text for checking procedure)**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Preload A Pounds [kg] | Load B Pounds [kg] |
|---|---|---|---|---|---|
| 179804 | White | .105 [2.67] | 5.2 | 2.00 [ 0.91] | 7.5- 8.5 [ 3.40- 3.86] |
| 179806 | Orange | .105 [2.67] | 4.1 | 3.00 [ 1.36] | 11.3- 12.7 [ 5.13- 5.77] |
| 179808 | Purple | .120 [3.04] | 4.6 | 4.00 [ 1.82] | 15.0- 17.0 [ 6.81- 7.72] |
| 179816 | Blue-White | .120 [3.04] | 4.1 | 5.00 [ 2.27] | 18.8- 21.2 [ 8.54- 9.62] |
| 179818 | Blue-Orange | .135 [3.43] | 4.7 | 6.00 [ 2.72] | 22.5- 25.5 [10.21-11.58] |
| 179820 | Blue-Purple | .135 [3.43] | 4.3 | 7.00 [ 3.18] | 26.3- 29.7 [11.94-13.48] |
| 179822 | White-Green | .135 [3.43] | 4.1 | 8.00 [ 3.63] | 30.1- 33.9 [13.66-15.39] |
| 179824 | White-Red | .135 [3.43] | 3.9 | 9.00 [ 4.09] | 33.8- 38.2 [15.35-17.34] |
| 179826 | White-Yellow | .148 [3.76] | 4.4 | 10.00 [ 4.54] | 37.6- 42.4 [17.07-19.25] |
| 179828 | Green-Red | .148 [3.76] | 4.2 | 11.00 [ 4.99] | 41.3- 46.7 [18.75-21.20] |
| 179830 | Green-Yellow | .148 [3.76] | 4.0 | 12.00 [ 5.45] | 45.1- 50.9 [20.47-23.11] |
| 179832 | Orange-Purple | .148 [3.76] | 3.8 | 13.00 [ 5.90] | 48.9- 55.1 [22.20-25.02] |
| 179834 | Red-Purple | .148 [3.76] | 3.7 | 14.00 [ 6.36] | 52.6- 59.4 [23.88-26.97] |
| 179836 | Purple-Yellow | .156 [3.96] | 4.0 | 15.00 [ 6.81] | 56.4- 63.6 [25.60-28.87] |
| 3000592 | Light Green | .156 [3.96] | 3.9 | 16.00 [ 7.26] | 60.1- 67.9 [27.29-30.83] |
| 3007692 | Lt. Blue-Green | .162 [4.11] | 3.8 | 18.00 [ 8.17] | 67.7- 76.3 [30.74-34.64] |
| 3007694 | Lt. Blue-Red | .177 [4.50] | 3.7 | 20.00 [ 9.08] | 75.2- 84.8 [34.14-38.32] |
| 3007696 | Lt. Blue-Yellow | .177 [4.50] | 3.7 | 22.00 [ 9.99] | 82.7- 93.3 [37.55-42.36] |
| 3007698 | Lt. Green-White | .177 [4.50] | 3.6 | 24.00 [10.90] | 90.2-101.8 [40.95-46.22] |

16. Carefully push the bellows down between the piston and the housing. Make sure the bellows is flat where it touches the cover.
17. Line up the bellows holes with the housing and cover plate holes.
18. Install the cover capscrews and washers finger tight. After the AFC is set on the test stand, tighten the cover capscrews to 30 to 35 in. lb. [3.4 to 4.0 N•m] torque.
19. Put a coating of lubricating oil on the O-ring of the no air needle valve. Use Part No. 3375148 AFC O-Ring Installation Tool to install the O-ring to the needle valve.
20. Install the no air needle valve into the housing, above the throttle shaft, until it bottoms.
21. Install the jam nut for the no air needle valve finger tight. The jam nut will be tightened after it is set on the test stand.
22. If the fuel pump does not have an AFC, install the no air needle valve plug and tighten to a torque of 30 to 45 in. lb. [3.4 to 5.1 N•m].

#### AFC Glyd Ring Requirements

In May, 1978 the hardened AFC barrels were put in the fuel pumps. The hardened barrels can have an "H" or two concentric grooves on the face of the barrel. At that time, the glyd ring and the O-ring were taken off of the AFC plunger.

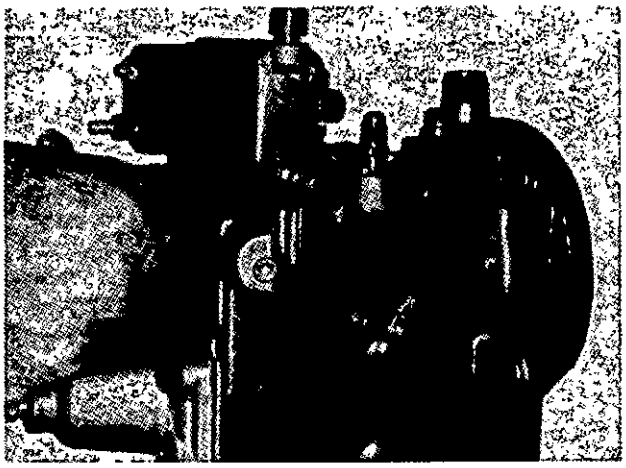


Fig. 2-15, (F5302). Install the AFC bellows and piston assembly.

The 1/8 inch [3.17 mm] lead in chamfer of the plunger barrel hole was taken out in Sept., 1979.

1. The glyd ring must be used with the soft barrel that was used before May, 1978.
2. Rapid wearing of the AFC barrel will occur if the glyd ring is not used in a soft barrel. This wear will result in an eventual loss of engine power.
3. The glyd ring can be taken out when a hard barrel is in use. The AFC cavity must have a drain line to the injector drain or to the fuel tank.
4. When the glyd ring is removed, the AFC section of the fuel pump must be calibrated.

### Flow Valve in the AFC Cover

1. Inspect the flow valve. Make sure the check ball is loose. Make sure the hole near the bottom of the valve is not plugged.
2. Install the flow valve in the AFC cover. Tighten to a torque of 5 ft. lb. [7 N•m].

### Air Signal Attenuator (ASA) Installation

1. Install the air ASA valve in the AFC cover. Install the hydraulic ASA valve in the top of the fuel pump housing.
2. Tighten to a torque of 5 ft. lb. [7 N•m].

### Tachometer Drive — Mechanical in the Main Housing

#### Disassembly

1. Remove the felt sealing washer, when used, and the oil seal from the tachometer drive shaft. Fig. 2-16.
2. Press the tachometer drive shaft from the drive gear and bushing, if the gear is badly worn or the shaft and bushing are damaged. Check the shaft outside diameter and the bushing inside diameter. Replace if necessary. Table 2-4.
3. If the shaft is replaced, make sure the hole in the top of the new shaft is the same diameter as the hole in the shaft which was removed.

#### Assembly

Install the bushing on the tachometer shaft with the bushing chamfer toward the gear. Press the

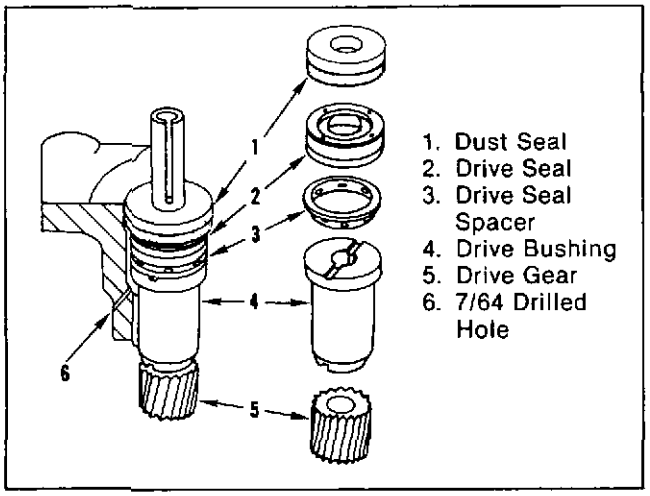



Fig. 2-16, (F5214). The tachometer drive parts in the housing.

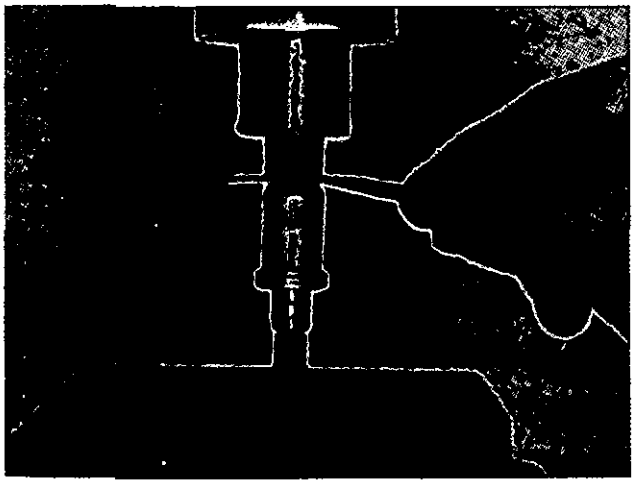


Fig. 2-17, (F537). Press the tachometer gear on the shaft.

1. Left Hand Rotation Fuel Pump *Clockwise Tachometer Drive*
2. Right Hand Rotation Fuel Pump Clockwise Tachometer Drive

Fig. 2-18, (F5140). Tachometer and matching drive gears.

gear onto the shaft until it is even with the end of the shaft, Fig. 2-17. Check to see that the shaft turns freely in the bushing. The maximum clearance between the gear and the bushing is 0.005 inch [0.127 mm].

**Note:** Check the driven gear to make sure it matches with the tachometer drive gear, Fig. 2-18.

**Table 2-4: Tachometer Drive Parts Specifications**

| Part Description | Inches [mm] |
|---|---|
| **Front Cover Mounted** | |
| Tachometer Shaft | .3950/.3955 [10.033/10.046] |
| Shaft Bushing | .3963/.3970 [10.066/10.084] |
| Gear I.D. | .3940/.3948 [10.008/10.028] |
| **Housing Mounted** | |
| Tachometer Shaft | .3100/.3105 [7.874/7.887] |
| Shaft Bushing | .3120/.3130 [7.925/7.950] |
| Worn Limit Bushing Replacement Clearance | .005 [.127] |
| Gear I.D. | .3090/.3098 [7.849/7.869] |

## Right Hand and Left Hand Rotation Housings

Do not use a fuel pump housing that has a right hand rotation with a gear pump that has a left hand rotation. Look at the gear pump side of the housing. The fuel passage from the gear pump to the fuel filter is to the right of the main shaft in a housing that has a right hand rotation.

The fuel passage is to the left of the main shaft in a housing that has a left hand rotation.

# NOTES

# Front Cover Assemblies

The front cover assemblies contain the cover, main shaft and bearing, and the carrier assembly for the governor weights. Most of the front covers made after Jan. 1975 will contain the tachometer drive. The cover can be flange mounted to the compressor or to the fuel pump drive.

## Disassembly and Inspection of the Standard or Automotive Cover

1. Check the shaft of the governor weight carrier in its bushing before it is removed. There is excessive wear if you can move the shaft from side to side in the bushing. See paragraph 12.
2. Check the gear backlash between the weight shaft gear and the drive gear. Normal backlash is 0.005 to 0.009 inch [0.13 to 0.23 mm].

**Note:** Remove the weight assist plunger.

3. To remove the weight carrier assembly from the drive cover, use the ST-709 Puller. Pull the assembly and the bushing from the front cover, Fig. 3-1. The bushing can be held on the shaft with a retaining ring. If the retaining ring pulls off the shaft, leaving the bushing in the front cover, use the inside puller of the ST-709 to pull the bushing. If the shaft pulls off the cast carrier, use the ST-667 Dowel Puller to remove the shaft and bushing. New assemblies do not have a retaining ring.
4. Remove the coupling retainer capscrew of the fuel pump drive and the washers. If the cover contains a tachometer drive, pull the coupling with the ST-709 puller. Pull the spline drive coupling with ST-1249.
5. If the front cover contains a tachometer, remove the tachometer drive housing.
6. Use the ST-667 Dowel Puller or a brass punch to remove the tachometer shaft, seal and bushing from the front cover. Discard the seal.
7. Remove the large retaining ring from the drive shaft that is between the drive cover and the drive gear. Use a pair of hose clamp pliers or grind a small groove in a pair of needle nose pliers, Fig. 3-3.
8. Replace the retainer capscrew of the drive coupling with a longer capscrew. Press on the capscrew to remove the drive shaft bearing and the shaft assembly from the front cover, Fig. 3-4. Remove the key from the shaft.

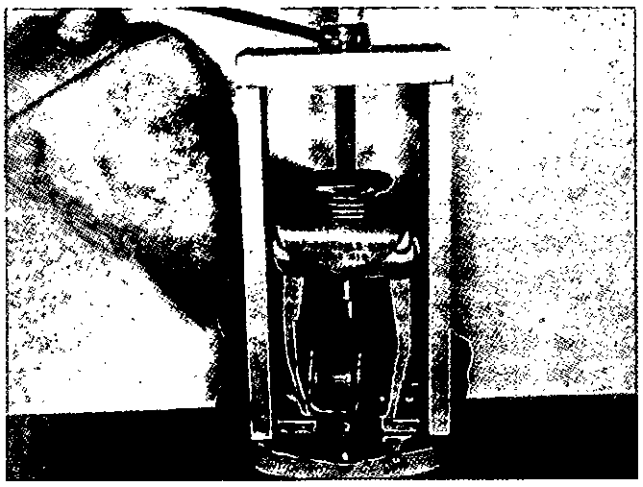


Fig. 3-1, (F538). Use the ST-709 to pull the governor weight assembly.

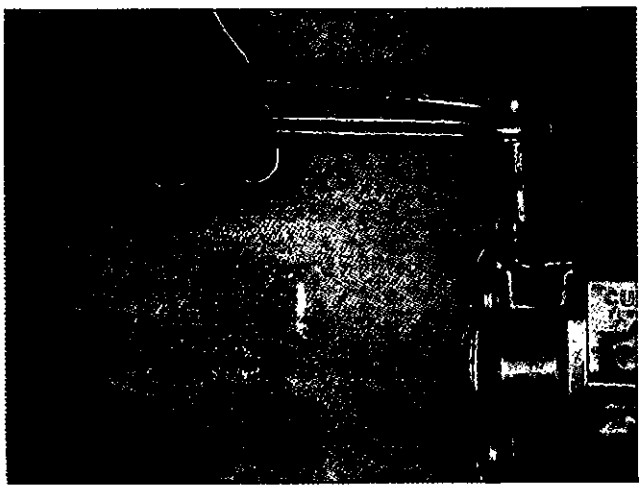


Fig. 3-2, (F5385). Remove the tachometer drive housing.

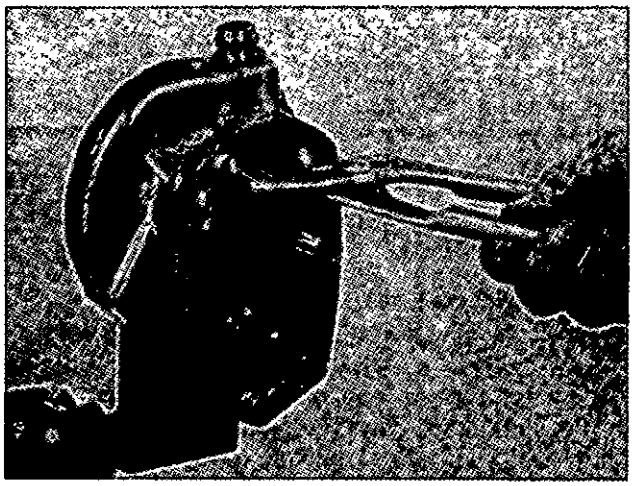


Fig. 3-3, (F539). Remove the retaining ring from the groove in the front cover.

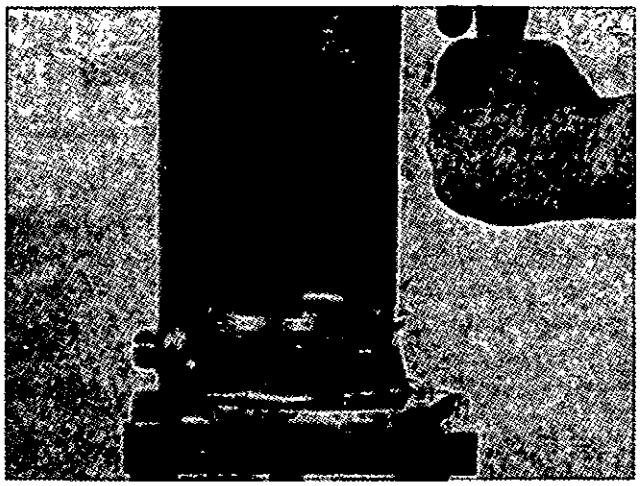


Fig. 3-4, (F5144). Press the drive shaft assembly from the front cover.

9. Press the oil seals of the drive shaft from the drive cover or the shaft.
10. Remove the tachometer drive gear from the shaft.
11. Inspect for wear or damage on the oil seal area of the drive shaft.
12. The governor weight assembly can be disassembled to change the gear and the bushing. The cast governor weight carrier, weights and shaft parts can be replaced. If the bushing is worn larger than 0.504 inch [12.80 mm], replace the bushing.

## Disassembly of Variable Speed Fuel Pump Cover

1. Remove the lower governor weight carrier, the main drive shaft and gear, drive coupling, tachometer drive and oil seals as described before.
2. Heat the cover in an oven set at 300° F [149° C]. Remove the idler shaft and bushing assembly. If the idler shaft can not be removed, heat the area with a propane torch.

**Note:** The cover will twist out of shape if it is heated with an acetylene torch. If the idler shaft has a capscrew hole, hold the gear to the shaft with a capscrew and a washer. Pull the assembly with the ST-709. If the idler shaft does not have a capscrew hole, do not use a gear puller to pull the idler shaft and gear. The gear will pull off of the shaft.

3. Remove the retaining ring, thrust washer and bushing from the idler gear shaft. If the idler bushing is worn larger than 0.507 inch [12.88 mm], replace the bushing.
4. The normal gear backlash of the idler gear and the upper weight carrier gear is 0.005 to 0.009 inch [0.13 to 0.23 mm].
5. Remove the upper weight carrier with ST-709 Puller with 3375360 Jaws. If the gear pulls off of the shaft, use a dowel puller to remove the shaft.
6. Remove the locknut and ball bearing. Remove the shield if used. If the cover is heated with a propane torch to remove the idler shaft locknut and the main shaft, the oil seals must be replaced.
7. Inspect the ball bearing and replace if found defective.

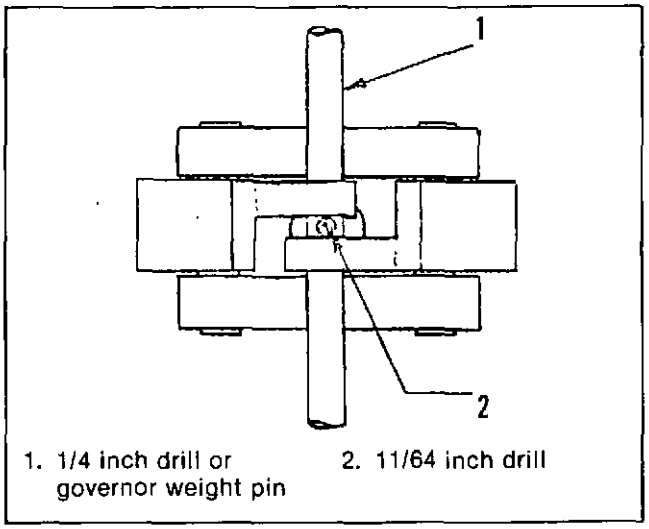
## Governor Weight Carrier

The cast weight assemblies can be ordered as an assembly. The welded pins can not be replaced. The welded assemblies are no longer available and can be replaced with the cast assemblies.

1. The cast carrier shaft can pull off when removing it from the cover. To install, press the shaft into the carrier until the end of the shaft is even to 0.005 inch [0.13 mm] below the weight side of the carrier surface.

**Note:** Do not use the old parts unless there is a minimum of 0.0005 inch [0.013 mm] tight fit between the shaft and the carrier.

2. To check the governor weight pins for wear use two drill bits.
   a. Put a 1/4 inch [6 mm] drill bit, or a new weight pin under the weight feet.
   b. Try to put a 11/64 inch [4.365 mm] drill bit down between the weight feet, Fig. 3-5.
   c. *If the 11/64 inch [4.365 mm] drill bit will go* between the weight feet, replace both of the pins.




1. 1/4 inch drill or governor weight pin
2. 11/64 inch drill

Fig. 3-5, (F5400). Check the governor weight pins for wear.

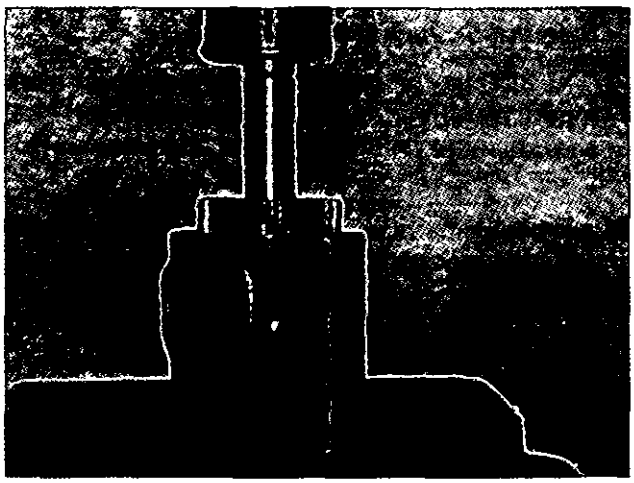


*Fig. 3-6, (F5285). Remove the gear from the welded weight carrier with ST-1231.*

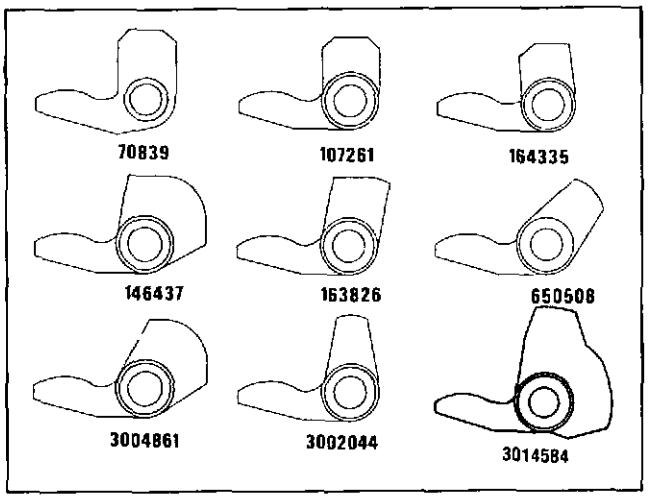



Fig. 3-7, (F5252). Governor weight identification.

   d. *After the pins are removed*, check the weight for wear or damage.
   e. Check both of the weights. Sometimes one weight will wear more than the other. If wear or damage is found, replace both of the weights.

3. Remove the gear if it is damaged, Fig. 3-6. The chamfered side of the gear goes toward the carrier weight. Press the gear until it is against the carrier.
4. Slide the governor carrier bushing on the carrier shaft with the flanged end of the bushing next to the gear. The retaining ring is not now required.

## Drive Shaft

### Disassembly

1. Press the drive coupling of the gear pump *or the tachometer drive gear, when used, and* the governor drive gear from the drive shaft, Fig. 3-8.
2. Remove the tachometer drive gear from the drive shaft with a small gear puller.

**Note:** *Press away from the bearing because the* shaft under the bearing is larger in diameter than the bearing.

3. Press the drive bearing from the shaft only if the bearing is rough or if there are grooves in the shaft. To check the bearing, hold the bearing and spin the shaft and bearing assembly.

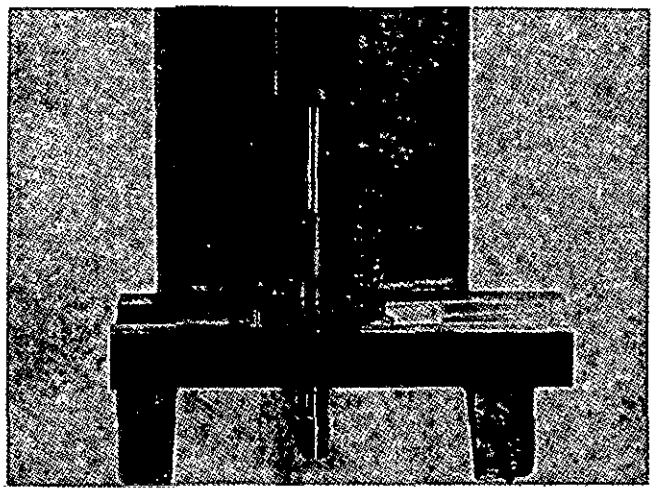


Fig. 3-8, (F5146). Press the shaft from the gear.

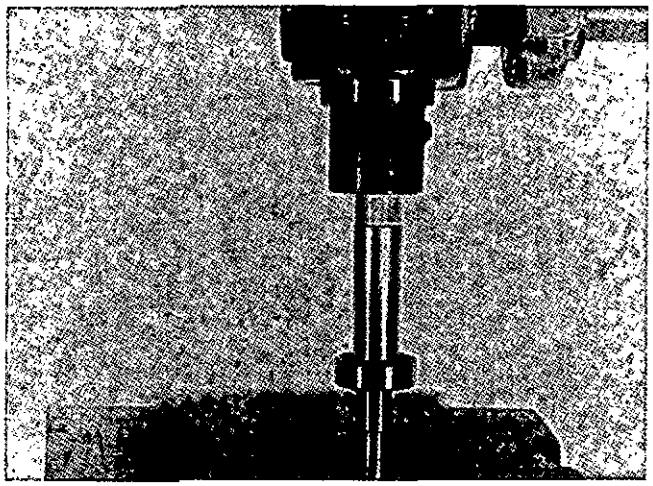


Fig. 3-9, (F541). Press the drive bearing on the shaft.

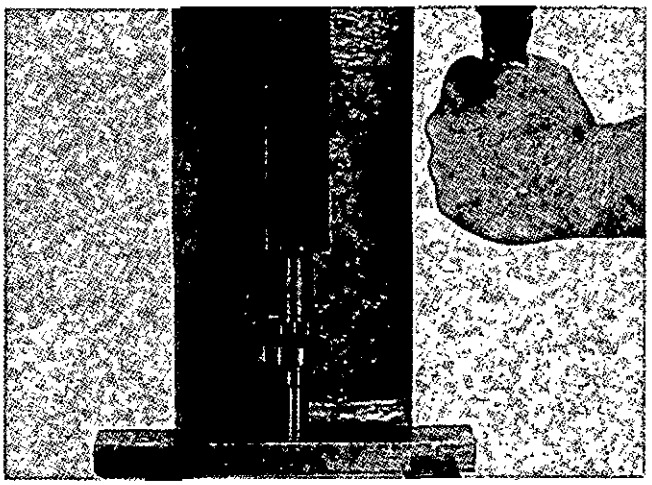


Fig. 3-10, (F542). Press the drive coupling on the shaft.

### Assembly

1. If the bearing or the shaft is replaced, lubricate the shaft with high pressure lubricant. Use 3375172 Driver to press the bearing over the shaft. Press against the inner race of the bearing, Fig. 3-9.

**Note:** The bearing and the drive gear can be pressed on the shaft at the same time.

2. Use the 3375172 to press the governor drive gear to the drive shaft bearing on the shaft.
3. Lubricate the shaft and bore. Press the drive coupling of the gear pump or the rear tachometer drive gear, if used, on the shaft. Press it against the governor drive gear, Fig. 3-10.

**Note:** Check the tachometer drive when used, to make sure it fits the tachometer gear to give the proper rotation, Fig. 2-18. The standard V555 fuel pump rotates at about 78% of the engine rpm. These pumps require a different set of tachometer gears. The fuel pump for the V555 with a V504 rear gear drive rotates at the same rpm as the engine. Check the parts list if required.

4. Check to see if the parts are seated. Install the retaining ring between the ball bearing and the governor drive gear.

## Drive Cover

### Assembly of Standard Cover and Cover with Tachometer Drive

1. Clean all of the parts completely with mineral spirits or the equivalent.
2. In 1980 the oil seals for the front cover have a coat of rubber on the outside diameter. These seals must be installed dry. These seals go in very easy.
3. If the front cover has the tachometer drive in it install the seals after the main shaft has been installed.
   a. Install the main shaft. See step 6.
   b. Install the guide pin of the Service Tool over the drive end of the fuel pump main shaft. The guide pin aligns the seal in the seal bore and protects the seal lips as they are expanded over the shaft.

c. Position one fuel pump seal over the guide pin of the Service Tool. This seal must be installed with the sealing lip toward the rear of the fuel pump.

d. Press the seal into location using the seal driver without the spacer installed.

e. Position another fuel pump seal over the guide pin of the Service Tool. This seal must be installed with the sealing lip toward the front of the fuel pump.

f. Press the seal into location using the seal driver with the spacer installed.

**Note:** This procedure will put the seals in the correct location of the seal bore.

4. In the old style front covers, without the tachometer drive provisions, install the seals before the main shaft is installed. The seal area of the old style front covers is thicker. The seals must be installed from both sides of the cover.

   a. Install the oil seals into the old style front cover with 3375173 Seal Driver. Install the seals even to 0.015 inch [0.38 mm] below the surface, Fig. 3-11.

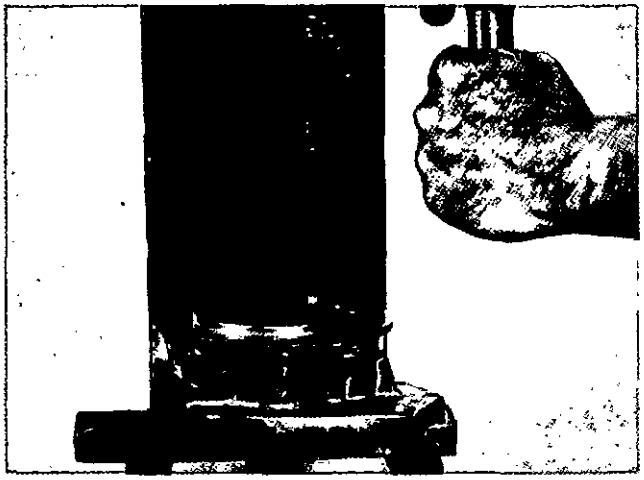


*Fig. 3-11, (F543). Install the inside oil seal in the drive cover.*

   b. Install the outside oil seal into the drive cover from the outside. The oil seal lip must be toward the outside of the cover.

   c. Install the inside oil seal into the cover from the inside. The oil seal lip must be toward the inside of the cover.

5. The checking or weep hole between the oil seals must be open.

**Note:** The air compressor can require modifications when changing to a fuel pump with a tachometer drive in the front cover. The oil must be permitted to go from the air compressor housing into the front cover cavity of the fuel pump. This oil will lubricate the tachometer drive gears. If an oil seal is used on the fuel pump side of *the compressor drive shaft, the seal must be* removed. All oil drain holes must have the plugs removed before installing the fuel pump. The air outlet connection of the air compressor can hit the tachometer cable. Use an air outlet connection with an off set.

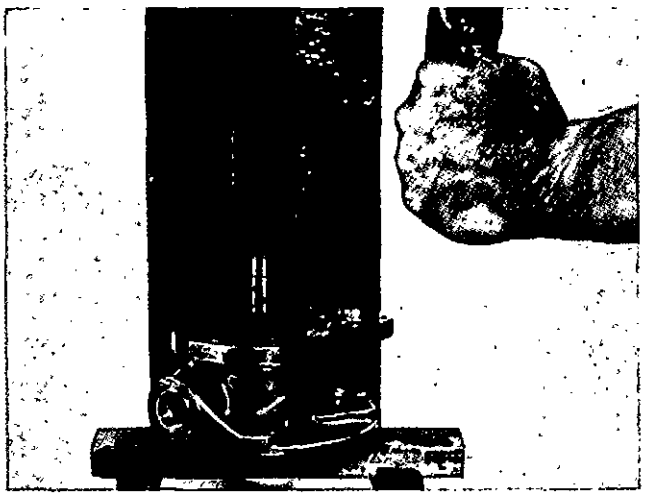


Fig. 3-12, (F5277). Press the drive shaft assembly into the cover.

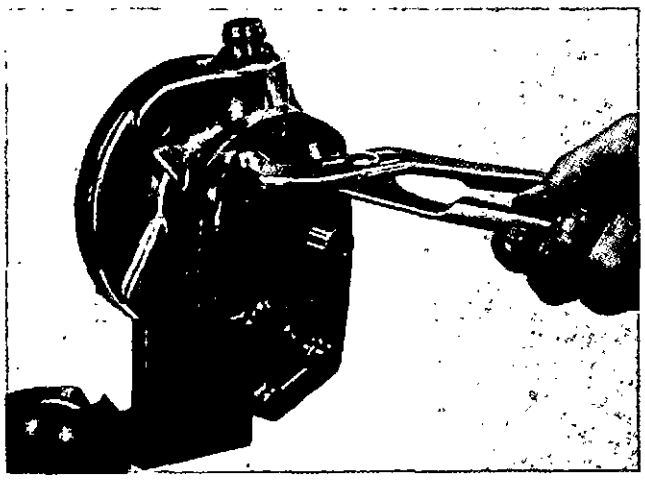


Fig. 3-13, (F544). Install the retaining ring in the groove.

6. Lubricate the ST-419 Assembly Tool and install the tool over the main shaft. Put the retaining ring between the drive gear and the bearing. Carefully install the main shaft assembly into the front cover with an arbor press, Fig. 3-12. Do not move the oil seals, if they have been installed. Push the assembly until the bearing touches the bottom of the cover hole. Install the retaining ring in the groove of the cover, Fig. 3-13. Look through the holes in the gear to make sure the retaining ring is in the groove.

**Note:** If the tachometer drive is not required, apply cup plug sealant to the cup plug, Part No. 175831. Drive it into the cover hole with Service Tool 3375271.

7. Align the oil groove in the top of the tachometer drive bushing with the drive shaft of the fuel pump. Press the bushing, shaft and gear assembly into the cover until the bushing bottoms.

8. Install the spacer on the top of the bushing with the slotted edge down. The spacer must bottom on the bushing. Make sure the spring side of the tachometer oil seal is down. Use the 3375174 Seal Driver to install the oil seal.

**Caution: Do not over press the spacer. It can be pressed flat which will destroy its efficiency.**

9. Cover the top of the oil seal with a thin coating of oil. Install the tachometer housing to the cover. Tighten the screw in the housing to 35 to 45 ft. lb. [47 to 61 N•m].

10. Install the front tachometer drive gear into position on the drive shaft. Install the key. Press the drive coupling on the drive shaft. Align the parts and press slow. Make sure the tachometer gear teeth are aligned.

11. Install the coupling retaining flat washer, lockwasher and capscrew to the shaft. Tighten the capscrew to 5 ft. lb. [7 N•m]. Hold the coupling or the main shaft in a copper jawed vise while tightening.

12. Put a coating of high pressure lubricant on the weight carrier bushing and press it into the front cover. The bushing must seat against the housing. Slide the carrier assembly into the bushing. Rotate the weight assembly, with the weights opened out to make sure it will turn completely in housing.

**Note:** When replacing a welded sheet metal carrier with a cast carrier, the fuel pump must be assembled and calibrated to a cast carrier code. Most of the codes were updated in 1979.

13. Install the shims, when required, spring and the governor assist plunger between the governor weights and into the bore of weight carrier shaft, Fig. 3-14.

**Note:** Always install the weight assist plunger with the smallest end of the plunger toward the weights.

14. Use enough shims behind the spring to make the protrusion of the weight assist plunger above the gasket surface of the front cover.

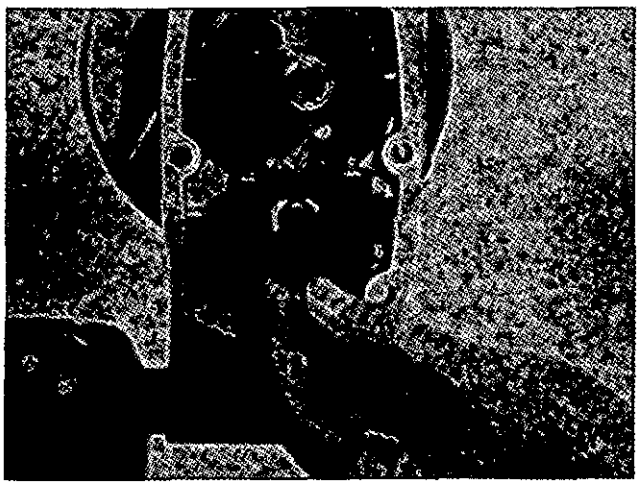


Fig. 3-14, (F5305). Install the weight assist plunger in the cast weight carrier.

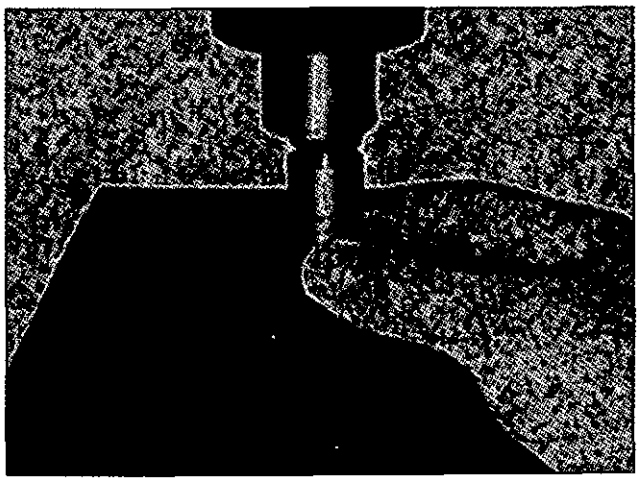


Fig. 3-15, (F5278). Press the idler gear on the shaft.

Check the protrusion with a dial depth gauge, ST-1120 or ST-1241.

a. This is a reference setting. This protrusion can be changed to get the correct check point pressures.

**Note:** See the calibration data in Bulletin Nos. 3379182, 3379068, 3379077 and 983533 for the approximate weight assist protrustion for the pump being rebuilt.

15. Fuel pumps that had a splined coupling drive can use the front cover with the tachometer drive. This will require the buffer type coupling.

    a. Use the front cover assembly with the buffer type coupling.

    b. The splined shaft, from the drive unit, outside diameter must not exceed 1.420 to 1.423 inch [36.07 to 36.14 mm] for use of the conversion coupling.

    c. Install the conversion fuel pump-to-drive unit splined/buffer coupling, Part No. 208755.

### Assembly of Variable Speed Fuel Pump Cover

The front cover of the PT (type H) fuel pump is interchangeable with the PT (type G) VS front cover. The heavy-duty design of the PT (type H) front cover is required in some high vibration installations.

1. Heat the cover in hot oil for 15 minutes, in an oven at 400° F [200° C] for 30 minutes or with a propane torch in the idler shaft area.

2. While the cover is heating, assemble the thrust washer of the idler gear and the retaining ring on the idler gear shaft. Slide the bushing on the shaft. Press the gear on the shaft with the smooth side of the gear against the bushing. The bushing end clearance is 0.002 to 0.007 inch [0.05 to 0.18 mm], Fig. 3-15.

**Note:** If the bushing end clearance is too small, remove the retaining ring and the bushing. Check the shaft for a rough surface near the gear.

3. Install the upper governor carrier weight shield over the weights if required, Fig. 3-16. (The shield can be used when the governed pump rpm is above 2300.) Do not use the

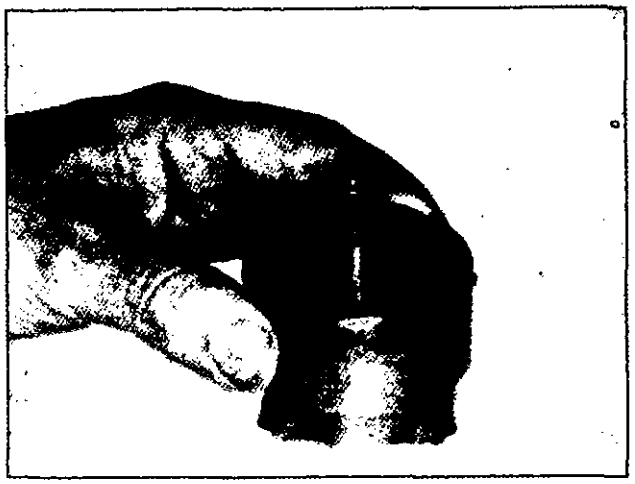


Fig. 3-16, (F5279). Install the governor weight carrier shield.

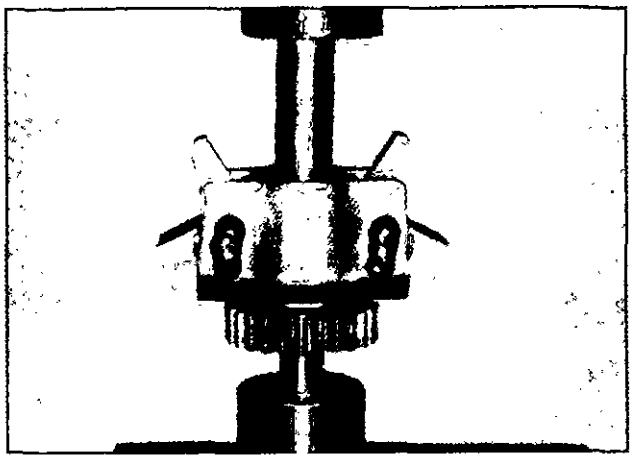


Fig. 3-17, (F5280). Install the governor weights on the shaft.

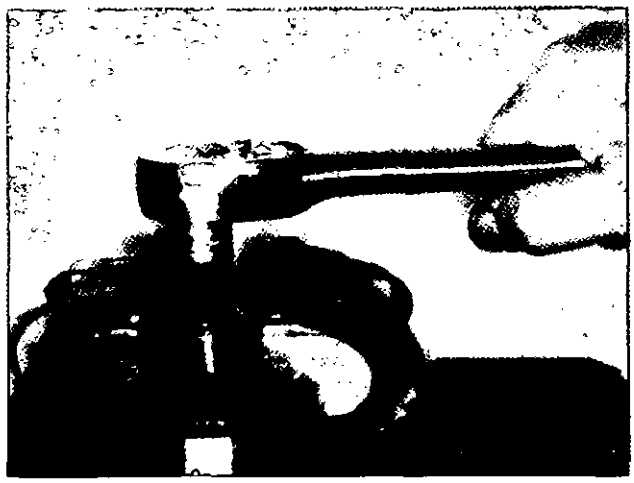


Fig. 3-18, (F5283). Install the locknut on the shaft.

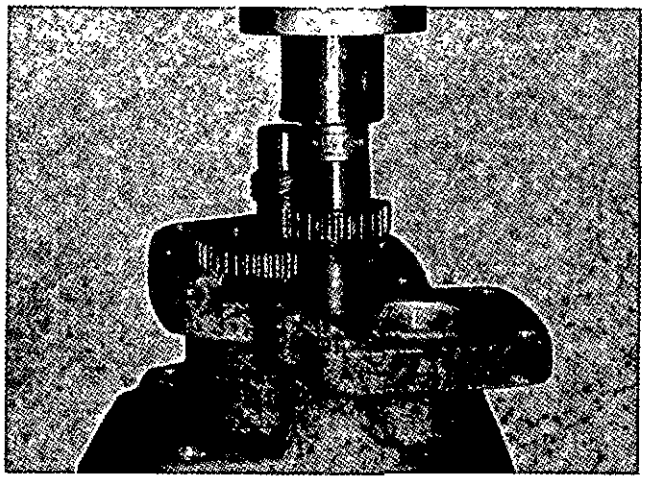


Fig. 3-19, (F5281). Press the idler gear into the cover.

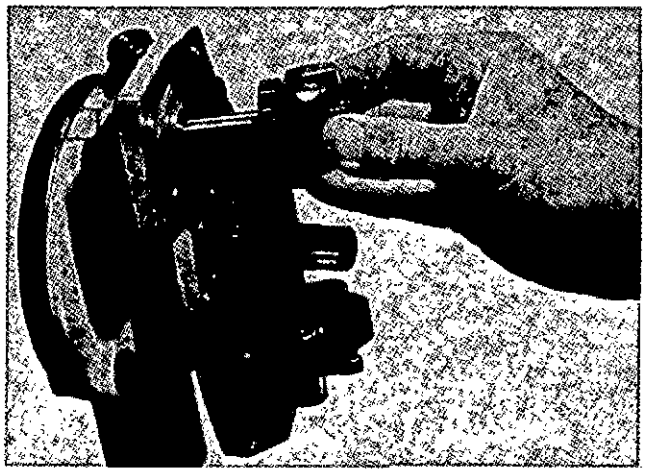


Fig. 3-20, (F5402). Install the VS governor weights into the cover.

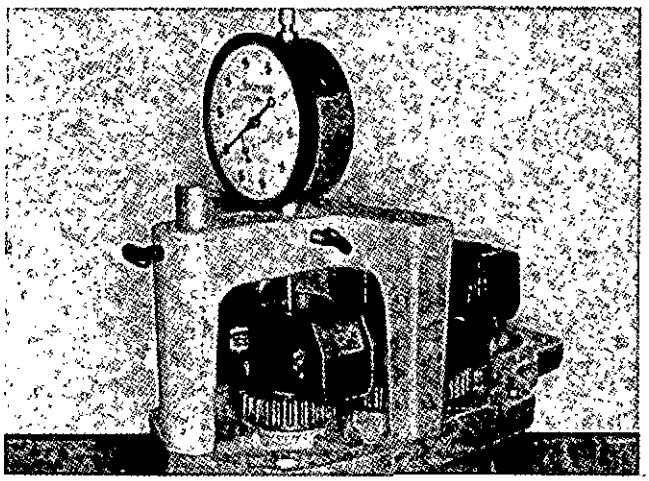


Fig. 3-21, (F5267). Check the weight assist protrusion on a VS pump with the ST-1241.

shield with the cast carrier. Press the gear on the shaft with the lead in chamfer toward the weights.

4. Press against the inner race of the ball bearing to assemble it on the shaft, Fig. 3-17. Hold the assembly together with a new locknut, Fig. 3-18.

**Note:** Some new type of upper carriers can have a bushing instead of a ball bearing.

5. Remove the cover from the heat and press the idle gear and bushing assembly into the cover. Press against the gear, Fig. 3-19.
6. To install the upper weight carrier, (with bearing only) press against the shaft inside of the carrier or use ST-1231. If the cover cools off, this can require pressing, Fig. 3-20.
7. Let the cover cool before installing the new oil seals, main shaft and drive coupling.
8. Press in the lower weight carrier bushing. Slide in the weight carrier assembly. Make sure both of the weight carriers are horizontal.

**Note:** when replacing a sheet metal carrier with a cast carrier, calibrate the fuel pump to a cast carrier code.

## Check the Protrusion with ST-1120 or ST-1241

The ST-1120 or ST-1241 is a bracket which sits on the machined surface of the front support of the fuel pump. It has a dial indicator to give a direct reading of the plunger protrusion, Fig. 3-21. **This is a reference point only and can be changed during the calibration.**

**Note:** The dial indicator is a special light loaded indicator. Do not use other type of indicators. The inside loading in a standard indicator will compress the weight assist spring and cause wrong readings.

### Measure the Protrusion with the Carrier in the Cover

1. Put the bracket assembly on a surface plate. Put the contact point of the dial indicator on the 1/2 inch [12.7 mm] diameter 1.000 inch [25.4 mm] long gauge pin. Zero the dial indicator.
3. The dial indicator will give a direct reading of the amount of the protrusion. If the protrusion is below the specifications, add shims. (See

Fuel Pump Calibration Manual, Cummins Bulletin No. 3379068, 3379182 or 3379077 for *the approximate setting.) If the protrusion is* above the specifications, remove the shims. Grind the small end of the weight assist plunger if no shims are in use, Fig. 3-21

**Carrier Not in Cover**

1. Install the governor weight assembly, with the bushing, into the 5/8 inch [15.87 mm] hole in the test gauge body.
2. Follow Steps one and two as listed before.
3. Remove the bracket assembly from the test body and turn it 180°. Put it on test gauge body. This will put the contact point of the dial indicator over the weight assist plunger.
4. Follow Step three as listed before.

# NOTES

# Governor Spring Assembly

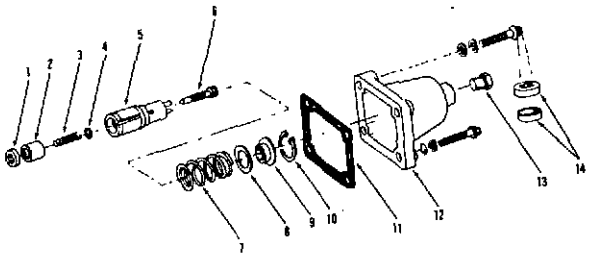
The governor spring assembly is the idle and maximum or high-speed springs, plunger, adjustment screw and shims. The springs control the engine speed. Adjustments are made by the shims or the adjustment screw, Fig. 4-1 and 4-2.

## Standard Lower Spring Assembly

### Disassembly

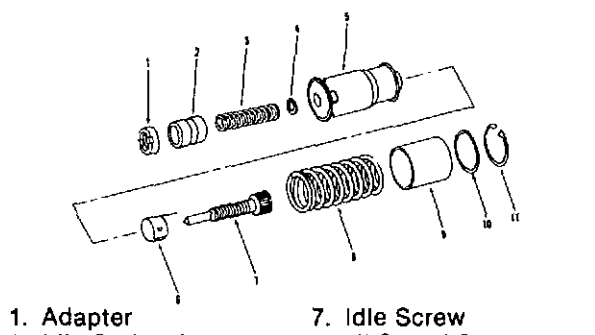
1. Remove the retaining ring, which holds the governor spring assembly in the spring housing, with a pair of snap ring pliers.
2. Remove the high speed spring, spring retainer and shims ffrom spring assembly housing.
3. Remove the idle spring plunger guide (adapter when in use), idle spring or springs, idle spring plunger and spring washer, Fig. 4-3.

See the Fuel Pump Assembly, section nine, for the assembly of the governor spring assembly to *the fuel pump.*



1. Adapter
2. Idle Spring Plunger
3. Idle Spring
4. Washer
5. Guide and Clip
6. Adjustment Screw
7. Hi-Speed Spring
8. Shim
9. Retainer
10. Retaining Ring
11. Gasket
12. Cover
13. Plug
14. Seal

Fig. 4-1, (F5148). Standard Governor — Disassembled View.



1. Adapter
2. Idle Spring Plunger
3. *Idle Spring*
4. Washer
5. Idle Plunger Guide
6. *Idle Screw Clip*
7. Idle Screw
8. Hi-Speed Spring
9. *Spacer*
10. Hi-Speed Spring Shims
11. *Retaining Ring*

Fig. 4-2, (F5284). Standard Governor in VS Pump.

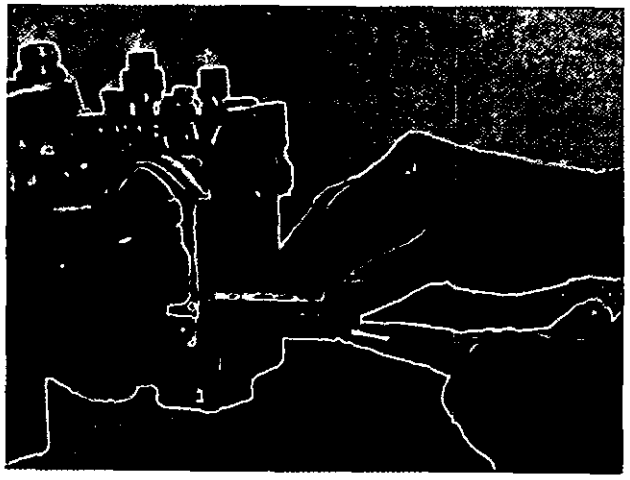


Fig. 4-3 (F510). Remove the standard spring assembly.

## Standard Spring Assembly in Use with the VS Governor

1. Remove the retaining ring, shims and spacer from the governor spring housing, Fig. 4-4.
2. Pull on the idle adjustment screw to remove the maximum speed spring and idle plunger guide. The guide contains the idle adjustment screw, screw clip, idle screw adjustment washer, idle spring, idle spring plunger and idle spring plunger adapter. The adapter is in use when the idle spring plunger is a No. 170 or higher.

## PT (type H) Lower Spring Assembly

### Disassembly

1. Remove the cover plate from the rear of the spring assembly housing.
2. Remove the retaining ring that holds the spring assembly. Remove the spring assembly, Fig. 4-5.

**Note:** The PT (type H) fuel pump has a standard lower type of spring assembly, a control plunger to control the fuel pressure and a fuel control damper. The lower idle spring plunger does not control the fuel pressure. This plunger is plain. See Table 18-9 for the control plunger sizes.

3. Use long point pliers or a magnet to remove the control plunger and the fuel control damper.
4. Remove the spring assembly housing. Do not remove the sleeves from the spring assembly housing.
5. Inspect and replace all damaged parts.

### Assembly

1. Use a new gasket and install the spring assembly housing.
2. Tighten the housing capscrews to 9 to 11 ft. lb. [12 to 15 N•m] torque.
3. Fill the fuel control plunger with fuel.
4. Install the fuel control damper in the control plunger.

**Note:** The fuel control damper controls the cycle oscillation of the fuel pressure.

5. Install the fuel control plunger and the control damper into the spring assembly housing.
6. Install the spring assembly in the housing.
7. Use the retaining ring to fasten the spring assembly in the housing.
8. Use a new gasket and install the spring assembly cover.
9. Tighten the cover capscrews to 9 to 11 ft. lb. [12 to 15 N•m] torque.

## Mechanical Variable-Speed Governor Pt (type G)

The Mechanical Variable-Speed (MVS) governor is mounted on top of the fuel pump housing over the filter screen assembly, Fig. 4-6.

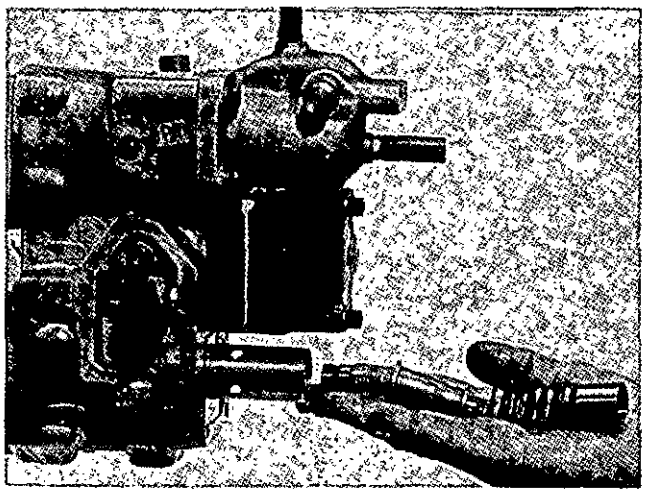


Fig. 4-4, (F5262). Remove the spring assembly of the VS pump.

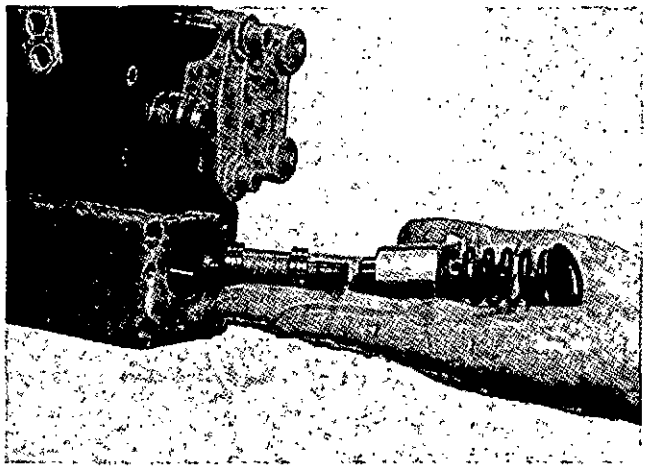


Fig. 4-5, (F5384). Remove the lower PT (type H) governor spring assembly.

### Disassembly

1. Remove the filter screen assembly.
2. Remove the MVS governor from the main housing and discard the O-rings. Remove the adapter from the top of the main housing, if damaged.
3. Remove the capscrews, lockwashers and flatwashers that hold the cover to the governor housing. Lift off the cover and discard the gasket.
4. Remove the cover adapter plate. Discard the O-ring. Remove the high speed spring, plunger and shims.

5. Remove the shim (or shims) from the plunger housing. Remove the spring retainer, idle spring and spring plunger.
6. Remove the setscrew that holds the governor stop on the throttle shaft. Pull the throttle shaft from the cover. Discard the O-rings.

### Governor Barrel Replacement

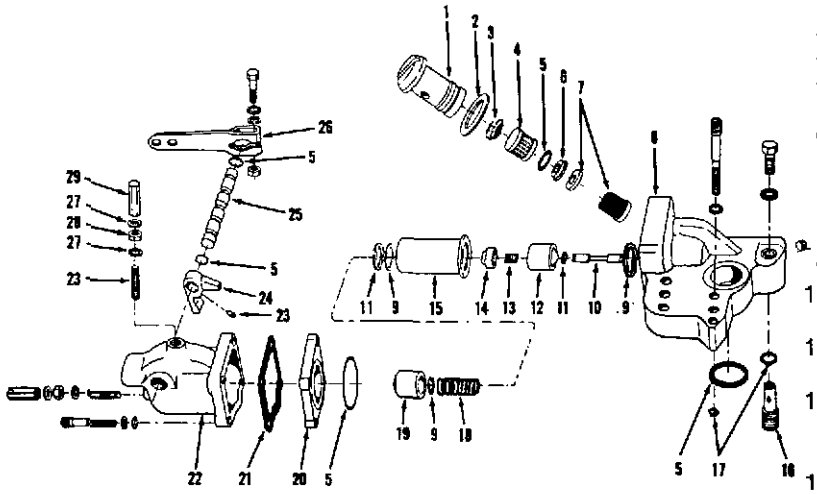
1. The aluminum housing must be marked, Fig. 4-7. This will align the fuel vent hole of the housing and the vent hole in the new barrel.
2. Remove the 1/8 inch N.P.T.F. pipe plug from opposite end of the housing. Insert a 5/16 inch [8 mm] diameter rod to press out the governor barrel. Heat the housing and barrel assembly in an oven at 325° to 350° F [163° to 177° C]. Press the barrel from the housing.
3. After removing the governor barrel, the barrel bore in the housing must be visually inspected for damage. If defects are found, the housing must be discarded.
4. Mark the new replacement governor barrel as shown in Fig. 4-7. The line must go through the center of the plunger bore and the center of the 1/8 inch [3.17 mm] diameter fuel vent hole.
5. Press the barrel into the housing with the marks aligned. The marks and the vent holes must align within 0.040 inch [1.02 mm].

**Note:** Hold the pressure applied to governor barrel for 15 to 20 seconds after the governor barrel is pressed into the housing. This continued pressure is necessary to make sure the governor barrel keeps in contact with the housing when the parts have cooled. It is possible for the governor barrel to slide out approximately 0.010 to 0.030 inch [0.25 to 0.76 mm] out of the heated aluminum housing.

6. The standard and oversize MVS governor plungers are in Table 4-1.

**Table 4-1: MVS Governor Plungers**

| Part Number | Class Size | Diameter Inches [mm] | Color Code |
|---|---|---|---|
| 154460 | 0 | 0.31140/0.31159 [7.9095/7.9144] | Red |
| 154463 | 1 | 0.31160/0.31179 [7.9146/7.9194] | Blue |
| 168906 | 2 | 0.31220/0.31239 [7.9298/7.9347] | Green |
| 168907 | 3 | 0.31250/0.31269 [7.9375/7.9423] | Yellow |
| 154461 | 0 | 0.31140/0.31159 [.9095/7.9144] | Red |
| 154462 | 1 | 0.31160/0.31179 [78.9146/7.9194] | Blue |
| 168908 | 2 | 0.31220/0.31239 [7.9298/7.9347] | Green |
| 168909 | 3 | 0.31250/0.31269 [7.9375/7.9423] | Yellow |



1. Cap
2. Gasket
3. Spring
4. Screen
5. O-Ring
6. Retainer
7. Screen and Cap
8. Governor Housing
9. Shim
10. Governor Plunger
11. Retaining Ring
12. Governor Spring Plunger
13. Idle Spring
14. Spring Retainer
15. Spring Assembly Housing
16. Adapter
17. O-Rings
18. Hi-Speed Spring
19. Throttle Plunger
20. Adapter Plate
21. Gasket
22. Cover
23. Setscrew
24. Stop
25. Throttle Shaft
26. Lever
27. Washer
28. Nut
29. Adjustment Nut

Fig. 4-6, (F547). MVS governor on the PT (type G) pump.

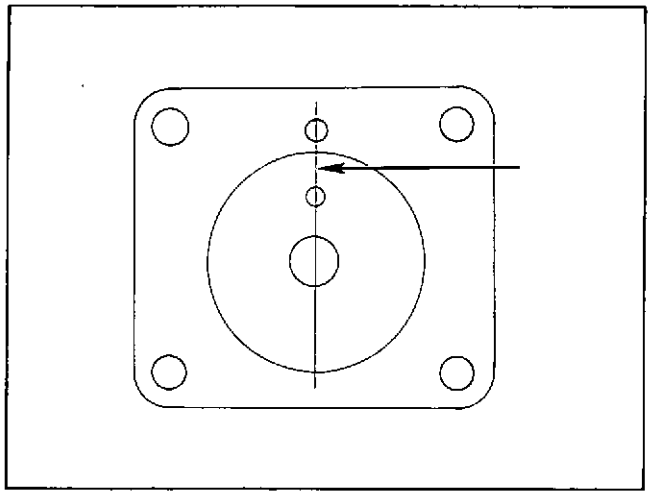


Fig. 4-7, (F5209). Mark the barrel and housing for alignment.

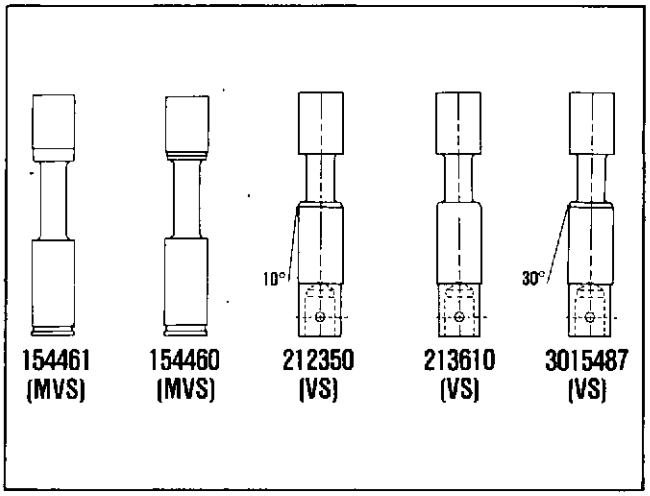
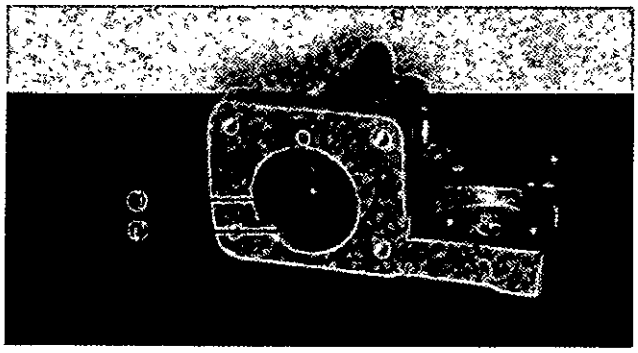



Fig. 4-8, (F5150). VS and MVS governor plungers.



1. Plunger Color Code 2. Barrel Class Size

Fig. 4-9, (F5151). PT (type G) MVS governor plunger and barrel.

7. The 154460 series plungers are used for standard droop. The 154461 chamfered series plungers are used for long droop and maximum stability.

### Inspection

1. Replace the throttle shaft bushing if the O-ring does not fit tight. Ream the bushing inside diameter to ].560 to 0.563 inch [14.22 to 14.30 mm] after assembly.
2. Inspect the parts for damage. Check the plunger to barrel clearance. It must be 0.0001 to 0.0005 inch [0.002 to 0.013 mm]. Oversize plungers are available, Table 4-1, Fig. 4-8.

**Note:** The color code is marked on the end of the plungers, Table 4-1. The size is marked on the end of the barrel, Fig. 4-9.

3. Inspect the springs, Table 4-3.

### Assembly

1. Install the retaining ring on the plunger. Insert the plunger into the barrel in the main housing. The plunger must drop freely into the barrel.
2. Install the new O-rings on the throttle shaft and insert the shaft in the cover through the throttle stop. Hold the stop with a setscrew.
3. Slide the spring assembly housing into the adapter plate and hold the assembly up against the governor barrel. If the housing is loose in the plate, shim as follows. Add shims between the spring assembly housing and the barrel until the housing is tight and the adapter plate is 0.003 to 0.006 inch [0.076 to 0.152 mm] from the barrel face. Keep the remainder of the shims until later in the calibration.
4. Install the large retaining ring in the groove inside the spring assembly housing.
5. Install 0.030 inch [0.76 mm] of shims into the housing from the flange end so they are against the retaining ring.

**Note:** Not enough shims will result in stalling or not enough throttle leakage. Too many shims will change the engine deceleration or result in too much throttle leakage. The number of shims can change from the 0.030 inch [0.76 mm] after the

engine is started. The 0.030 inch [0.76 mm] is correct in most pumps.

The V-504 and V-555 engine series can require only 0.015 inch [0.38 mm] shims. In some cases 0.060 inch [1.5 mm] shims can be required when this type of governor is used for an on the road vehicle.

6. Slide the throttle plunger, high speed spring and shims (about 0.100 inch [2.54 mm] of shim) into the rear end of the spring assembly housing.
7. Put the idle spring and idle spring retainer into the governor spring plunger. Slide the assembly into the flange end of the spring assembly housing.
8. Put the gasket over the cover and install the adapter plate on the gasket. Carefully slide the spring assembly housing with the springs and plungers into the adapter plate.
9. Install the O-ring into the adapter plate groove. Add the shims as in Step 3 and fasten the cover to the governor housing.

## Special Variable Speed (SVS) Governor PT (type G) Pump

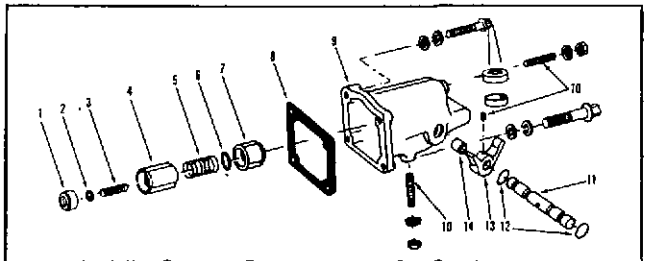
The SVS governor cover replaced the spring assembly cover on a standard PT (type G) fuel pump, Fig. 4-10.

### Disassembly and Inspection

1. Remove the housing. Discard the gasket.
2. Loosen the setscrew in the throttle shaft. Pull the throttle shaft from the cover. Discard the O-rings.
3. The bushings can be replaced in the cover assembly if the new O-rings will not keep out the dirt. The bushing inside diameter must be 0.560 to 0.563 inch [14.22 to 14.30 mm] after assembling.
4. Slide the throttle lever plunger and governor spring from the pump.
5. Remove the spring-plunger guide, idle spring and idle spring plunger.
6. Check for damage. Replace as necessary.

**Table 4-2: Governor Weights and Springs**

| Maximum High Idle R.P.M. — SVS Governor | | | |
|---|---|---|---|
| Governor Spring Part No. | 146437 Weights RPM | 163826 Weights RPM | 107261 Weights RPM |
| 70821 | 2400 | 2600 | 3700 |
| 70822 | 2500 + | 3150 | 4000 + |
| 101002 | 1900 | 2050 | 2700 |
| 105422 | 1300 | 1500 | 2000 |
| 107787 | 2000 | 2200 | 2850 |
| 109686 | 2500 | 2750 | 3800 |
| 109687 | 2500 + | 2900 | 4000 |
| 109688 | 2500 + | 3400 | 4000 |
| 109689 | 2500 + | 3400 + | 4000 + |
| 109690 | 2500 + | 3400 + | 4000 + |
| 110460 | 1300 | 1500 | 2000 |
| 110461 | 1700 | 1850 | 2500 |
| 118128 | 1150 | 1325 | 1750 |



1. Idle Spring Plunger
2. Shim
3. Idle Spring
4. Plunger Guide
5. Hi-Speed Spring
6. Shim
7. Spring Guide
8. Gasket
9. Cover
10. Setscrew
11. Throttle Shaft
12. O-Ring
13. Stop
14. Bushing

Fig. 4-10, (F5152). SVS governor spring assembly — disassembled view.

### Assembly

1. Install the idle spring and idle spring plunger in the deep end of the spring-plunger guide. Install assembly with the deep end toward the main housing.
2. Install the high speed spring (Table 4-3) and spring guide into the plunger guide. Insert the assembly into the spring assembly housing.
3. Install the new O-rings on the throttle shaft. Slide the throttle shaft in the cover through the throttle stop. Fasten the stop with the setscrew. Install the cover on the main housing with a new gasket.

## Table 4-3: Governor Springs

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| **Maximum or High Speed Springs and Specifications** | | | | | | | | |
| 70711-G | Orange/White | | .054 [1.37] | 5.5 | 1.82/2.07 [.83/.94] | @ | 1.19 [30] | |
| 70711-H | Lt. Blue/Orange | | .054 [1.37] | 6.5 | 1.50/1.71 [.68/.78] | @ | 1.19 [30] | |
| 70711-J | Lt. Green/White | | .051 [1.30] | 6.2 | 1.21/1.39 [.55/.63] | @ | 1.19 [30] | |
| 70711-K | Orange/Lt. Green | | .047 [1.19] | 7.2 | 0.78/0.89 [.35/.40] | @ | 1.19 [30] | |
| *143247 | Yellow | | .092 [2.34] | 7.4 | 17.72/16.36 [8.04/7.42] | @ | 1.00 [25] | 1.487 [37.8] |
| 143248 | Yellow/Green | 70711 | .092 [2.34] | 7.9 | 16.20/14.96 [7.35/6.79] | @ | 1.00 [25] | 1.487 [37.8] |
| 143249 | Yellow/White | | .086 [2.18] | 7.1 | 14.68/13.56 [6.66/6.15] | @ | 1.00 [25] | 1.487 [37.8] |
| 143250 | Red/White | 70711A | .086 [2.18] | 7.7 | 13.17/12.15 [5.97/5.47] | @ | 1.00 [25] | 1.487 [37.8] |
| *143251 | Blue/Purple | 70711B | .086 [2.18] | 8.4 | 11.65/10.75 [5.28/4.89] | @ | 1.00 [25] | 1.487 [37.8] |
| 143252 | Red | | .080 [2.03] | 7.6 | 10.13/9.35 [4.59/4.24] | @ | 1.00 [25] | 1.487 [37.8] |
| 143253 | Red/Yellow | 70711C | .080 [2.03] | 8.6 | 8.61/7.95 [3.91/3.60] | @ | 1.00 [25] | 1.487 [37.8] |
| 143254 | Red/Purple | 135158 | .072 [1.83] | 7.5 | 7.09/6.55 [3.22/2.97] | @ | 1.00 [25] | 1.487 [37.8] |
| 143255 | Red/Green | *70711D | .067 [1.70] | 7.8 | 5.21/4.81 [2.37/2.18] | @ | 1.00 [25] | 1.487 [37.8] |
| 143256 | White/Blue | 70711E-F | .062 [1.57] | 7.5 | 4.05/3.74 [1.84/1.70] | @ | 1.00 [25] | 1.487 [37.8] |
| *144478 | White | | .086 [2.18] | 7.7 | 19.92/18.40 [9.04/8.35] | @ | 1.00 [25] | 1.737 [44.1] |
| *144479 | Green | | .086 [2.18] | 8.4 | 17.63/16.27 [8.00/7.38] | @ | 1.00 [25] | 1.737 [44.1] |
| *144490 | Orange | | .080 [2.03] | 7.6 | 4.93/4.55 [2.23/2.06] | @ | 1.00 [25] | 1.237 [31.4] |
| *144491 | Light Blue | | .080 [2.03] | 8.6 | 4.19/3.87 [1.90/1.75] | @ | 1.00 [25] | 1.237 [31.4] |
| *147292 | Purple | | .092 [2.34] | 7.0 | 16.02/14.78 [7.27/6.70] | @ | 1.00 [25] | 1.405 [35.7] |
| 147293 | Orange/Yellow | | .092 [2.34] | 6.6 | 13.72/12.68 [6.22/5.75] | @ | 1.00 [25] | 1.322 [33.6] |
| 147294 | White/Purple | | .092 [2.34] | 6.3 | 11.21/10.35 [5.08/4.69] | @ | 1.00 [25] | 1.245 [31.6] |
| 147295 | Orange/Red | | .092 [2.34] | 6.0 | 11.58/10.69 [5.25/4.85] | @ | 1.00 [25] | 1.237 [31.4] |
| 147296 | Purple/Green | | .092 [2.34] | 5.8 | 12.31/11.37 [5.58/5.16] | @ | 1.00 [25] | 1.237 [31.4] |
| 153232 | Blue | | .086 [2.18] | 7.1 | 6.60/7.14 [3.00/3.24] | @ | 1.00 [25] | 1.237 [31.4] |
| 153235 | Green/Orange | | .080 [2.03] | 8.6 | 6.40/5.90 [2.90/2.68] | @ | 1.00 [25] | 1.362 [34.6] |
| 153236 | Green/Blue | | .086 [2.18] | 7.7 | 9.78/9.04 [4.44/4.10] | @ | 1.00 [25] | 1.362 [34.6] |
| 153237 | Blue/Yellow | 125498 | .086 [2.18] | 8.4 | 8.66/7.99 [3.93/3.62] | @ | 1.00 [25] | 1.362 [34.6] |
| 153238 | Blue/Red | | .080 [2.03] | 7.6 | 7.25/6.95 [3.29/3.15] | @ | 1.00 [25] | 1.362 [34.6] |
| 157059 | Blue/Orange | | .092 [2.34] | 6.3 | 20.75/22.03 [9.41/9.99] | @ | 1.00 [25] | 1.487 [37.8] |
| 177629 | Purple/Orange | | .102 [2.59] | 6.1 | 19.3/21.3 [8.75/9.66] | @ | .945 [24] | 1.270 [32.2] |
| 3000932 | Purple/Lt. Blue | | .080 [2.03] | 7.64 | 15.33/14.15 [6.96/6.42] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000933 | Purple/Orange | | .080 [2.03] | 8.64 | 13.03/12.03 [5.91/5.46] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000934 | Blue/Lt. Blue | | .072 [1.83] | 7.46 | 10.73/9.91 [4.87/4.50] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000935 | Green/Lt. Blue | | .072 [1.83] | 9.00 | 8.43/7.79 [3.83/3.54] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000936 | Yellow/Lt. Blue | | .092 [2.34] | 6.65 | 10.10/9.32 [4.59/4.23] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000937 | White/Lt. Blue | | .092 [2.34] | 7.00 | 9.36/8.64 [4.25/3.92] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000938 | Red/Lt. Blue | | .092 [2.34] | 7.44 | 8.62/7.96 [3.91/3.61] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000939 | White/Orange | | .092 [2.34] | 7.94 | 7.88/7.28 [3.58/3.31] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000940 | Orange/Lt. Blue | | .086 [2.18] | 7.69 | 6.41/5.91 [2.91/2.68] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000941 | Green/White | | .086 [2.18] | 8.43 | 5.67/5.23 [2.57/2.37] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001146 | Yellow/Purple | | .072 [1.83] | 9.00 | 6.87/6.34 [3.12/2.88] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001147 | Brown | | .076 [1.93] | 8.70 | 8.74/8.06 [3.97/3.66] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001148 | Brown/Green | | .080 [2.03] | 8.70 | 10.61/9.79 [4.82/4.44] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001149 | Brown/White | | .080 [2.03] | 7.70 | 12.49/11.51 [5.67/5.22] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001150 | Brown/Yellow | | .086 [2.18] | 8.50 | 14.35/13.25 [6.51/6.02] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001151 | Brown/Red | | .086 [2.18] | 7.70 | 16.22/14.95 [7.36/6.79] | @ | 1.00 [25] | 1.600 [40.6] |

**Table 4-3: Governor Springs (Continued)**

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 3001152 | Brown/Blue | | .086 [2.18] | 7.10 | 18.10/16.70 [8.22/7.58] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001153 | Grey | | .092 [2.34] | 8.00 | 19.95/18.45 [9.06/8.38] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001154 | Brown/Orange | | .092 [2.34] | 7.40 | 21.85/20.15 [9.92/9.15] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001155 | Brown/Lt. Blue | | .086 [2.18] | 7.10 | 10.92/10.08 [4.96/4.58] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001156 | Brown/Purple | | .092 [2.34] | 7.94 | 12.03/11.12 [5.46/5.05] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001157 | Grey/Yellow | | .092 [2.34] | 7.44 | 13.18/12.18 [5.98/5.53] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001158 | Grey/Green | | .092 [2.34] | 7.00 | 14.31/13.21 [6.50/6.00] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001159 | Grey/White | | .092 [2.34] | 6.65 | 15.42/14.23 [7.00/6.46] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001160 | Grey/Red | | .092 [2.34] | 5.70 | 13.06/12.06 [5.93/5.48] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001161 | Grey/Blue | | .092 [2.34] | 5.40 | 13.81/12.75 [6.27/5.79] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001162 | Grey/Brown | | .092 [2.34] | 5.30 | 14.53/13.43 [6.60/6.10] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001163 | Grey/Orange | | .092 [2.34] | 5.10 | 15.28/14.11 [6.94/6.41] | @ | 1.00 [25] | 1.237 [31.4] |
| 3004750 | Grey/Purple | | .072 [1.83] | 6.45 | 6.08/5.61 [2.92/2.54] | @ | 1.00 [25] | 1.48 [37.8] |
| 3004751 | Grey/Lt. Blue | | .067 [1.70] | 9.40 | 4.99/4.61 [2.26/2.09] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004752 | Pink | | .072 [1.83] | 9.70 | 6.24/5.76 [2.83/2.61] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004753 | Pink/Yellow | | .072 [1.83] | 8.45 | 7.49/6.91 [3.39/3.13] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004754 | Pink/Green | | .067 [1.70] | 9.40 | 6.13/5.66 [2.78/2.57] | @ | 1.00 [25] | 1.737 [44.1] |
| 3004755 | Pink/White | | .072 [1.83] | 9.70 | 7.66/7.08 [3.47/3.21] | @ | 1.00 [25] | 1.737 [44.1] |
| 3004756 | Pink/Blue | | .072 [1.83] | 8.45 | 9.20/8.47 [4.17/3.84] | @ | 1.00 [25] | 1.737 [44.1] |
| **MVS and SVS Governor Springs and Specifications** | | | | | | | | |
| 70821 | Red | | .072 [1.83] | 10 | 8.91/7.29 [4.04/3.31] | @ | 1.12 [28] | 1.395 [35.4] |
| 70822 | Green | | .080 [2.03] | 9.5 | 12.65/10.25 [5.74/4.65] | @ | 1.12 [28] | 1.358 [34.5] |
| 101002 | White | | .063 [1.60] | 11 | 6.43/5.47 [2.92/2.48] | @ | 1.12 [28] | 1.514 [38.4] |
| 105422 | Black | | .054 [1.37] | 11 | 3.35/2.85 [1.52/1.29] | @ | 1.12 [28] | 1.508 [38.3] |
| 107787 | Yellow/Blue | | .072 [1.83] | 12 | 8.75/7.45 [3.97/3.38] | @ | 1.12 [28] | 1.482 [37.6] |
| 109686 | Blue | | .072 [1.83] | 8.5 | 8.03/6.57 [3.64/2.98] | @ | 1.12 [28] | 1.318 [33.5] |
| 109687 | Yellow | | .080 [2.03] | 10 | 11.2/9.2 [5.08/4.17] | @ | 1.12 [28] | 1.347 [34.2] |
| 109688 | Green/White | | .080 [2.03] | 9 | 14.1/11.5 [6.39/5.22] | @ | 1.12 [28] | 1.370 [34.8] |
| 109689 | Gray | | .080 [2.03] | 8.5 | 16.3/13.3 [7.39/6.03] | @ | 1.12 [28] | 1.384 [35.1] |
| 109690 | Pink | | .080 [2.03] | 8 | 18.5/15.1 [8.39/6.85] | @ | 1.12 [28] | 1.396 [35.4] |
| 110460 | Orange | | .063 [1.60] | 14 | 4.97/4.23 [2.25/1.92] | @ | 1.12 [28] | 1.538 [39.1] |
| 110461 | Purple | | .063 [1.60] | 12 | 5.72/4.88 [2.68/2.21] | @ | 1.12 [28] | 1.528 [38.8] |
| 116508 | None (Idle) | | .029 [.736] | 10.5 | .350 [0.16] | @ | .40 [10] | 0.440 [10.3] |
| 118128 | Black/White | | .054 [1.37] | 14 | 2.42/2.84 [1.10/1.29] | @ | 1.12 [28] | 1.558 [39.6] |
| 118934 | Blue/White | | .072 [1.83] | 11 | 8.96/7.64 [4.06/3.46] | @ | 1.12 [28] | 1.439 [36.5] |
| 118935 | Orange/White | | .063 [1.60] | 9 | 7.64/6.50 [3.46/2.95] | @ | 1.12 [28] | 1.498 [37.0] |
| 143849 | Yellow (Idle) SVS | | .025 [.635] | 9 | 2.38/2.62 [1.08/1.19] | @ | .325 [8.2] | .650 [16.5] |
| 153240 | None (Idle) MVS & VS | | .044 [1.12] | 5.5 | 3.70/4.10 [1.68/1.85] | @ | .295 [7.5] | .430 [10.9] |
| 153232 | Blue | | .086 [2.18] | 7.1 | 6.60/7.14 [2.99/3.24] | @ | 1.00 [25] | 1.237 [31.4] |
| 201116 | Green (Idle) | | .032 [.813] | 7.4 | 1.49/1.64 [.67/.73] | @ | .285 [7.2] | .625 [15.9] |
| **Weight Assist Springs and Specifications** | | | | | | | | |
| 143847 | Blue | | .028 [.711] | 9.7 | 3.30/3.70 [1.50/1.68] | @ | .325 [8.2] | .584 [14.8] |
| 143848 | White | | .030 [.762] | 9 | 4.17/4.83 [1.89/2.19] | @ | .325 [8.2] | .529 [13.4] |
| 143849 | Yellow | | .025 [.635] | 11 | 2.38/2.62 [1.09/1.19] | @ | .325 [8.2] | .650 [16.5] |
| 143855 | White/Yellow | | .022 [.559] | 10 | 0.90/1.10 [.41/.50] | @ | .325 [8.2] | .475 [12.1] |
| 650662 | Green | | .022 [.559] | 7.5 | 1.92/2.08 [.870/.943] | @ | .325 [8.2] | .710 [18.0] |
| 416920 | White/Red | | .032 [.81] | 10 | 9.02/9.46 [4.1/4.3] | @ | .319 [8.1] | .670 [17.0] |

**Table 4-3: Governor Springs (Continued)**

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| **Idle Springs and Specifications** | | | | | | | | |
| 70778 | None VS | | .032 [.813] | 6.5 | 0.28/0.36 [0.13/0.16] | @ | .265 [6.7] | 0.335 [8.50] |
| 138810 | None | | .032 [.813] | 7 | 0.39/0.49 [.18/.22] | @ | .418 [11] | 0.525 [13.3] |
| 138811 | None | | .032 [.813] | 12 | 0.58/0.92 [.26/.42] | @ | .850 [21] | 0.918 [23.3] |
| 144195 | None Std. Auto | | .032 [.813] | 14 | 0.69/0.85 [.31/.38] | @ | .955 [24] | 1.025 [26.0] |
| 218957 | None V555 | | .044 [1.12] | 14 | 6.05/7.45 [2.7/3.4] | @ | .900 [22.9] | 1.05 [26.7] |
| 3018767 | Yellow | | .039 [.991] | 11.5 | Preload 3.5, Subtract .250, Load 11.75-12.75 | | | 0.900 [22.9] |

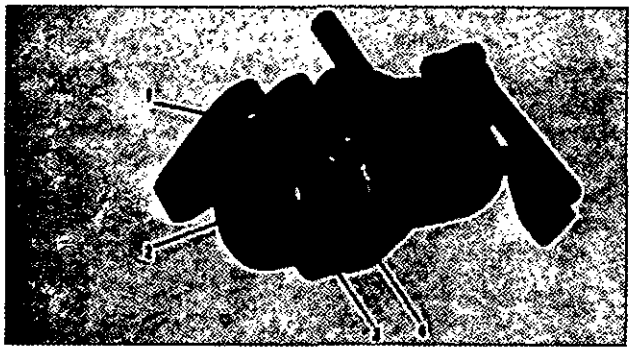
**Note:** 138810 and 138811 used only in fuel pumps without weight assist.

*Formerly color coded — 143247 Yellow/Black, 143251 Red/Black and Blue/Brown, 144478 Black/White, 144479 Black/Green, 144490 Black/Orange, 144491 Black/Blue and 147292 Black/Brown and Brown.

## Remote Mechanical Variable Speed PT (type G) Governor

A remote mechanical variable speed governor is for use with the PT (type G) fuel pump. This governor is used when the MVS governor can not be mounted on top of the fuel pump, Fig. 4-11.

1. The remote governor must be bracket mounted on the engine at a point as close to the fuel pump as possible.
2. The fuel lines to and from the governor must be made of steel tubing. The fuel lines must be held with a line clip to stop the vibration. The line sizes must be:
   a. The pressure line must be 1/4 inch [6.35 mm] outside diameter steel tubing (line from center of governor housing to the fuel damper.)
   b. All other lines to and from the governor are to be 5/16 inch [7.937 mm] outside diameter steel tubing.
   c. When the Torque Modification Device is in use with this governor, drain the governor to the bottom of the fuel pump housing.
3. The governor barrel and housing assembly capscrews, oil seals and other installation parts are the only differences between the remote and the pump installed MVS governors.
4. The piping diagram for this governor is in the injector manual, Bulletin No. 3379071.



1. Injector Supply
2. To Pulsation Damper
3. From Fuel Pump
4. To Fuel Pump

Fig. 4-11, (F5153). Remote MVS governor PT (type G).

## Variable Speed Governor PT (type G)

### Disassembly

1. Remove the cover and discard the gasket. Loosen the setscrew in the throttle shaft, Fig. 4-12. Pull the throttle shaft from the cover. Discard the O-rings. Remove the dust seals of the throttle shaft, if used.
2. The bushings can be replaced in the cover assembly if the new O-rings are not tight. The bushing inside diameter must be 0.560 to 0.563 inch [14.22 to 14.30 mm] after assembly.
3. Slide the throttle lever plunger and governor spring from the pump. Remove the retaining ring, spring guide, idle spring and plunger.

4. Check for damage. Replace as necessary.

### Assembly

1. Install the governor plunger listed in the fuel pump code.
2. Install the governor spring plunger, idle spring, spring retainer and retaining ring.
3. Install the governor spring, Table 4-3, and the throttle lever plunger into the pump, Fig. 4-13.
4. Press the new dust seals for the throttle shaft in the cover, if used.
5. Install the new O-rings on the throttle shaft. Install the shaft in the cover through the throttle stop. Hold the stop with a setscrew, Fig. 4-12.
6. Use a new gasket and install the cover to the main housing.
7. When the adjustment screws with a nylon coating are in use, the copper sealing washers and locknuts are not required

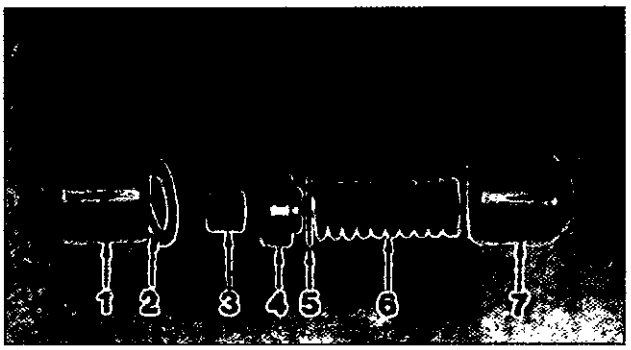
## Torque Converter Governor

The governor assembly of the torque converter has two spring and plunger assemblies; one for the engine, the other for the converter.

**Note:** The PT (type G) VS Torque Converter Governor is like the PT (type R) Torque Converter Governor, except the following:

1. The standard governor spring assembly in the fuel pump housing does not change, Fig. 4-14.
2. The engine speed is controlled by a lever on the VS governor, not by a lever on the standard (lower) spring assembly cover.
3. The pump idle and high speed are set with the adjustable screws in the VS cover.
4. The torque converter governor has only one throttle lever. The converter speed is controlled by this lever.
5. The fuel flows from the bottom of the fuel pump housing and through the torque converter governor. The fuel then flows back into the housing through the throttle shaft in the main housing.
6. The control adjustments of the torque converter governor are still on the front of the torque converter governor.

Fig. 4-12, (F549). Loosen the setscrew of the throttle shaft.




1. Governor Spring Plunger
2. Retaining Ring
3. Idle Spring
4. Spring Retainer
5. Shim
6. Governor Spring
7. Throttle Lever Plunger

Fig. 4-13, (F550). Variable speed governor spring assembly.

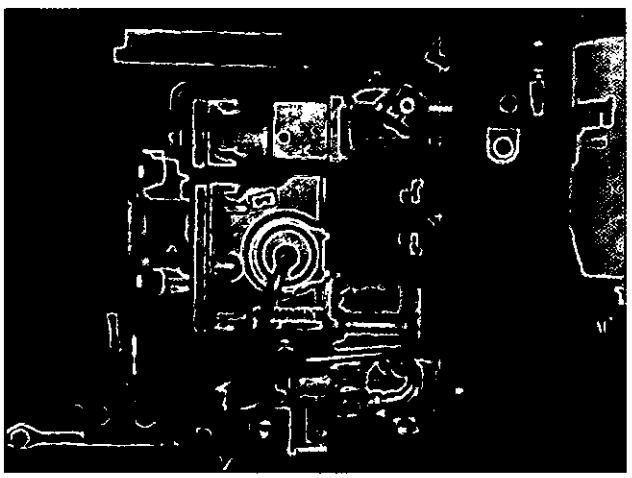


Fig. 4-14, (F5292). PT (type G) VS fuel pump with a torque converter governor.

### Disassembly and Inspection

1. Remove the governor housing from the fuel pump. Discard the gasket. Remove the plunger, spring and spring retainer.
2. Remove the converter governor cover from the housing.
3. Disassemble the drive cover of the torque converter governor by pulling the governor drive sleeve. The sleeve has two holes aligned with the drive cable slot to engage a pin for pulling.
4. Remove the converter governor plunger. *Replace the converter drive bushing if it is* worn larger than 0.569 inch [14.45 mm] inside diameter.
5. If the weight carrier assembly of the torque converter governor is worn, replace it with a new assembly.
6. Remove the screws that hold the torque converter governor spring cover to the torque converter governor housing. Remove the housing and discard the gasket.
7. *Remove the plunger, plunger spring and* spring retainer. Check the parts and replace as necessary.

### Assembly

1. Install the engine governor plunger, spring retainer and spring, Fig. 4-15. Use the correct parts for the pump being built. See Table 4-3 and the fuel pump code.
2. Install the converter governor housing assembly to the fuel pump. Use a new gasket, Fig. 4-16.
3. Install the converter governor plunger, spring retainer and spring in the converter governor housing and cover, Fig. 4-17. Select the correct spring for fuel pump being built, Table 4-3.
4. The long adjustable screw protrusion in the cover must be 0.635 to 0.640 inch [16.13 to 16.26 mm] from the cover, Fig. 4-18.
5. Use a new gasket to assemble the cover to the converter governor housing.
6. Install the converter governor plunger, Fig. 4-19.
7. Install the sleeve in the drive cover of the torque converter governor, if removed. Align the holes in the sleeve with the slot in the shaft.

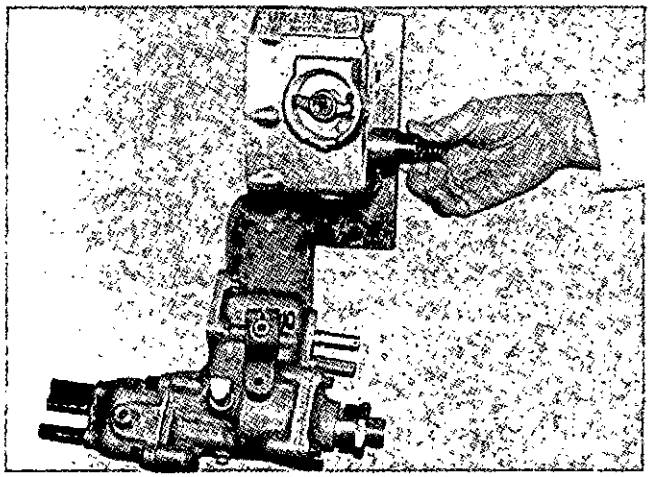


Fig. 4-15, (F551). Install the plunger.

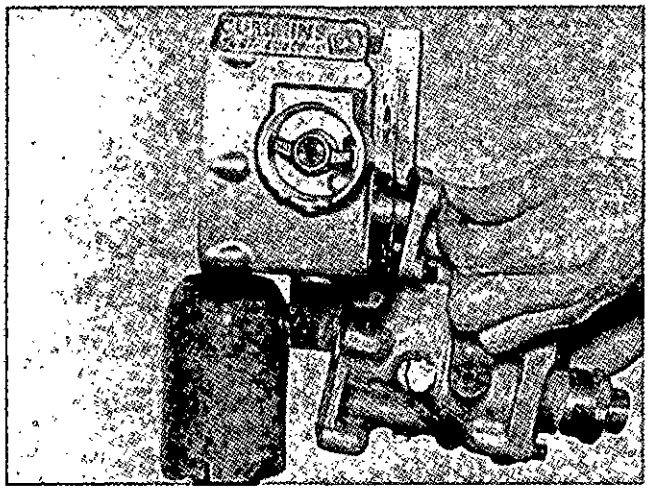


Fig. 4-16, (F552). Assemble the governor housing to the pump.

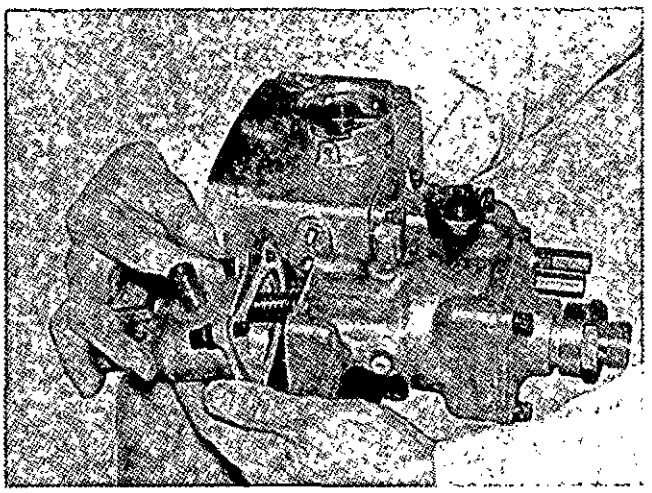


Fig. 4-17, (F553). Install the converter cover assembly.

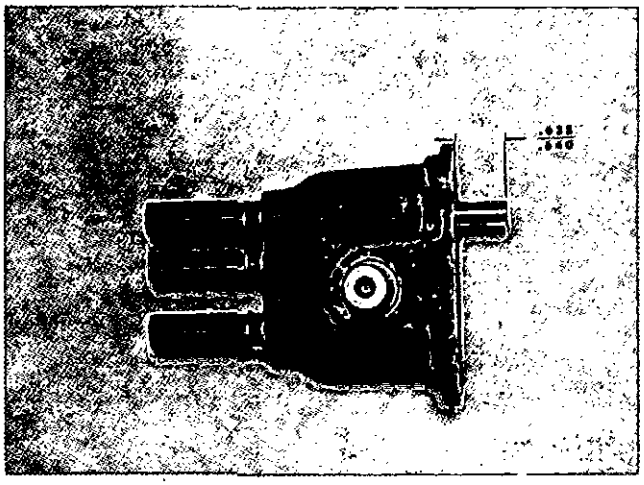


Fig. 4-18, (F554). Adjust the screw protrusion.

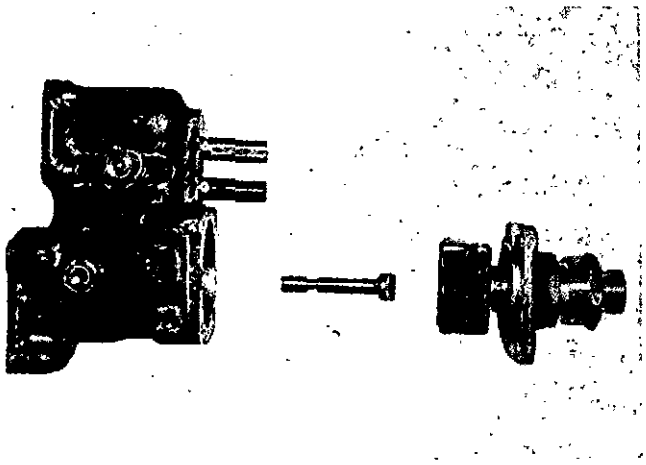


Fig. 4-19, (F555). Install the auxiliary governor plunger.

8. Press in a new oil seal even with the cover. Install the weight assembly in the converter governor cover. The clearance between the thrust bearing and the bushing must be 0.003 to 0.005 inch [0.076 to 0.127 mm].

**Note:** When the cast weight assembly is installed, use a new designed bushing.

9. Use a new gasket to install the cover to the converter governor housing. Install the cap to the cover.

### Instruction on use of Table 4-4

1. Find the converter no-load speed. (If the full load speed is known add 200 to 300 rpm for the governor droop.)
2. Find the drive ratio of the torque converter governor for the specific converter in use.
3. Multiply the converter no-load drive shaft speed by the drive ratio of the torque converter governor. This will tell the no-load speed of the governor weight.
4. Use the table to find the spring.

### Example

1. The full load speed of the converter drive shaft can be 1150 rpm. The no-load speed is then 1150 + 250 = 1400 rpm.
2. The drive ratio of the converter governor for this specific converter is 2.5.
3. The no-load of the governor weights then is 1400 × 2.5 = 3500 rpm.
4. From the table, the spring for this example is Part No. 118934.

**Table 4-4: Guide to Torque Converter Spring Selection**

| Torque Converter Governor Weight — No Load Speed | | | |
|---|---|---|---|
| RPM | Between | Spring Part No. | Color Code |
| 2000 | 2050 | 118128 | Black/White |
| 2050 | 2170 | 105422 | Black |
| 2170 | 2375 | 110460 | Orange |
| 2375 | 2540 | 110461 | Purple |
| 2540 | 2750 | 101002 | White |
| 2750 | 3000 | 118935 | Orange/White |
| 3000 | 3250 | 107787 | Yellow/Blue |
| 3250 | 3510 | 118934 | Blue/White |
| 3510 | 3800 | 70821 | Red |
| 3800 | 4370 | 109686 | Blue |
| 4370 | 4880 | 109687 | Yellow |
| 4880 | 5120 | 70822 | Green |
| 5120 | 5380 | 109688 | Green/White |
| 5380 | 5740 | 109689 | Gray |
| 5740 | 6100 | 109690 | Pink |

Use this table as a guide to the spring selection. Do not replace those springs that already have their performance approved in field use. This table is to be used as a way of selecting a spring that will be close to the correct speed droop.

## Road Speed Governor PT (type G) VS

The air cylinder assembly is in use on the PT (type G) VS and PT (type G) AFC-VS upper governor assembly. Fig. 4-20.

The spring assembly is controlled by air pressure from the vehicle transmission.

### Disassembly

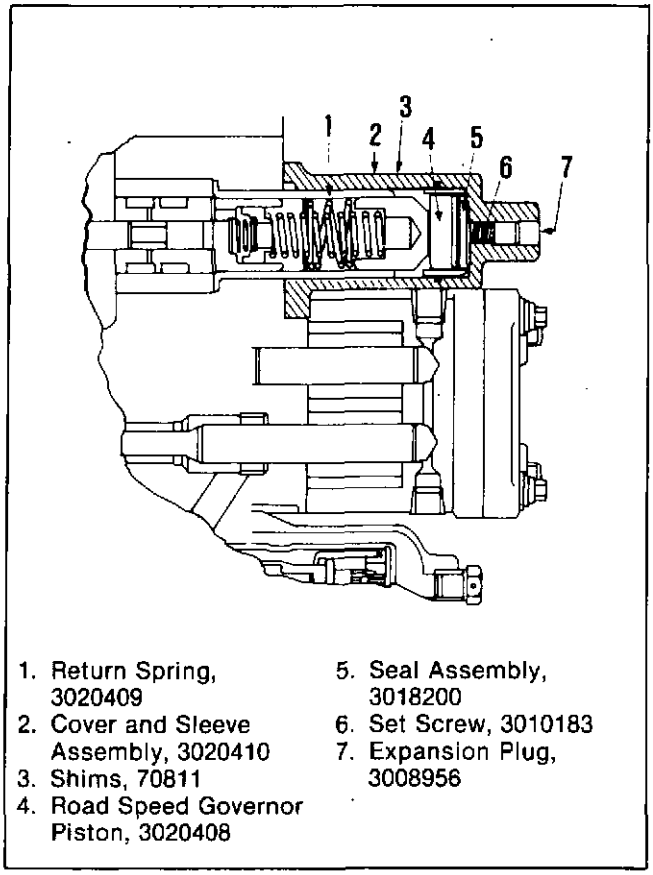
1. Remove the upper spring assembly cover.
2. Remove the piston/seal assembly. Discard the seal.
3. If the sleeve is loose in the cover, remove the sleeve and replace the O-ring in the cover.
4. If the "VS" idle is to be reset, remove the expansion plug from the rear of the cover. Turn out the idle adjustment screw.

### Assembly

1. Lubricate the cover bore and the O-ring. Press the sleeve into the cover until it touches the bottom.

**Note:** If the sleeve is tight in the housing, heat the housing to 350° F [176° C).

2. Install a new idle setscrew in the rear of the cover. The point of the setscrew is to be even with the inside surface of the cover.
3. Lubricate the piston fuel oil seal and install on the governor piston. The two lip side of fuel oil seal is to be away from the notched face of the piston.
4. Slide the piston assembly into the installation tool, 3375372, with the notched face of the piston toward the flange.
5. Insert the tool, with piston assembly, in the cover. Make sure the tool is against the sleeve. Press the assembly into the sleeve.
6. Install the return spring in the VS spring assembly. This spring goes between the retaining ring and the throttle lever plunger.
7. Install a new expansion plug after the engine is tested.
8. When the fuel pump is rebuilt, install the cover to the fuel pump housing with break off capscrews.




1. Return Spring, 3020409
2. Cover and Sleeve Assembly, 3020410
3. Shims, 70811
4. Road Speed Governor Piston, 3020408
5. Seal Assembly, 3018200
6. Set Screw, 3010183
7. Expansion Plug, 3008956

Fig. 4-20, (F5380). Road speed governor cross section Part No. 3020411.

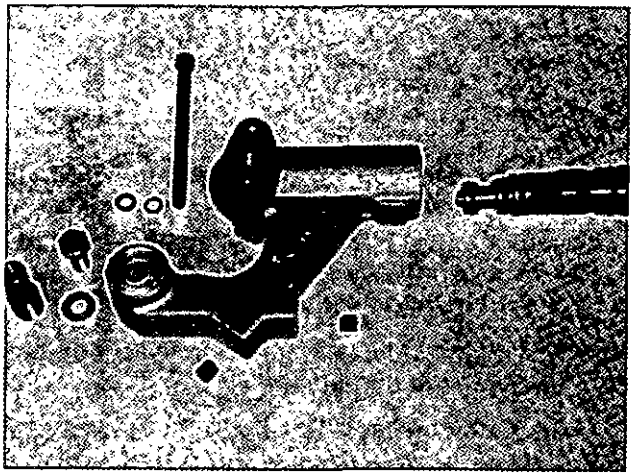


Fig. 4-21, (F5213). Disassembled view of the torque modification device with a pressure regulator.

## Hydraulic Governors

Hydraulic governors are in use on power applications where it is necessary to keep a closely

controlled even speed with changing loads. The manufacturer has the latest repair and assembly information for the specific governor being rebuilt. See the Auxiliary Equipment Section for Adjustments.

## High Torque Rise Fuel Pumps

The bypass valve setting on the torque modification device must be made with ST-589. It must be the same as it is on the nameplate or in the calibration data.

The procedure for adjusting the TMD is in the Calibrating Instructions Section.

# Gear Pump and Pulsation Damper

## Gear Pump

**Note:** The PT (type H) and the special C.I.T.E. fuel gear pumps will have the assembly number on the side of the gear pump.

### Disassembly

1. Remove the cooling check valve on the rear of the gear pump.
2. Remove the capscrews holding the gear cover to the gear body.
3. Remove the cover from the body. Hold the body in a vise. Press on the dowels and remove the cover from the body. Discard the gasket.
4. Lift the drive gear and shaft, and the driven gear and shaft from the gear pump body.
5. Remove the pressure valve, if used.

### Cleaning and Inspection — PT (type G)

1. Check the pump shafts. Discard them if they are damaged. Replace the shaft if it is worn smaller than 0.4998 to 0.5001 inch [12.695 to 12.703 mm] diameter.
2. Check the gear width, Table 5-1. If the gears are damaged, they must be replaced.
3. Check the gear body and cover for damage and replace them as needed. Check the gear hole depth. See Table 5-1. Fig. 5-2.
4. The shaft bore in the cover and body must be 0.5013 to 0.5016 inch [12.733 to 12.740 mm] inside diameter in the PT (type G) gear pumps.
5. Press the gears on the shaft 0.680 to 0.690 inch [17.27 to 17.53 mm] from the body end of the shaft, if removed. Put a coating of oil on the shaft before assembly.
6. Check and clean the lubrication holes, if used, in the cover and body.
7. Clean the cooling kit components, if used. Dry with compressed air.

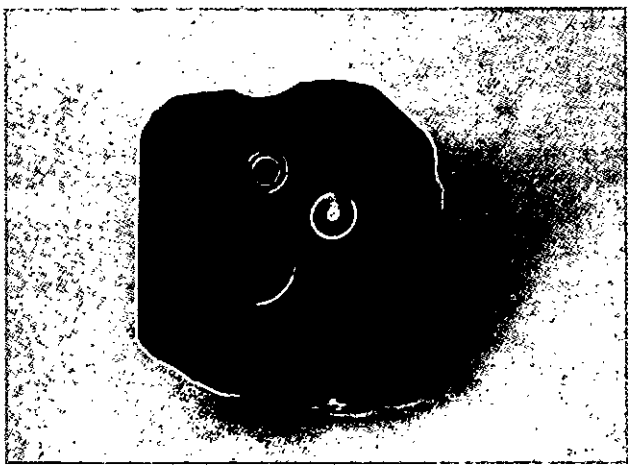


Fig. 5-1, (F5372). Gear pump with the pressure valve installed.

Fig. 5-2 (F523). Check the Gear pump hole depth.

**Table 5-1: PT (type G) Gear Width and Hole Depth**

| Pump Size Inch [mm] | Gear Width Inch [mm] | Gear Hole Depth Inch [mm] |
|---|---|---|
| 7/16 [11.11] | 0.4360/0.4363 [11.074/11.082] | 0.4353/0.4356 [11.056/11.064] |
| 3/4 [19.05] | 0.7483/0.7486 [19.006/19.014] | 0.7478/0.7481 [18.994/19.002] |
| 1 [25.40] | 0.9980/0.9983 [25.349/25.356] | 0.9980/0.9983 [25.349/25.356] |
| 1-1/4 [31.75] | 1.2483/1.2486 [31.706/31.714] | 1.2482/1.2485 [31.704/31.712] |

### Cleaning and Inspection of PT (type H)

1. The gear pump shafts must be checked for damage. The shafts must be replaced if they are damaged or worn smaller than 0.6874 inch [17.460 mm] diameter.
2. Check the gear width, Table 5-2. If the gears are damaged, they must be replaced.

**Table 5-2: PT (type H) Gear Width and Hole Depth**

| Pump Size Inch [mm] | Gear Width Inch [mm] | Gear Hole Depth Inch [mm] |
|---|---|---|
| 5/8 [15.87] | 0.6244/0.6247 [15.859/15.867] | 0.6239/0.6242 [15.847/15.855] |
| 13/16 [20.64] | 0.7999/0.8002 [20.317/20.325] | 0.7994/0.7997 [20.305/20.312] |
| 1 [25.4] | 0.9999/1.0002 [25.397/25.405] | 0.9994/0.9997 [25.385/25.392] |

3. The gear pump body and cover must be inspected for damage and replaced if needed.
4. Check the gear hole depth, Table 5-2.
5. The shaft bore in the cover and the body must be 0.6891 to 0.6894 inch [17.503 to 17.511 mm].
6. Put a coating of oil on the shafts before assembly. Press the driven gear on the shaft 0.865 to 0.875 inch [21.97 to 22.22 mm] from the cover end of the shaft.
7. Press the drive gear on the shaft 3.425 to 3.435 inch [86.99 to 87.25 mm] from the end with the spline.
8. Clean the lubrication hole in the back of the body. Clean the lubrication groove in the cover.
9. Clean and/or replace the cooling valve. Dry with compressed air.

### Assembly

1. Install the pressure valve in the gear pump cover with 3375959 driver. The valve must be even to 0.015 inch [0.38 mm] below the cover face.
2. Lubricate and install the shafts and the gears into the body. Make sure the parts are clean.
3. Position a new gasket and install the cover on the body. Align the location notches. Fig. 5-3.

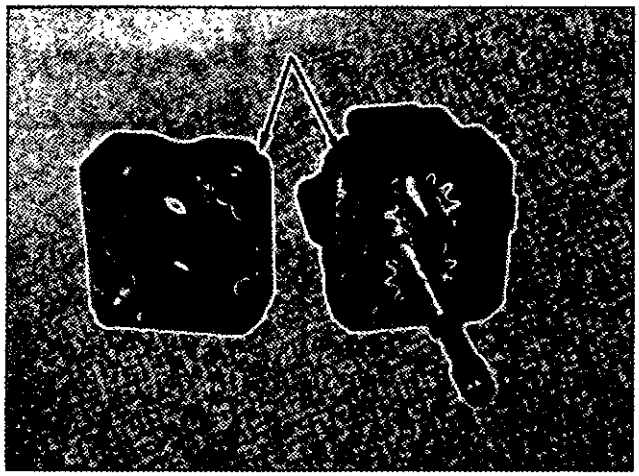
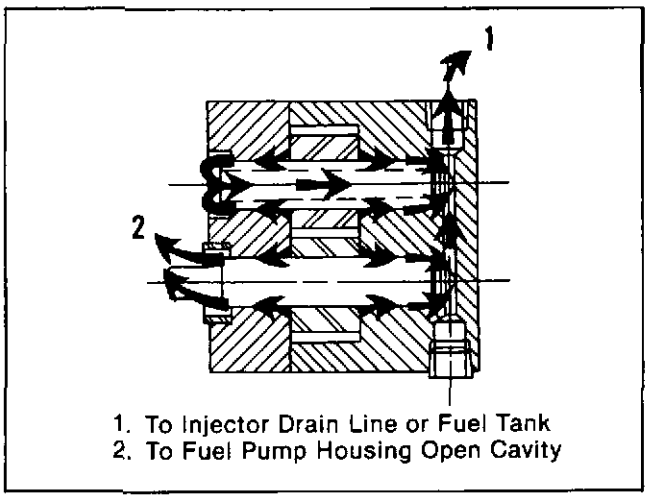


Fig. 5-3, (F524). Location notches of a gear pump with a right hand rotation.

**Note:** The location of the notches and the drive shaft determines the rotation of the gear pump.

4. Assemble a right hand rotation pump as follows:
   a. Place the driven gear shaft of the gear pump in the body nearest the location nothces.
   b. Place the driving gear shaft in the other hole.
   c. The ring dowel is always around the drive shaft.
5. Align the cover and body with the dowels. Tighten the capscrews evenly to 11 to 13 foot pounds [15 to 18 N•m]. Check that the pump rotates freely with finger pressure.

**Note:** Total gear backlash must be 0.006 to 0.010 inch [0.152 to 0.254 mm]. The drive shaft protrusion must be 2.370 to 2.412 inch [60.2 to 61.3 mm] from the body. The PT (type G) end clearance must not exceed 0.0015 inch [0.038 mm] or be less than 0.0009 inch [0.023 mm]. Gaskets are available in 0.0020 inch [0.051 mm] (red) and 0.0015 inch [0.038 mm] (purple). If the gear pump does not rotate freely or if the end clearance exceeds 0.0015 inch [0.038 mm], check for an error in the assembly. The PT (type H) end clearance must be 0.0020 to 0.0012 inch [0.051 to 0.038 mm]. The error in the assembly must be corrected to prevent an early pump failure.




1. To Injector Drain Line or Fuel Tank
2. To Fuel Pump Housing Open Cavity

Fig. 5-4, (F5157). Gear pump cooling and lubricating fuel flow.

6. If the cooling system is in use, install the elbow and/or the check valve. If 1/8 inch [3.17 mm] pipe plugs are in use, tighten them to 10 to 13 foot pounds [14 to 18 N•m], Fig. 5-4.

**Note:** Step No. 7 must be complete before installing the MVS housing.

7. Install the elbow check valve, Part No. 175836, in 1/8 inch drain hole in the gear pump. A 1/8 inch N.P.T.F. brass street pipe elbow and a check valve, Part No. 179037, can replace the check valve.

**Note:** The check valve is necessary to prevent the fuel in the pump from draining away which will then let air inter the pump. The check valve will also allow pressure to build up during engine cranking.

8. The check valve can be pressure checked with calibration test oil, in the direction of flow at 4 to 9 psi [27.6 to 63 kPa].

9. To test for leakage, apply 3-1/2 psi [24 kPa] for 5 minutes. Replace the valve if a leak occurs.

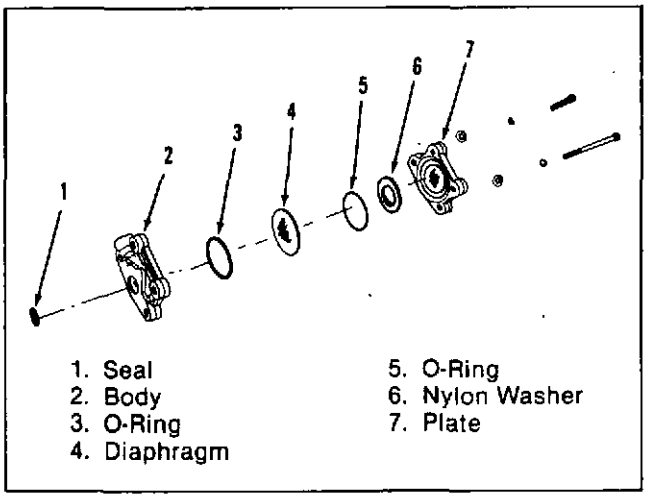
10. To test leakage in the opposite direction of flow, apply 1/4 psi [172 kPa] for 5 minutes. Replace if the check valve has a leak.

11. Beginning about May 1980, the check valves can have a thread sealer applied to the threads. Tighten these check valves to 6 to 12 ft. lb. [8 to 16 N•m].

## Fuel Damper

### Disassembly and Inspection

1. Remove the housing from the cover. Remove the spring steel diaphragm. Discard the O-ings. Inspect the nylon washer, discard if damaged.
2. Check for corrosion, wear or cracks in the cover or the diaphragm. Replace the damaged parts, Fig. 5-5.
3. To check the diaphragm for a hidden crack, drop it on a flat hard surface. It must have a clear ring. If it has a flat sound replace the diaphragm.




1. Seal
2. Body
3. O-Ring
4. Diaphragm
5. O-Ring
6. Nylon Washer
7. Plate

Fig. 5-5, (F5132). Fuel damper — disassembled view.

### Assembly

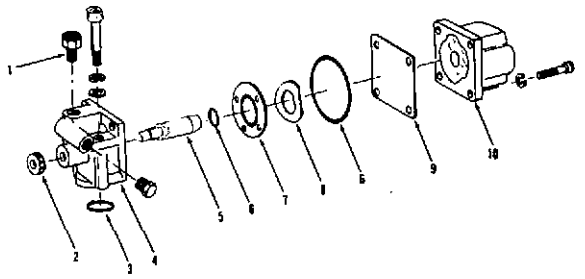
1. Install new O-rings in the grooves and a new nylon washer.
2. Clean the diaphragm. Put a coating of 20W oil on the diaphragm. Put the diaphragm in the cover.
3. Assemble the cover to the housing. Tighten the capscrews to 11 to 13 ft. lb. [15 to 18 N•m].

# Shutoff Valves

## Electric Shutoff Valve

### Disassembly

Remove the coil housing and the fuel shield from the valve housing. Discard the O-ring. Remove the spring washer and plate type of valve. Remove the manual opening knob. Remove the shaft from the valve housing. Check the shaft and discard the O-ring, Fig. 6-1.



1. Connection
2. Knob
3. Sealing Ring
4. Housing
5. Shaft
6. O-Ring
7. Valve
8. Spring
9. Shield
10. Coil

Fig. 6-1, (F5143). Electric shutoff valve — disassembled view.

### Cleaning and Inspection

1. Clean all of the parts except the coil assembly in mineral spirits.

**Note:** Do not get the coil wet with solvent. Clean it with a clean dry cloth. Polish the coil face with a 200 grit emery cloth on a flat surface.

2. Visually check the valve and valve seat for dirt, metal parts, wear, bonding separation failure or corrosion. Replace if necessary. The valve seat must have a minimum seat width of 0.015 inch [0.38 mm], Fig. 6-2.

3. Check the coil assembly with an Ohm meter. Replace the coil if it is below the values given in Table 6-1. The coil action can be checked with a volt meter.

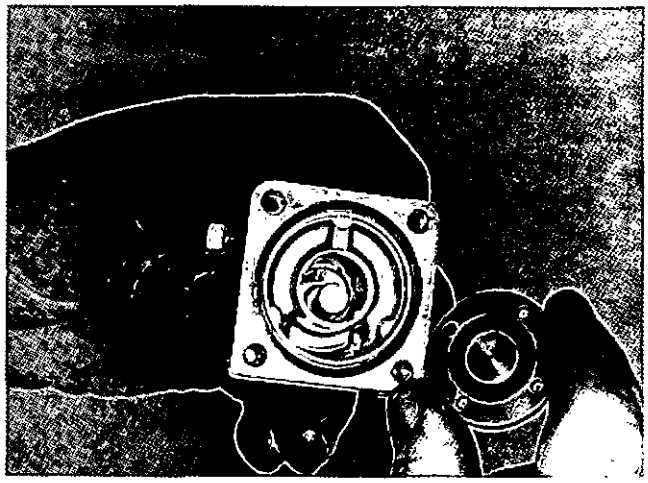


Fig. 6-2, (F528). Inspect the plate of the valve.

**Caution: The starting switch must be turned off when checking the coil.**

**Table 6-1: Coil Resistances**

| Coil Part No. | Voltage and Type | Coil Resistance (Ohms) |
|---|---|---|
| 134072 | 12 V.D.C. Single Terminal | 7.5 ± 0.5 |
| 134073 | 6 V.D.C. Single Terminal | 1.87 ± 0.15 |
| 134074 | 24 V.D.C. Single Terminal | 30 ± 2 |
| 134074 | 24 V.D.C. Requires 149190 Housing Assembly | 30 ± 2 |
| 134075 | 12 V.D.C. Two Terminal | 7.5 ± 0.5 |
| 134076 | 24 V.D.C. Two Terminal | 30 ± 2 |
| 134077 | 32 V.D.C. Two Terminal | 53 ± 3.5 |
| 134078 | 64 V.D.C. Two Terminal | 212 ± 14 |
| 134079 | 115 V.D.C. 36″ Lead Wires | 690 ± 45 |
| 134080 | 115 V.A.C. 36″ Lead Wires | |
| 134081 | 240 V.A.C. 36″ Lead Wires | |
| 143809 | 32 V.D.C. Single Terminal | 53 ± 3.5 |
| 144707 | 48 V.D.C. Two Terminal | 115 ± 10 |
| 149174 | 36 V.D.C. Two Terminal | 58 ± 3.5 |
| 149175 | 36 V.D.C. Single Terminal | 58 ± 3.5 |
| 149176 | 32 V.D.C. 36″ Lead Wires | 53 ± 3.5 |
| 149177 | 74 V.D.C. Two Terminal | 345 ± 22 |
| 188555 | 24 V.D.C. 36″ Lead Wires | 30 ± 2 |
| 196066 | 24 V.D.C. Single Terminal | 30 ± 2 |
| 209940 | 12 V.D.C. Single Terminal | 7.5 ± 0.5 |
| 3017494 | 24 V.D.C. Single Terminal H.D. | 30 ± 2 |
| 3021420 | 24 V.D.C. Two Terminal H.D. | 30 ± 2 |

### Assembly

1. Install a new O-ring on the new shaft. Put a coating of lubricant on the O-ring.
2. Install the shaft into the housing until it reaches the bottom, Fig. 6-3. Use a depth micrometer set at 0.118 inch [2.997 mm]. Check the distance from the face of the valve housing to the tip of the shaft. If necessary, turn the shaft out until it is 0.118 inch [2.997 mm] below the housing face. Do not move the shaft and press the knob on until it touches the valve housing. This is the stop position, Fig. 6-4.
3. Put the valve into the valve housing with the rubber side toward the housing.

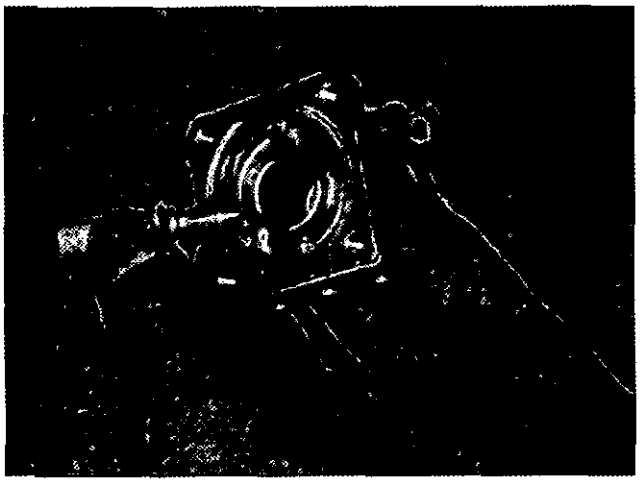


Fig. 6-3, (F529). Install the shaft.

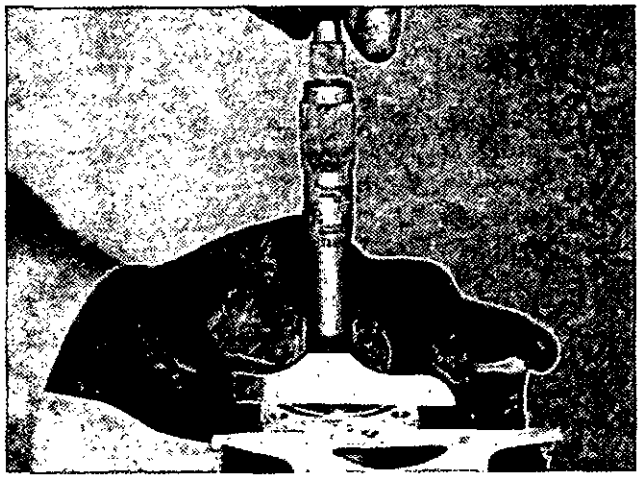


Fig. 6-4, (F530). Check the shaft tip depth.

4. Apply lubricant to the housing O-ring and the seat in the groove.
5. Put the spring washer on the valve with the cavity side up and in a position around the valve locator, Fig. 6-5.
6. Install the fuel shield and the coil on the valve housing. Tighten the coil screws to 25 to 30 in. lb. [2.8 to 3.4 N•m] torque.
7. To pressure test the valve, energize the coil and move the test fluid through the valve at 300 psi [2068 kPa]. Deenergize the valve and the valve must hold the 300 psi [2068 kPa] load with no leakage.
8. If the valve does not hold the pressure, check the body for damage where the body and the plate come together. Check the rubber in the plate for damage.

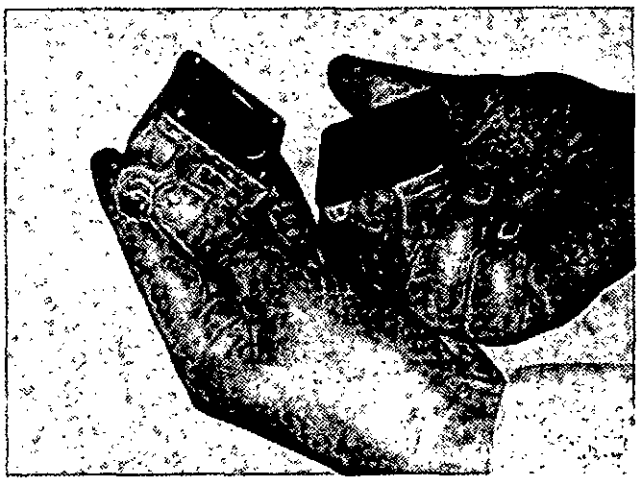


Fig. 6-5, (F531). Assemble the shutoff valve.

## Manual Shutoff Valve

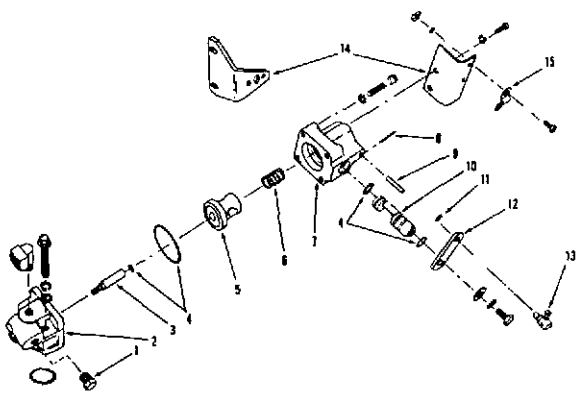
### Disassembly and Inspection

1. Remove the valve housing from the control housing. Discard the housing O-ring.
2. If the problem is fuel leaking around the shaft, remove the shaft from the control housing. Remove the shaft O-ring and discard. This shaft is used only for a seal on the manual valve and need not be removed if no leakage is found. If replaced, install into the housing as far as it will go.

3. Remove the small pin dowel holding the manual shutoff shaft in the housing, Fig. 6-6. Lift out the shaft and discard the O-ring.
4. Lift out the manual shutoff valve and spring. Remove the control lever, if necessary.
5. Visually check the valve and the valve seat for wear or corrosion, Fig. 6-7. Replace if necessary.

### Assembly

1. *If removed, install a new O-ring on the shaft.* Put a coating of lubricant on the O-ring.
2. Install the shaft in the valve housing.



1. Plug
2. Front Housing
3. Override Shaft
4. O-Ring
5. Valve
6. Spring
7. Valve Housing
8. Roll Pin
9. Roll Dowell
10. Shaft
11. Retaining Ring
12. Lever
13. Swivel Block
14. Bracket
15. Clip

Fig. 6-6, (F5133). Manual shutoff valve.

3. Install the manual shutoff valve and spring in the valve housing. Install a new O-ring on the control shaft near the end with the lever. Push the control shaft through both the valve housing and the control valve. Continue to push *the shaft through the housing until the O-ring* groove on the end of shaft is seen. Install the O-ring on the shaft. Lubricate and slide the *shaft back through the housing to align the* pin groove. Insert the pin to hold the control shaft, Fig. 6-6.

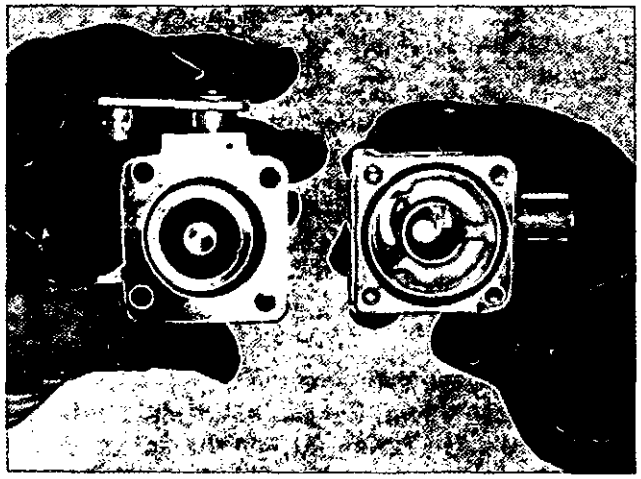


Fig. 6-7, (F533). Check the manual valve.

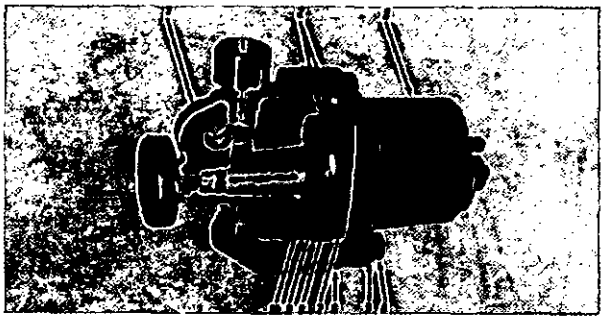
4. Install a new O-ring between the housings; hold the housings together. Tighten the capscrews to a torque of 25 to 30 inch pounds [2.8 to 3.4 N•m]. Install the control lever, if removed.

## High Pressure Fuel Shutoff Valve

The arrangement of the high pressure fuel shutoff valve, AR-05592 is in Fig. 6-8.

### Assembly

1. Remove the solenoid from the valve body.



1. Housing Assembly
2. 192888 O-Ring
3. Coil Assembly
4. S-1215 Capscrews (10-24 × ¾) 4 Reqd.
5. S-607 Lockwasher 4 Reqd.
6. 196055 Spacer
7. 129839 Fuel Shield
8. 129768 Spring
9. 196056 Disc, Orifice
10. 196057 Disc, Piloting

Fig. 6-8, (F5232). High pressure fuel shutoff valve.

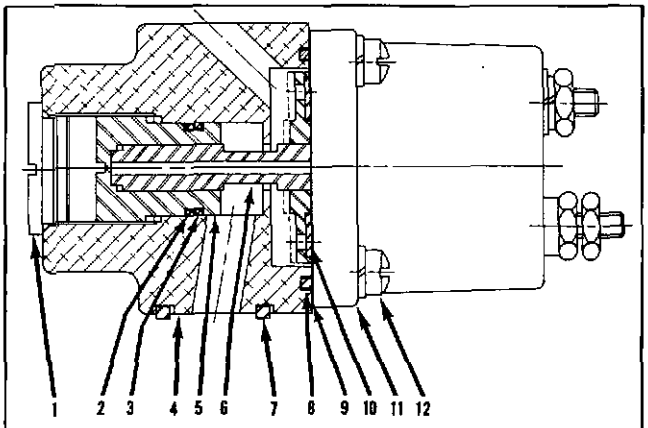
Discard the standard disc in the valve body. Keep the wave spring and the stainless steel plate.

2. Put the spacer block on the valve body with the O-ring groove toward the solenoid. Make sure the O-rings are in the grooves in the valve body and the spacer block.
3. Insert the orifice disc, with the hole in center, in the valve body. Insert the pilot disc, with no center hole, in the spacer block.
4. Put the wave spring on the high part of the top disc fuel shield. Put the stainless steel plate on the wave spring. Attach the solenoid with 10-24 × 3/4 inch [19 mm] screws. Tighten to 25 to 30 in. lbs. [2.8 to 3.4 N•m].

## Dual Power Torque Limiting Valve

### Assembly of Valve

1. Put the spring on the armature. Install the plunger-armature assembly into the body. Put the seal ring in the body groove. Install the fuel shield. Install the coil assembly on the power valve body. Tighten the capscrews to 25 to 30 in. lb. [2.8 to 3.4 N•m].
2. Install the sleeve O-ring and the backup teflon ring on the sleeve, Fig. 6-9.




1. Plug, Valve
2. O-Ring, Teflon Sleeve
3. O-Ring
4. Body, Valve
5. Sleeve, Valve
6. Assembly, Armature and Plunger
7. Ring, Sealing
8. Ring, Shutoff Valve Seal
9. Shield, Shutoff Valve Fuel
10. Spring, Shutoff Valve
11. Coil (voltage must be specified)
12. Screw

Fig. 6-9, (F5276). Dual valve assembly cross-section.

3. Lubricate the O-rings and install the sleeve into the body. Turn the sleeve in until it bottoms. Rotate it out three turns for the beginning adjustment. Install the plug in the body.

**Note:** Make sure the O-rings slide by the chamfer without rolling. The sleeve will turn hard when the O-rings enter the chamfer.

4. The procedure for setting the valve is in the PT (type G) calibration section.

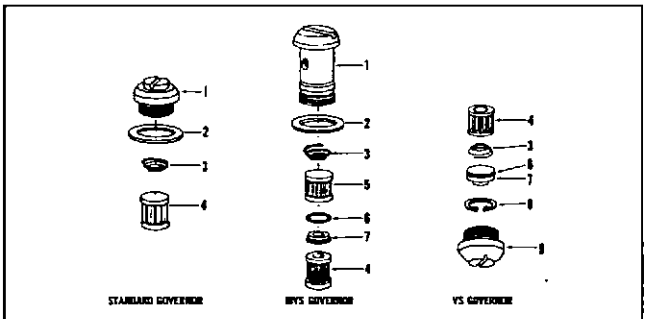
# Fuel Pump Filter Screen

Cummins engines are equipped with single or double fuel screens that are in the fuel pump housing.

## Disassembly and Inspection

Three types of screens are used on the PT Fuel Pumps.

1. The screen assembly for the standard pump mounts in the top of the fuel pump housing. Fig. 7-1.
   a. Remove the retainer. The top of the screen contains a magnet to hold any steel particles that have entered the fuel pump. Some screens are a one piece assembly.
   b. The lower screen retainer has a hole in the center to permit fuel flow.
   c. Clean the retainer in fuel oil and dry it with compressed air. Visually inspect the retainer and magnet for damage or wear.
   d. Clean the filter screens by putting them in a carbon-dissolving solvent. Flush in any ultrasonic cleaner or clean the screen and retainer in fuel oil and dry with compressed air.
   e. Visually inspect the screen for holes or for metal particles in the mesh.



1. Cap
2. Seal
3. Spring
4. Screen and Magnet
5. Screen
6. O-Ring
7. Retainer
8. Snap Ring
9. Cap, PT (type H)

Fig. 7-1, (F5183). Fuel filter screens.

   f. Discard the damaged or worn parts and replace with new parts.
2. The VS governed fuel pump screen is the same as standard screen. It is in the bottom of fuel pump housing under the shutoff valve. Install the screen in the housing with the hole up.
3. There are two screen assemblies used in the "MVS" governor. The top screen cannot be disassembled.
   a. The top screen assembly has a hole in the bottom to permit fuel flow. Clean the assembly in fuel oil and dry with compressed air.
   b. The lower screen assembly has holes in both ends and can be disassembled. Inspect the screens for breaks, metal particles in the mesh or other damage.
   c. Replace the worn or damaged parts with new parts.
4. The screen in the PT (type H) fuel pump is in the same location as the PT (type G) VS screen.
   a. The PT (type H) screen is longer.
   b. Use a screwdriver to remove the retaining cap. Discard the O-ring.
   c. Clean and inspect the screen.

### Filter Screen Optional Replacements

Two fuel filter screens, both with a 40 micron mesh, are available for use in the PT fuel pumps. Use the filter screen, Part No. 200004, to replace the screen, Part No. 146483, when additional protection is needed in the single screen type of fuel pumps.

Use the new screen to check if the primary fuel filter if filtering. Tests with a good primary filter show that the 200004 Screen must be cleaned at the 50,000 mile or the 1600 hour intervals. When a primary filter that was not a Cummins filter was

used, the screen cleaning periods had to be moved up to much closer intervals to prevent an early failure.

### PT (type G) with Mechanical Variable-Speed Governor

A filter screen, Part No. 200743, is available for use in the PT (type G) fuel pumps that have the MVS governor. This screen replaces screen, Part No. 137808, in the MVS governor. The 137808 will continue to be used in electro-hydraulic governor operated fuel pumps.

# Fuel Pump Assembly

Clean all of the fuel pump parts before starting the fuel pump assembly. The assembly operations must be done carefully.

## Tools

The use of the correct tools has many advantages. The fuel pump has many aluminum parts that makes it light. These parts can be easily damaged if the correct tool is not used during assembly.

**Note:** To prevent damage to aluminum parts, be careful when you move them.

See your Cummins distributor for the service tools for the fuel pump.

Use an arbor press for all operations that require a press to control pressure and alignment. Always make sure that the part is on a support block when pressing in another part. The parts can easily be damaged beyond repair if they are not supported correctly.

## Pressing Lubricant

A high pressure lubricant must be used on both surfaces in all pressing or driving operations. The lubricant prevents damage during assembly. Make sure you remove all rough edges from both parts before putting together in a press.

## Capscrews and Washers

Capscrews used in assembling a part to aluminum must have an engaging thread depth two times the diameter. This will prevent damage to the threads with a capscrew that is too short or breaking a part from using a capscrew that is too long.

Do not use a lock washer next to aluminum. Always use a flat washer between the lock washer and the aluminum part.

## Vise and Holding Fixture

Install the fuel pump on the Holding Fixture ST-546 or 3375133 and Swivel Vise ST-302.

## Tachometer Drive in Housing

The life of the dust seal for the tachometer drive can be extended by keeping the maximum clearance between the gear and bushing to .005 inch (0.127 mm). Install the drive assembly correctly into the fuel pump housing.

1. Align the oil groove in the top of the bushing with the drive shaft of the fuel pump. Press the bushing, shaft and gear assembly into the housing with ST-1032 Driver until the bushing touchs the bottom, Fig. 8-1.

**Note:** The use of any tool but ST-1032 Driver can cause holes in the oil seal which will lead to an early oil seal failure.

Fig. 8-1, (F556). Install the tachometer drive in the housing.

2. Install the spacer on the top of the bushing with the slotted edge down. Install a new oil seal, with the spring side down, with St-1032. The spacer must touch the bottom of the bushing.

**Caution: Do not press the spacer too much. It can be pressed flat which will destroy its efficiency.**

3. Put some drops of lubricant on top of the oil seal.

4. Install a new felt dust seal with the white side up.
5. Install a new gasket on the tachometer cover. Install the cover and gasket on the fuel pump housing.

## Filter Screen

### Single Screen Types

1. Assemble the filter screen assembly into the top of the standard housing. The hole in the screen goes down, Fig. 8-2.

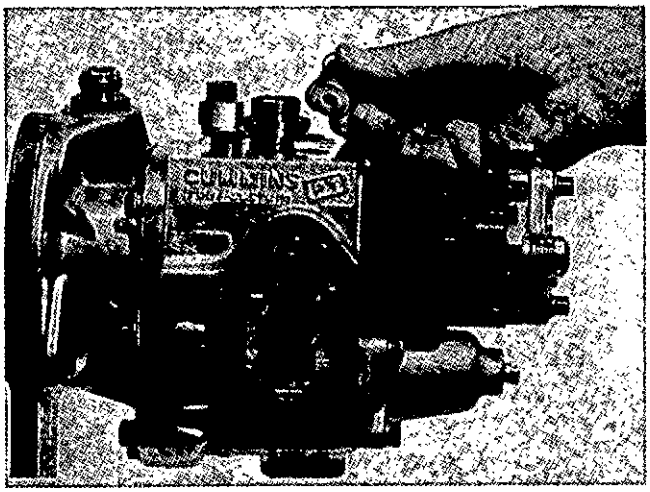


Fig. 8-2, (F557). Install the fuel screen in the standard housing.

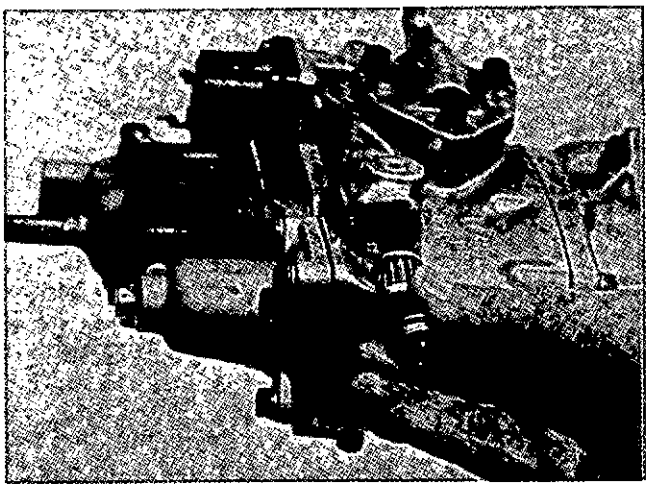


Fig. 8-3, (F5265). Install the fuel screen in the PT (type G) VS housing.

2. Install the O-ring on the cover. Use grease to hold the O-ring on the cover.
3. Install the spring and tighten the cover in the housing to 8 to 12 foot pounds [11 to 16 N•m].
4. Assemble the screen in the bottom of the PT (type G) VS housing with the hole in the screen up, Fig. 8-3.
5. Install the spring and plug. Install the retaining ring.
6. Use a screwdriver to install the PT (type H) screen plug.

### Double Screen

1. Install the lower screen (one with holes in each end). Install the screen retainer and a new O-ring.
2. Install the upper screen with the hole down. Install the spring.
3. Lubricate the new O-ring and the plate on the cover. Tighten the cover to the fuel pump housing to 8 to 12 ft. lb. [11 to 16 N•m].

## Governor Spring Assembly

### Automotive Governor

1. Assemble the idle screw into the plunger guide. Install the small washer over the screw tip that is inside the guide, Fig. 8-4. Some fuel pumps require two idle washers, see the calibration code. Put the small idle spring into the guide. Assemble the idle plunger (button) against the spring in the guide. Fig. 8-5.

**Note:** When you assemble the governor spring assembly, use the new improved plunger, Fig. 8-6.

2. The size of the counterbore changes with the different engine models. See the pump calibration data for the correct idle plunger to use. The idle plunger must be flat where it contacts the governor plunger, replace if worn. The idle plunger controls the maximum fuel

pressure of the fuel pump. All idle plungers with a Code No. 170 or higher, require the adapter Part No. 144676.

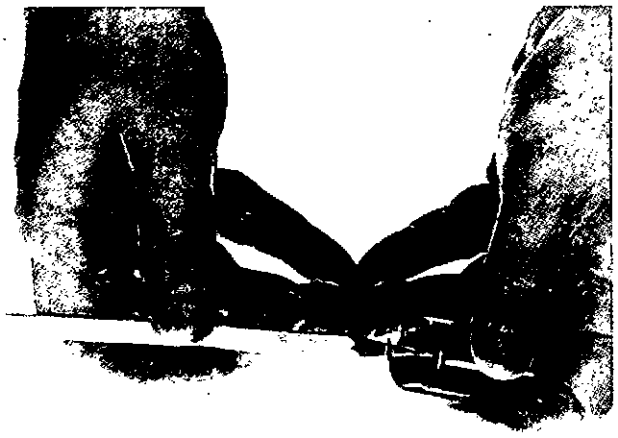


Fig. 8-4, (F558). Install the washer over the idle screw.

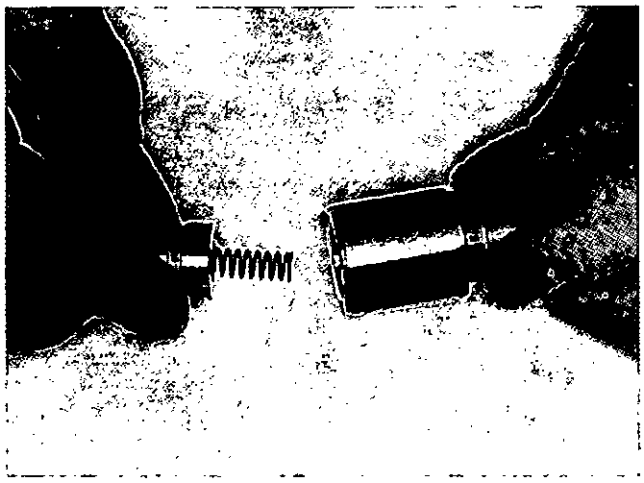


Fig. 8-5, (F559). Install the idle plunger button.

3. Install the maximum speed spring over the rear of the idle plunger guide. Assemble the shim against the spring. Install the retainer and the retaining ring to fasten the assembly in the governor sleeve, Fig. 8-7.

### Spring Assembly Notes

**Note:** There are different maximum speed springs available. Their identification is by color stripes. See the Governor Spring Assembly section for the tabulations and specifications.

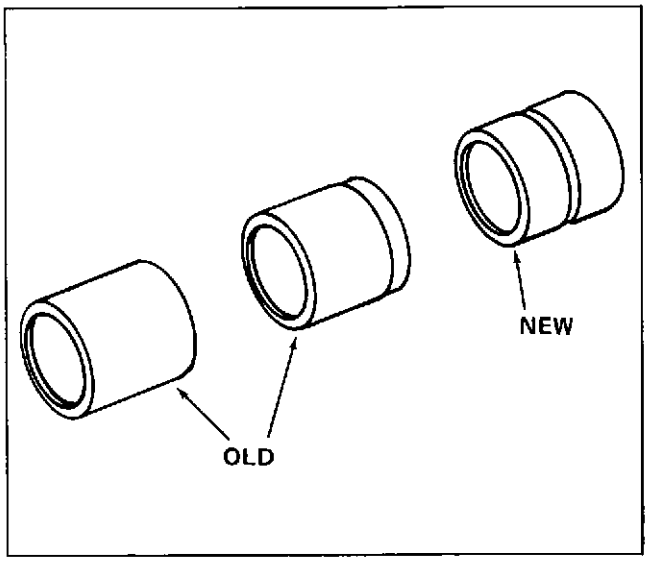



Fig. 8-6, (F5149). Old and new design of the idle plunger buttons.

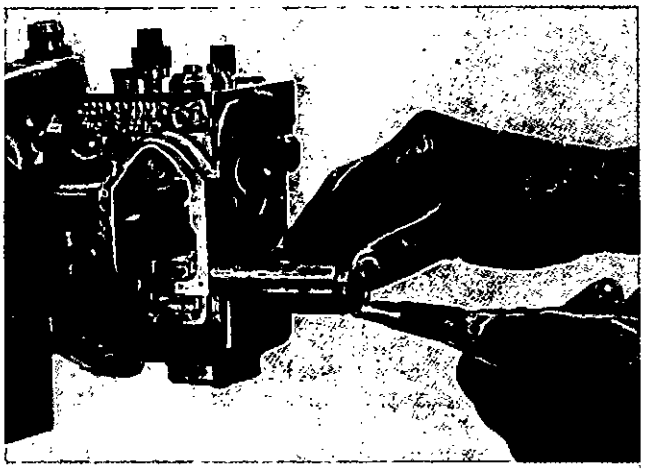


Fig. 8-7, (F560). Install the retaining ring of the spring assembly.

**Note:** Shims are available in 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thickness. The total number of shims must be installed during the fuel pump calibration. See Bulletin No's 3379182, 3379068,and 3379077 for the PT (type G) calibration values.

4. Install the spring assembly cover and a new gasket. Tighten the cover to the housing to 9 to 11 ft. lb. [12 to 15 N•m]. See the Governor Spring Assembly, Section Four, for the installations of the other type of governors to the fuel pump.

## Throttle Shaft

### Fuel Adjustment Screw Type

Make sure the throttle shaft is the correct size. Check the color code.

1. Lubricate the O-ring and slide it on the new fuel adjustment screw.
2. Insert the fuel adjustment screw into the throttle shaft about six rotations. Make sure the fuel hole in the throttle shaft is open, Fig. 8-8.
3. Lubricate the O-ring and slide it on the throttle shaft.

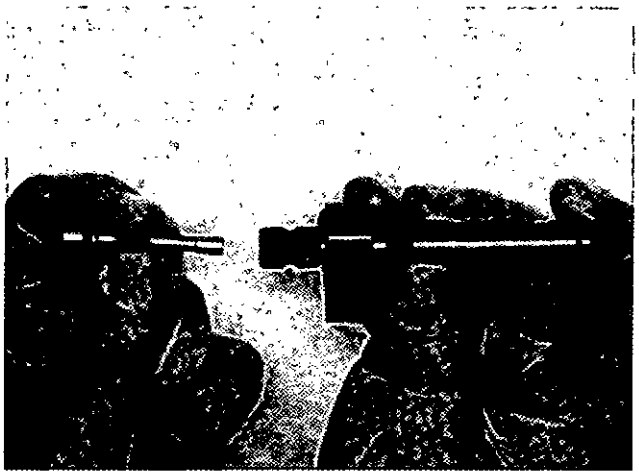


Fig. 8-8, (F5307). Install the fuel adjustment screw in the throttle shaft.

4. Insert the throttle shaft in the housing with the counterbore of the fuel port down. The throttle stop is up in the PT (type G) AFC fuel pump.
5. The AFC throttle stop must be held to the shaft with two setscrews. The second setscrew is a locking setscrew on top of the first setscrew. Tighten both setscrews to 70 to 90 in. lb. [8 to 10 N•m].
6. Install the retaining ring on the end of the throttle shaft, Fig. 8-9.
7. Install the ball in the throttle shaft with Service Tool No. 3375204 after the pump is calibrated.

### Restriction Plunger Type

Throttle shafts change with the applications. Replace the throttle shaft with the same type and class, if needed, Table 8-1.

1. Install a new O-ring on the throttle shaft. Use ST-835 Sleeve for 1/2 inch [12.7 mm] (ST-422 for larger) shaft to protect the O-ring. Lubricate the O-ring before assembly.

**Note:** Install enough shims to make the plunger even with the fuel passage. It must be completely open for the pump calibration, Fig. 8-11. Some throttle shafts do not have a restriction plunger.

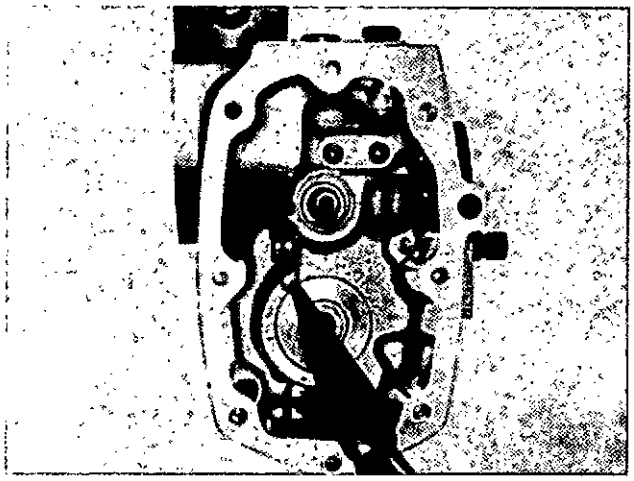
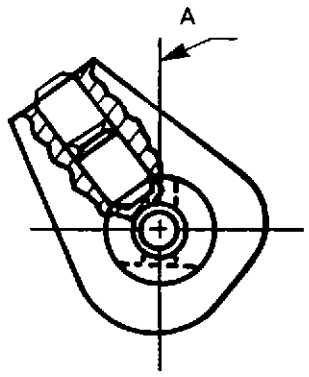


Fig. 8-9, (F5299). Install the retaining ring on the throttle shaft.

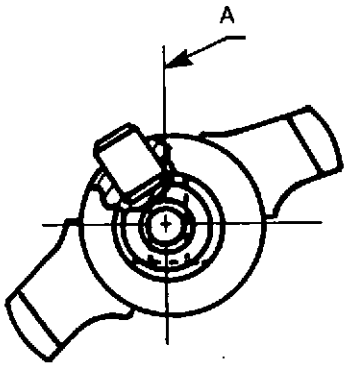
2. Install the restriction plunger in the throttle shaft, if used. Tighten the pipe plug to 40 to 55 in.-lbs. [4.5 to 6.2 N•m].
3. Install the washer over the shaft. Insert the old design throttle shaft in the sleeve so the casting is curved down, Fig. 8-10. If a pin is in use, the open side of the pin goes down. Lubricate the shaft with fuel oil.
4. Install the old design VS pump throttle shaft with the open side of the pin toward the front of the pump, Fig. 8-12.

**Note:** The counterbored port on the PT (type G) throttle shaft must go down. The throttle shaft in use on the torque converter governor must have the counterbored port up.

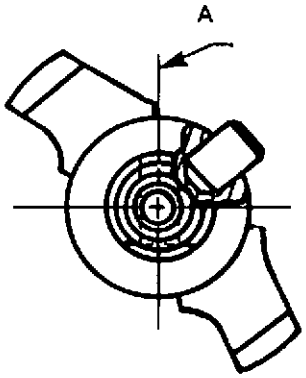
5. Install the retaining ring. Lock it in the groove in front of the cover plate of the throttle shaft.
6. Do not install the cover plate for the AFC throttle shaft to the housing before the pump is calibrated.




PT (type G) AFC throttle shaft




PT (type G) throttle shaft for an automotive pump




PT (type G) throttle shaft for a VS pump

Fig. 8-10, (F5403). Location of the throttle stop on the throttle shaft.

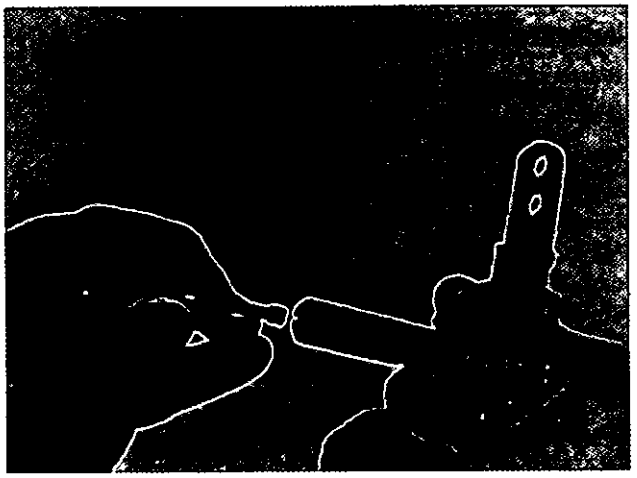


Fig. 8-11, (F564). Install the throttle restriction plunger.

## Throttle Lever

Install and tighten the throttle lever on the throttle shaft. The throttle levers are available in lengths of about 1-1/4 to 5 inches [31.7 to 127 mm]. Use the correct length for the pump application.

The throttle lever that is spring loaded is in use to prevent damage to the throttle shaft bushing. This damage can occur when too much pressure is applied to the throttle lever in the full fuel position. The spring loaded lever is designed to break over when under this high pressure and then spring back when the pressure is released.

This will also prevent the throttle lever from turning on the shaft and damaging the spline shaft diameter.

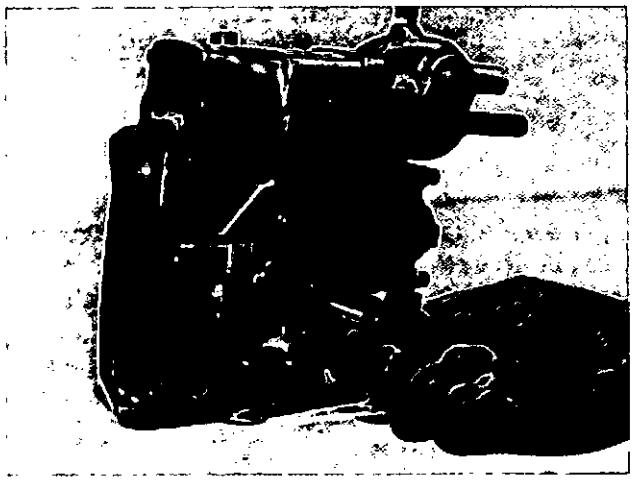


Fig. 8-12, (F5263). Install the throttle assembly in the VS housing.

**Table 8-1: Throttle Shafts 1/2" PT (type G)**

**Standard, except as noted below:**

| Code | Red | Blue | Green | Yellow | Orange | Black | Gray | Purple | |
|---|---|---|---|---|---|---|---|---|---|
| **Size** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Notes** |
| Part No. | AR-12520 | AR-12521 | AR-12522 | AR-12523 | AR-12524 | AR-13046 | AR-13047 | | |
| Part No. | 149030 | 149031 | 149032 | 149033 | 149034 | 149035 | 161596 | 161597 | |
| Part No. | *AR-13070 | AR-13071 | AR-13072 | AR-13073 | AR-13074 | AR-13075 | AR-13076 | AR-13077 | |
| Part No. | 177140 | 177141 | 177142 | 177143 | 177144 | 177145 | 177146 | 177147 | |
| Part No. | AR-40530 | AR-40531 | AR-40532 | AR-40533 | AR-40534 | AR-40535 | | | Restricted shaft-VS |
| Part No. | 208740 | 208741 | 208742 | 208743 | 208744 | 208745 | | | Restricted shaft-VS |
| Part No. | AR-40540 | AR-40541 | AR-40542 | AR-40543 | AR-40544 | AR-40545 | | | Restricted shaft-VS |
| Part No. | 208730 | 208731 | 208732 | 208733 | 208734 | 208735 | | | Solid shaft-VS |
| Part No. | AR-12790 | AR-12791 | AR-12792 | AR-12793 | AR-12794 | AR-12795 | | | TC Gov.-VS |
| Part No. | 157940 | 157941 | 157942 | 157943 | 157944 | 157945 | | | Stub Solid Shaft-MVS |
| Part No. | 155380 | 155381 | 155382 | 155383 | 155384 | 155385 | | | Gov. Restricted Stub |
| Part No. | AR-41000 | AR-41001 | AR-41002 | AR-41003 | AR-41004 | AR-41005 | | | AFC-Restricted Shaft |
| Part No. | 3006350 | 3006351 | 3006352 | 3006353 | 3006354 | 3006355 | 3006356 | 3006357 | AFC-0.173 Fuel Port |
| Part No. | 3006360 | 3006361 | 3006362 | 3006363 | 3006364 | 3006365 | 3006366 | 3006367 | AFC-0.250 Fuel Port |
| Part No. | 3006450 | 3006451 | 3006452 | 3006453 | 3006454 | 3006455 | | | AFC-VS-TC Gov. |
| Part No. | 3017140 | 3017141 | 3017142 | 3017143 | 3017144 | 3017145 | 3017146 | 3017147 | AFC-0.250 Fuel Port |

| Code | Red/Gray | Blue/Gray | Green/Gray | Yellow/Gray | Orange/Gray | Black/Gray |
|---|---|---|---|---|---|---|
| **Size** | **10** | **11** | **12** | **13** | **14** | **15** |
| Part No. | AR-13050 | AR-13051 | AR-13052 | AR-13053 | AR-13054 | AR-13055 |
| Part No. | 169890 | 169891 | 169892 | 169893 | 169894 | 169895 |

| Code | Red/Purple | Black/Purple | Green/Purple | Yellow/Purple | Orange/Purple | Black/Purple |
|---|---|---|---|---|---|---|
| **Size** | **20** | **21** | **22** | **23** | **24** | **25** |
| Part No. | AR-13060 | AR-13061 | AR-13062 | AR-13063 | AR-13064 | AR-13065 |
| Part No. | 169900 | 169901 | 169902 | 169903 | 169904 | 169905 |

*Used on pumps requiring over 100 lb./hr. flow (usually V12 engines) with 1-1/4 inch [31.75] gear pump.

**Throttle Shaft 5/8" PT (type G)**

| Code | Red | Blue | Green | Yellow | Orange | Black | |
|---|---|---|---|---|---|---|---|
| **Size** | **0** | **1** | **2** | **3** | **4** | **5** | **Use Standard** |
| Part No. | 144530 | 144531 | 144532 | 144533 | 144534 | 144535 | |
| Part No. | 144830 | 144831 | 144832 | 144833 | 144834 | 144835 | With Vented Injectors |

**Note:** The throttle lever stop in the vehicle chasis must be adjusted so there will be a minimum amount of break over of the throttle lever.

**Warning: When the throttle linkage stop is not correctly adjusted, the spring loaded lever may let the linkage mechanism go "over center." This will lock the throttle in the full fuel position.**

## Governor Plunger

1. Lubricate with engine oil and install the plunger into the barrel, Fig. 8-13. Make sure the plunger is the correct fit and code number, if it is replaced. Mark the governor barrel if an oversize plunger is in use. The size of the barrel and plunger must be the same.
2. Lubricate the VS plunger with engine oil and install it in the upper barrel.

## Drive Cover Assembly

1. Install a new gasket over the dowel pins on the front surface of the pump housing.

Fig. 8-13, (F566). Install the governor plunger.

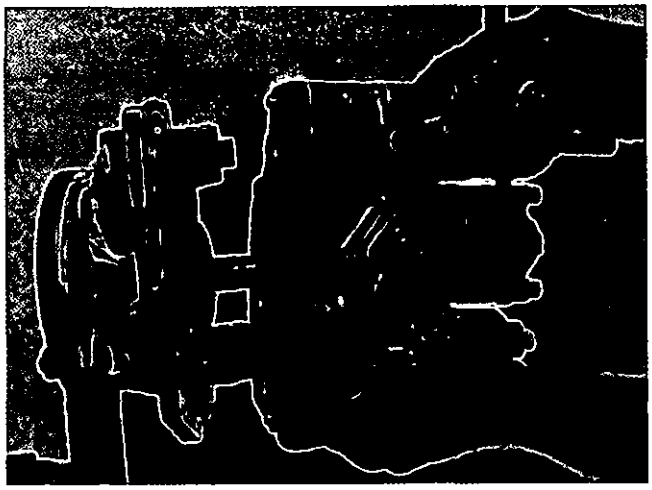


Fig. 8-14, (F5264). Install the front cover on the VS housing.

2. Install the weight assist plunger in the weight shaft bore with the spring and shims, when required.
3. Hold the governor weights in to hold the *assist plunger while you assemble the cover* to the housing.

**Note:** If the tachometer drive is in the housing, make sure the tachometer gears engage.

4. Turn the plunger drive tang horizontally. Turn the weight carrier horizontally, Fig. 8-14.

**Note:** The weight feet go on both sides of the governor plunger driver.

5. Tighten the front cover capscrews 9 to 11 ft.-lbs. [12 to 15 N•m]. Replace the breather capscrew with a sealing capscrew, Part No. 3018682. Do not use a washer with this sealing capscrew.

**Note:** The AFC cavity is now drained to the fuel drain line or to the fuel tank.

6. Rotate the drive shaft to make sure the tachometer gears engage.

## Gear Pump

1. Use a new gasket and assemble the gear pump to the main housing. Locate the notch for right hand or left hand rotation. For a right hand rotation, install the notch to the upper, right hand corner (looking from behind the fuel pump). For a left hand rotation, install the notch to the bottom left hand corner.

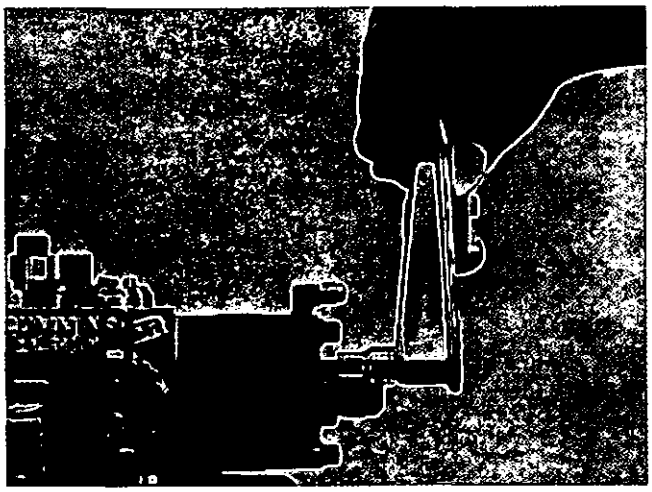


Fig. 8-15, (F562). Tighten the gear pump capscrews.

**Note:** Make sure the gasket is in the correct position. Make sure the housing fuel holes align with the gear pump holes. The gear pump, with the pressure valve, requires a gasket Part No. 3016683.

2. Tighten the capscrews to 11 to 13 ft.-lb. [15 to 18 N•m], Fig. 8-15. Turn the drive shaft to make sure the gear pump and tachometer drive shaft rotate freely.
3. Install the fuel inlet connection with the same type of threads that are in the gear pump. Some gear pumps use a 3/4 inch-16 UNF threaded connection with an O-ring. Older gear pumps had 3/8 inch NPTF inlet connection. The PT (type H) gear pumps use a 1 inch

connection. Do not let pipe sealant, used on NPTF, enter the gear pump. Keep the sealant out of the pump. Seal the connection to keep out the dirt.

4. Install the cooling check valve tee/or elbow into the top of the gear pump, if used.

## Shutoff Valve and Fuel Damper

1. Use petroleum jelly to hold a new O-ring to the bottom of the shutoff valve. Install the shutoff valve on the fuel pump housing.
2. Install the damper, with a new O-ring, to the gear pump. Tighten the capscrews to 11 to 13 ft.-lbs. [15 to 18 N•m].

# Auxiliary Equipment

Auxiliary equipment is available to change Cummins engines to special applications. Some applications that require auxiliary equipment are as follows:

1. An engine without an operator.
2. Several engines working together.
3. Applications requiring close control.
4. A high speed governor that is set high.

## Overspeed (Governor) Stop

On some applications, an overspeed (governor) stop is in use. This unit will automatically stop the engine if it overspeeds or underspeeds. The overspeed stop has rotating weights, driven by centrifugal force, which activate a microswitch. Reset the manual switch by pressing the button. The automatic switches reset at 125 rpm below the set speed, Table 9-1.

The location of the overspeed stop can be remote mounted or on top of the fuel pump. Both of the installations are connected to the tachometer drive. If it is remote mounted, a vertical mounting with the drive end down is best. Do not mount the drive end above the horizontal position.

### Adjustment

Loosen the cap adjustment lockscrew on the single element type of switch. Turn the cap until the correct speed is reached. Turn the overspeed stops clockwise to lower the speed or counterclockwise to increase the speed. Turn the underspeed stops clockwise to raise the speed or counterclockwise to lower the speed, Fig. 9-1. Make sure you tighten the cap lockscrew after the adjustment.

Use the setscrews under the top cover to adjust the speed on the two and three element switches. Rotating the cap can cause damage to the two and three element switches.

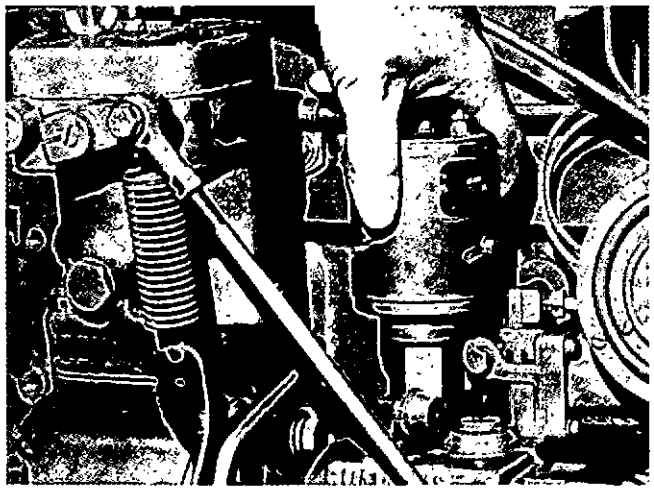


Fig. 9-1, (F5160). Overspeed stop adjustment.

### Overspeed Stop Adjustment Tool

An adapter, ST-1224, with a 2:1 ratio, is available to rotate the tachometer and speed switch at two times the engine speed. This tool replaces the existing adapter. The adjustment to the speed switch is a little over 1/2 of the engine and pump speed. This keeps the pump speed within its safe speed range while adjustments are being made.

## Tachometer Cable

The tachometer drive is a standard SAE size. It operates at one-half of the engine speed. Fill the cavity with clean, heavy grease before attaching the cable. Do not force the tang into the slot. If it is wrong, change the tang to a new standard SAE type.

When the outside of the tachometer cable is plastic, do not put it near the exhaust manifold or other "hot" areas.

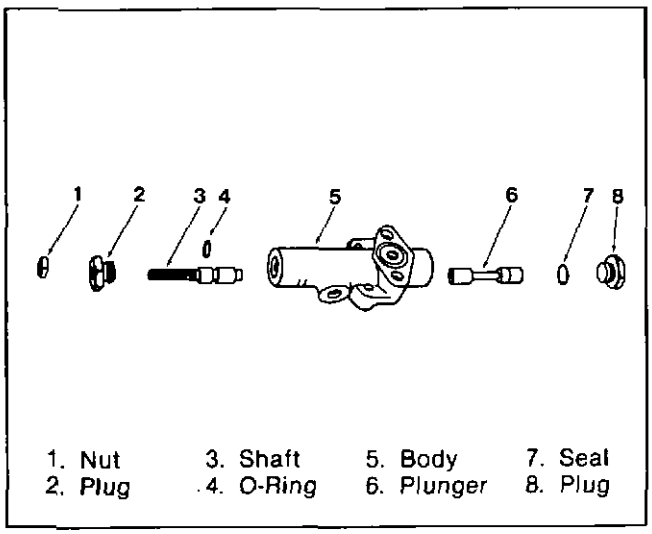
## Load Balance Valve for Multiple Engine Installation

When several engines must work together, the engine load balance can be controlled with a load balance valve. Fuel pressure controls the valv Fig. 9-2.

**Table 9-1: Overspeed Stops**

| Part Number | Settings (Engine RPM) Low | Medium | High | Element | Type of Switch | Installation | Remarks |
|---|---|---|---|---|---|---|---|
| 104267 | | | 2650 | Single | Manual | Remote | |
| 106643 | | | 1380 | Single | Manual | Remote | 1200 rpm Gen. Set |
| 106644 | | | 2070 | Single | Manual | Remote | 1800 rpm Gen. Set |
| 110468 | | | 2070 | Single | Automatic | Remote | |
| 112206 | | | 1720 | Single | Manual | Remote | 1500 rpm Gen. Set |
| 119582 | | | 1720 | Single | Manual | Remote | |
| 121282 | 600 | 1650 | 2070 | Triple | Automatic | Fuel Pump | |
| 125304 | | | 2070 | Single | Manual | Fuel Pump | 1800 rpm Gen. Set |
| 125305 | | | 2650 | Single | Manual | Fuel Pump | |
| 125306 | | | 1380 | Single | Manual | Fuel Pump | 1200 rpm Gen. Set |
| 125307 | | | 1720 | Single | Manual | Fuel Pump | 1500 rpm Gen. Set |
| 126790 | 600 | | 1720 | Double | Automatic | Remote | |
| 127413 | | | 2070 | Single | Manual | Remote | |
| 127414 | | | 2650 | Single | Manual | Remote | |
| 127939 | 600 | | 2070 | Double | Manual | Remote | 1800 rpm Gen. Set |
| 143205 | | | 2070 | Single | Manual | Fuel Pump | |
| 149222 | 600 | | 1380 | Double | Manual | Fuel Pump | |
| 165237 | | | 1450 | Single | Automatic | Fuel Pump | 1500/1800 rpm Gen. Set Field Flashing |
| 165238 | | | 1100 | Single | Automatic | Fuel Pump | 1200 rpm Gen. Set Field Flashing Under-Overspeed Type |
| 165239 | 1450 | | 2070 | Double | Manual | Fuel Pump | 1500/1800 rpm Gen. Set Field Flashing |
| 165240 | 1100 | | 2070 | Double | Manual | Fuel Pump | 1200 rpm Gen. Set Field Flashing |
| 165241 | 600 | 1450 | 2070 | Triple | Manual | Fuel Pump | 1500/1800 rpm Gen. Set Field Flashing |
| 165242 | 600 | 1100 | 1380 | Triple | Manual | Fuel Pump | 1200 rpm Gen. Set Field Flashing |
| 170209 | 1650 | | | Single | Automatic | Remote | Underspeed Type |
| 170966 | | | 2650 | Single | Automatic | Remote | |
| 174238 | 600 | 1650 | 2070 | Triple | Automatic | Fuel Pump | |
| 175239 | 1100 | | 2070 | Double | Manual | Fuel Pump | |
| 175240 | 600 | | 1380 | Double | Manual | Fuel Pump | 1200 rpm Gen. Set |
| 175241 | 600 | | 2070 | Double | Manual | Fuel Pump | 1800 rpm Gen. Set |
| 175242 | 600 | | 1720 | Double | Manual | Fuel Pump | 1500 rpm Gen. Set |
| 175243 | 600 | | 2600 | Double | Automatic | Fuel Pump | |
| 175244 | 600 | | 3500 | Double | Automatic | Fuel Pump | |
| 175245 | | | 2070 | Single | Manual | Fuel Pump | |
| 185560 | 600 | | 2070 | Double | Automatic | Remote | |
| 185561 | 600 | | 2550 | Double | Automatic | Remote | |
| 186076 | | | 2070 | Single | Automatic | Fuel Pump | |
| 186077 | 600 | | 2070 | Double | Automatic | Fuel Pump | |
| 188776 | 1100 | | | Single | Automatic | Remote | 1200 rpm Gen. Set Field Flashing |
| 188777 | 1450 | | | Single | Automatic | Remote | 1500/1800 rpm Gen. Set Field Flashing |
| 188778 | 1100 | | 1380 | Double | Manual | Remote | 1200 rpm Gen. Set Field Flashing |
| 188779 | 1450 | | 2070 | Double | Manual | Remote | 1500/1800 rpm Gen. Set Field Flashing |
| 188780 | 600 | 1100 | 1380 | Triple | Manual | Remote | 1200 rpm Gen. Set Field Flashing |
| 188781 | 600 | 1450 | 2070 | Triple | Manual | Remote | 1500/1800 rpm Gen. Set Field Flashing |
| 196075 | 550 | 1420 | 1560 | Triple | Manual | Remote | V12-525 Application |
| 199628 | | | 4150 | Single | Manual | Fuel Pump | 3600 rpm Gen. Set |
| 204351 | 600 | | 2070 | Double | Manual | Fuel Pump | 1800 rpm Gen. Set |
| 210314 | 600 | | 2100 | Double | Manual | Remote | Fire Pump Engine |
| 210315 | 600 | | 2800 | Double | Manual | Remote | Fire Pump Engine |
| 213190 | 1700 | 1900 | 2070 | Triple | Manual | Remote | |
| 215216 | 1450 | | 2070 | Double | Manual | Remote | 1500/1800 Gen. Set |
| 3000768 | 650 | | 2400 | Double | Manual | Remote | VT-1710 |

All settings have a tolerance of about ±40 rpm.
Most overspeed stops can be adjusted over or under the settings.




1. Nut
2. Plug
3. Shaft
4. O-Ring
5. Body
6. Plunger
7. Seal
8. Plug

Fig. 9-2, (F5161). Load balance valve-disassembled view.

### Balance Valve Installation PT (type G)

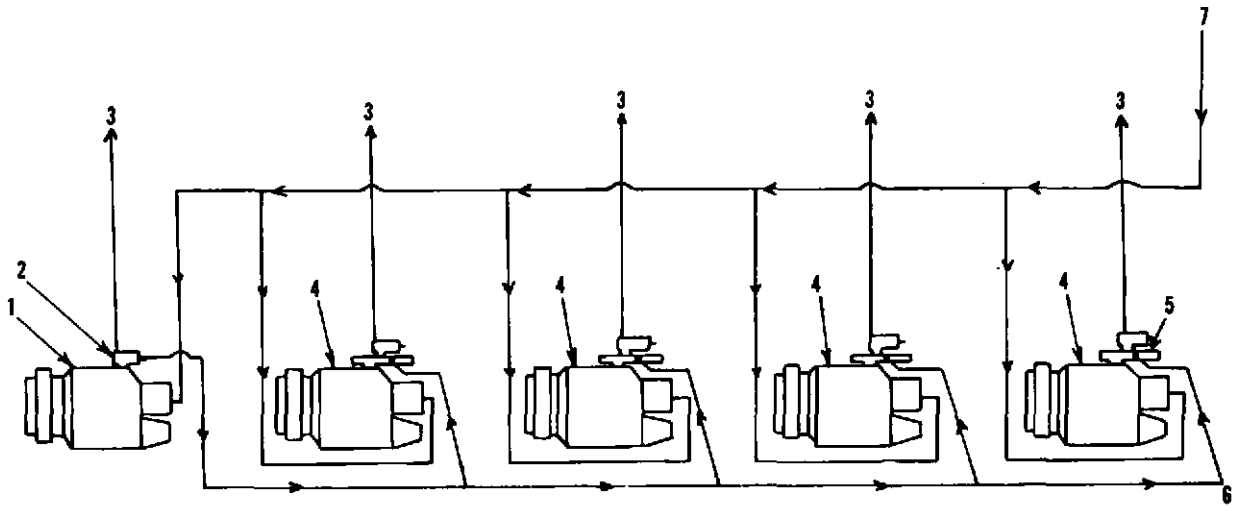
Select an engine for the master engine. The other engines will become controlled engines under the control of the master. See Fig. 9-3 for the fuel connections between the engines and the fuel pump.

### Master Engine

1. Remove the 1/8 inch [3.17 mm] pipe plug from the boss of the shutoff valve on the fuel pump of the master engine. This is where the rail pressure is normally taken.
2. Install a 1/4 inch [6.35 mm] line from the shutoff valve of the master fuel pump to the controlled engine load-balance valve, Fig. 9-3.

### Controlled Engine or Engines

1. Install the load balance valve, Part No. BM-39618, of the controlled engine under the electric shutoff valve.
2. Install the electric shutoff valve on the top of the load balance valve.
3. Connect the injector fuel supply tube to the electric shutoff valve. This tube must be as short as possible.
4. Connect the line from the master fuel pump to the load-balance valve.

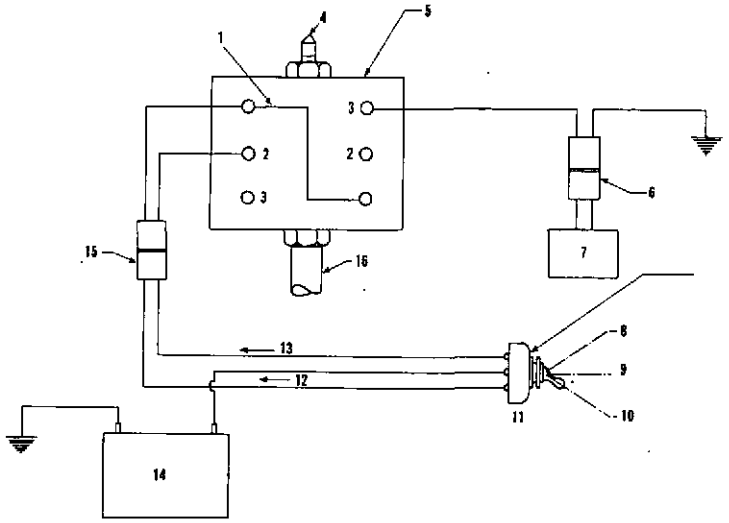



1. Master Engine Fuel Pump
2. Shutoff Valve
3. Fuel To Injector
4. Controlled Engine Fuel Pumps
5. Load Balance Valve
6. 1/4 Inch Line From Master Fuel Pump Shutoff Valve To The Controlled Engine Load Balance Valve
7. Fuel Pump Suction

**Notes:**

1. The fuel pressure on the controlled engines is to be set 5 psi higher than the fuel pressure of the master engine. The controlled engine torque curve will follow the master engine.
2. The governors on the controlled engines are to be set 25 rpm higher than the governor on the master engine.

Fig. 9-3, (F5162). Multiple engine installation with the load balance valve on the PT (type G) fuel pump.

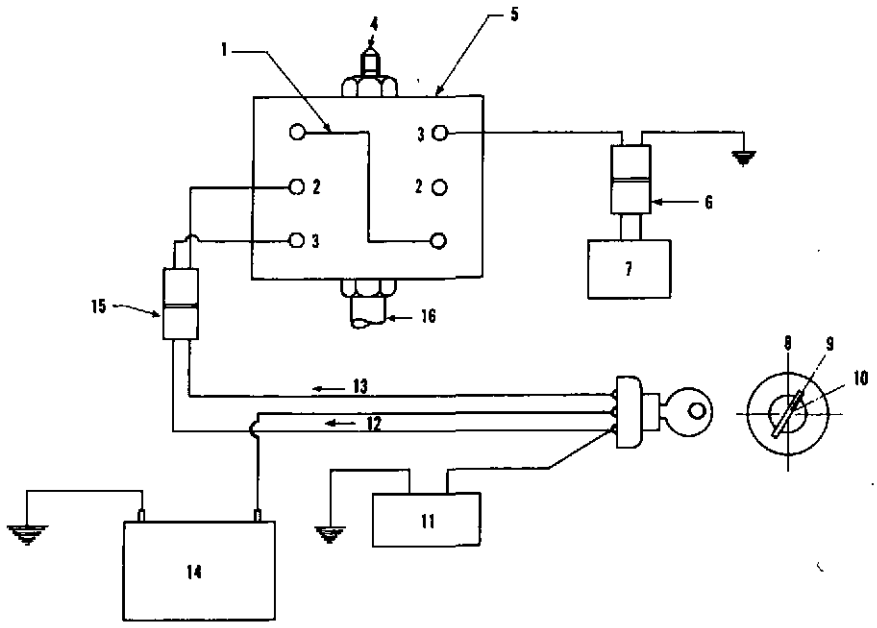



**Notes:**

1. The connectors shown are to be the double offset contact pin type such that polarity cannot be reversed.
2. The progressive two circuit toggle switch can be as manufactured by Carling, their type 6GG58 & purchased from Allied Corp., 100 N. Western Ave., Chicago, Ill. — Their Stock No. 34B394. The switch is to have a spring return from start to run.

1. "Common" Terminals Connected
2. Normally Opened
3. Normally Closed
4. Oil
5. Fulton Sylphon Control, Cummins Part No. 43730
6. Connector Optional
7. Solenoid Valve
8. Start
9. Run
10. Off
11. Toggle Switch
12. Start Circuit
13. Run Circuit
14. Battery Volts — D.C.
15. Connector Optional
16. Water

Fig. 9-4, (F582). Wiring diagram of electric shutoff valve with air starting system.




**Notes:**

1. The connectors shown are to be the double offset contact pin type such that polarity cannot be reversed.
2. The progressive two circuit key switch must have a spring return from start to run.
3. The starter solenoid must be same voltage as solenoid shutoff valve starter solenoid. These valves must both be energized at same time.

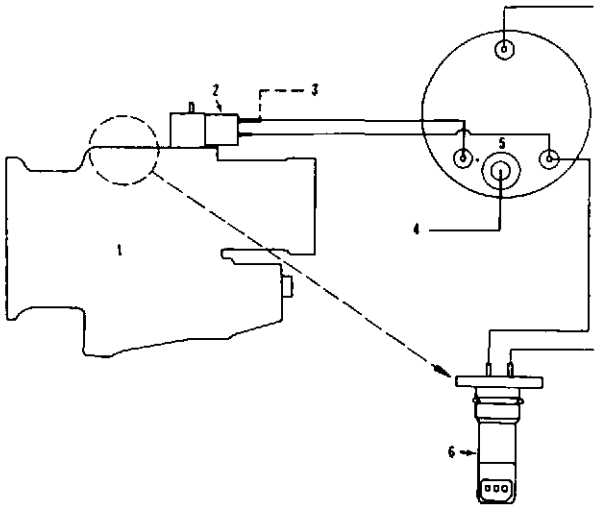
1. "Common" Terminals Connected
2. Normally Opened
3. Normally Closed
4. Oil
5. Fulton Sylphon Control, Cummins Part No. 43730
6. Connector Optional
7. Solenoid Valve
8. Off
9. Run
10. Start
11. Starter Solenoid
12. Start Circuit
13. Run Circuit
14. Battery Volts — D.C.
15. Connector Optional
16. Water

Fig. 9-5, (F583). Wiring diagram of electric shut-off valve with electric starting system.

5. Adjust the throttle linkage so that the controlled engines have a normal idle and engine deceleration. If the master and controlled engine throttles are mechanically connected, the controlled engine must be set equal to or a little before the master engine. When the throttles are not connected, the controlled engine throttle must be at full open position except during idle.

**Adjustment of the Load Balance Valve PT (type G)**

1. After installing the valve, turn the adjustment screw "In" to block open the valve plunger.
2. Set the controlled governed speed of the engine 25 rpm higher than the governed speed of the master engine.
3. Set the manifold fuel pressure on the controlled engines to 5 psi [34 kPa] higher than on the master engine. The controlled engine torque curve will follow the master engine.
4. Disconnect the pressure line from the master engine (master engine not running).
5. Start the controlled engine and hold the throttle in the closed position. Turn out the load balance valve adjustment screw until the engine speed drops below the idle setting of the fuel pump. Turn the screw "In" until the

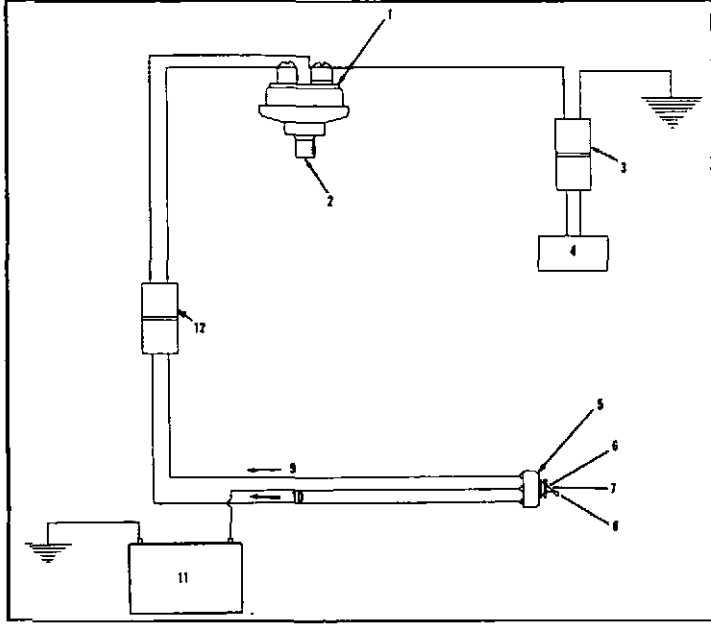



1. PT Fuel Pump
2. 12 Volt Shutoff Solenoid
3. Ignition Switch
4. Light Switch
5. 12 V
6. Insert Part No. 210808

**Note:**

The insert is not dependent on polarity. The leads can be attached to either connection.

Fig. 9-7, (F5255). Wiring diagram of the electronic tachometer.




**Notes:**

1. The connectors shown are to be the double offset contact pin type such that polarity cannot be reversed.
2. The progressive two circuit toggle switch can be Part No. 102057. The switch is to have a spring return from start to run.

1. Pressure Operated Switch No. 67864
2. Engine Oil Pressure
3. Connector Optional
4. Solenoid Valve
5. Toggle Switch
6. Start
7. Run
8. Off
9. Run Circuit
10. Start Circuit
11. Battery
12. Connector Optional

Fig. 9-6, (F584). Wiring diagram of electric shutoff valve with oil pressure safety switch.

engine speed increases to the original idle setting. Tighten the locknut.

6. Connect the line from the master engine.
7. To run the controlled engine alone, turn in the load-balance valve adjustment screw. The plunger will hit the cap on the opposite end.

## Woodward Governor

Woodward governors are on generator sets and other engines that must keep an even speed with changing oads.

The manufacturer has books for the specific governor being rebuilt. Consult the manufacturer for the latest information.

A small adjustment to the throttle movement will cause a large change to the rpm on engines that use a hydraulic governor. Do not change the setting of the idle stop screw. Use Tool No. 3375855 or a protractor to set the idle position of the fuel pump lever, Fig. 9-8.

### Governor Linkage Adjustment — SG and PSG Governor

1. Turn the Part No. 3003310 Lever of the fuel

Fig. 9-8. Tool No. 3375355 Fuel Pump Throttle Adjustment Template.

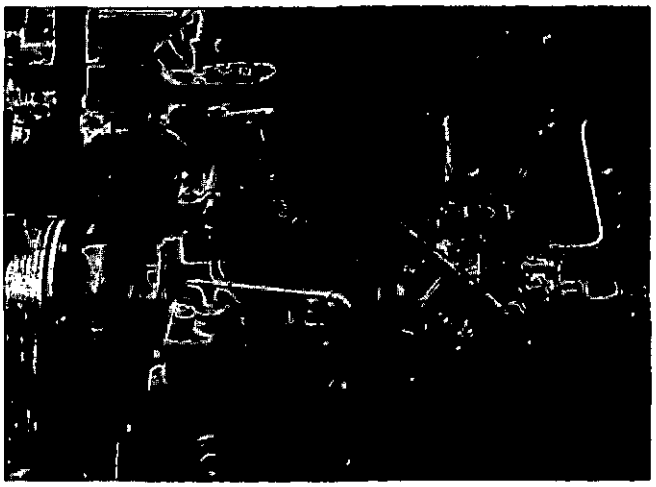
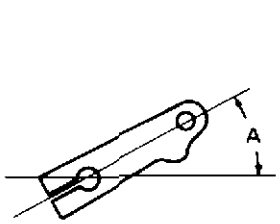
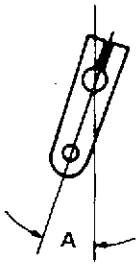


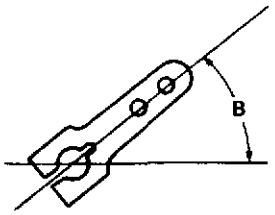
Fig. 9-10, (F5387). Completed linkage installation on a PSG governor.




Governor Lever; SG, PSG (3003308)




Governor Lever; EG3P, EGB2P (3003309)




Fuel Pump Lever (3003310)

| | SG | PSG | EG3P | EGB2P |
|---|---|---|---|---|
| Governor Lever Angle, Min. Fuel Position (A) | 15 | 10 | 28 | 9 |
| Fuel Pump Lever Angle, Min. Fuel Position (B) | 35 | 45 | 45 | 45 |
| Distance Between Swivel Centers, Inch [cm] | 11 - 5/8 [29.53] | 11 - 7/16 [29.05] | 13 - 1/4 [33.65] | 11 - 1/2 [29.21] |

**Notes:**

1. Use a 1/8 inch [3.17 mm] thick spacer of minimum outside diameter (114850) between the fuel pump lever and its swivel.
2. When all adjustments are made, check to make sure the swivels move freely.

Fig. 9-9, (F5388). Woodward Governor linkage adjustments.

pump against the idle stop to the angle in Fig. 9-9. Tighten the capscrew.

2. Set the linkage swivels so that their centerline dimensions are like Fig. 9-9.
3. Install the Part No. 3003308 Lever on the governor shaft. Do not tighten the lock screw.
4. Attach one swivel to the lever hole the farthest from the fuel pump shaft. Use the Part No. 114850 Spacer between the swivel and the lever. Remove the two 5/16 inch flat washer and one 1 × 5/16 capscrew and add one 1-1/4 × 5/16 capscrew.
5. Turn the governor shaft to the full clockwise position. Hold the lever and linkage against the idle stop of the fuel pump. This puts the governor lever at the correct angle, Fig. 9-9.
6. Tighten the lock screw of the governor lever.
7. The swivel lock nuts are not tight. Turn the threaded rod just enough to raise the governor lever off its stop. The fuel pump lever must be against its stop.
8. Tighten the swivel lock nuts while holding the swivel yokes as far in the direction of the lock nut rotation as the clearances will permit. This will make the swivel yokes almost parallel and have free operation of the linkage.
9. Check the linkage for full free movement and install the outside idle spring, Fig. 9-10.

**Note:** Do not use the outside idle spring when the PSG Governor is equipped with an outside droop adjustment. This governor has an inside idle spring.

**EG-3P Actuator**

1. Turn the Part No. 3003310 fuel pump lever against the idle stop to the angle in Fig. 9-9 and Fig. 9-13. Tighten the lever capscrew.
2. Set the linkage swivels so that their centerline dimensions are like Fig. 9-9.
3. Mount the Part No. 3003309 Lever to the governor shaft but do not tighten the lock screw.
4. Attach one swivel to the lever hole the farthest from the fuel pump. Use the 114850 Spacer between the swivel and the lever. Remove the two flat washers and one 1 × 5/16 capscrew and add one 1 · 1/4 × 5/16 capscrew.
5. Mount the actuator so that the electrical connector points toward the fuel pump. Attach the 3003309 Lever toward the front and below the horizontal, Fig. 9-11.
6. Turn the governor shaft to the full counterclockwise position. Hold the lever and linkage against the idle stop of the fuel pump. This places the governor lever at the correct angle, Fig. 9-9.
7. Tighten the lock screw of the governor lever.
8. The swivel lock nuts are not tight. Turn the threaded rod just enough to raise the governor lever off its stop. The fuel pump lever must be against its stop.

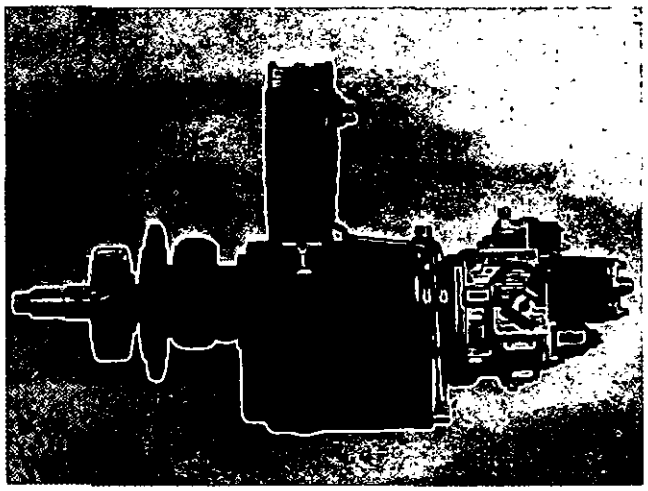


Fig. 9-11, (F5389). EG-3P Actuator (installed).

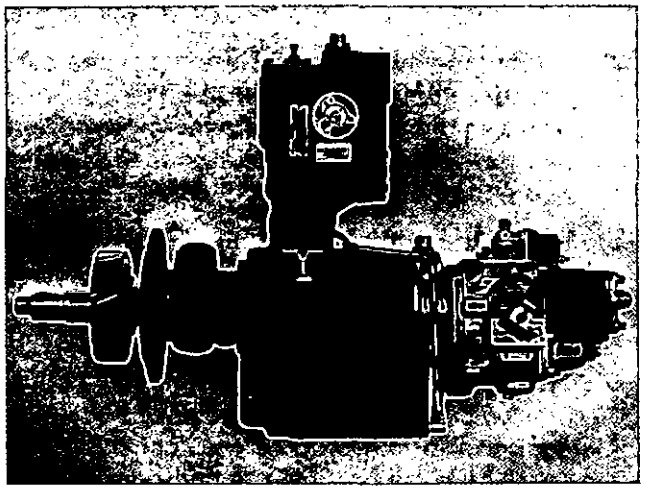


Fig. 9-12, (F5390). EG-B2P Actuator (installed).

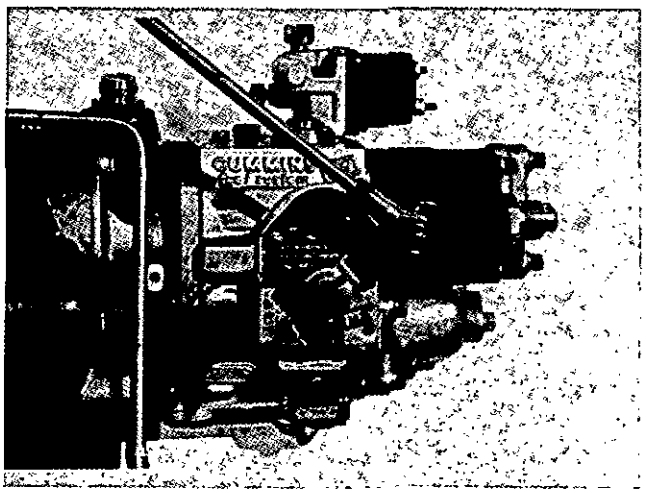


Fig. 9-13, (F5391). Throttle lever is set at 45 degrees at the idle speed.

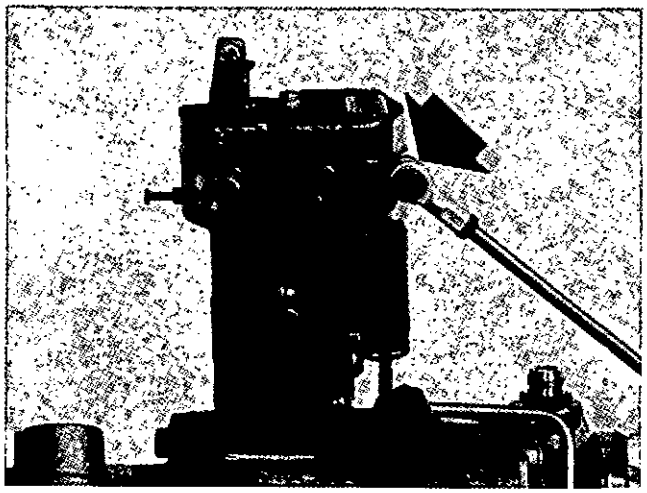


Fig. 9-14, (F5392). Governor lever is set at 10 degrees with the throttle lever set at 45 degrees.

9. Tighten the swivel lock nuts while holding the swivel yokes as far in the direction of the lock nut rotation as the clearances will permit. This will make the swivel yokes almost parallel and have free operation of the linkage.
10. Check the linkage for full free movement.

**Note:** Do not use an outside idle spring.

### EG-B2P Actuator

1. Turn the Part No. 3003310 fuel pump lever against the idle stop to the angle in Fig. 9-9 and Fig. 9-13. Tighten the lever capscrew.
2. Set the linkage swivels so that their centerline dimensions are like Fig. 9-9.
3. Mount the Part No. 3003309 Lever to the governor shaft but do not tighten the lock screw.
4. Attach one swivel to the lever hole nearest to the fuel pump shaft. Use the 114850 Spacer between the swivel and the lever. Remove the two flat washers and one 1 × 5/16 capscrew and add one 1 - 1/4 × 5/16 capscrew.
5. Install the actuator so that the nameplate is toward the fuel pump. Attach the 3003309 Lever toward the front and below the horizontal, Fig. 9-12.
6. Turn the governor shaft to the full counterclockwise position. Hold the lever and linkage against the idle stop of the fuel pump. This puts the governor lever at the correct angle, Fig. 9-9.

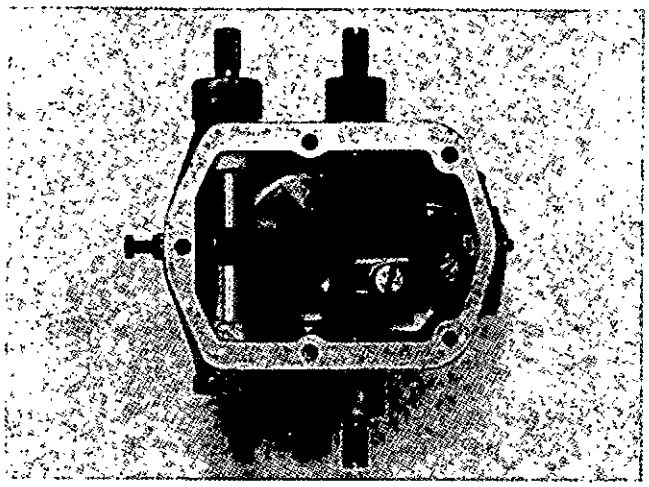


Fig. 9-15, (NG33). The inside adjustment screw for the speed droop.

7. Tighten the lock screw of the governor lever.
8. The swivel lock nuts are not tight. Turn the threaded rod just enough to raise the governor lever off its stop. The fuel pump lever must be against its stop.
9. Tighten the swivel lock nuts while holding the swivel yokes as far in the direction of the lock nut rotation as the clearances will permit. This will make the swivel yokes almost parallel and have free operation of the linkage.
10. Check the linkage for full free movement.

**Note:** Do not use an outside idle spring.

**Caution: *Make sure the linkage and levers move freely.***

**Note:** For the PT Fuel Pump calibration and speed setting, see the Fuel Pump Manual, Bulletin No. 3379182, 3379068, 3379077 or 983533 for the PT (type G) fuel pumps.

11. Start the engine and adjust the low speed stop screw for the desired idling speed.

### Speed Droop Adjustment

1. Remove the top cover from the governor to see the speed droop mechanism and adjustments, Fig. 9-15.
2. The speed droop bracket is held to the terminal lever by the slotted setscrew. When loosened, it can be moved to the front or the rear. When you move the bracket to the rear it will make more of a speed droop.
3. This lever movement for the speed droop will make a speed setting, which is a function of the terminal shaft position, with the speed decreasing as the fuel flow increases. **This is speed droop.**
4. Speed droop is increased by moving the bracket to the rear. Speed droop is decreased to approximately zero when the pivot pin is all the way forward. Since there is no calibration for the droop adjustment, the zero droop position can be set only by trying several settings on the engine. You can use a dial indicator on the speed droop lever during the manual rotation of the terminal shaft.
5. Speed droop is required when using the SG Woodward Governors. It must be set by operation on the engine. The speed droop bracket is adjusted to get the correct speed droop between full load and no load.

## Other Governors Used on Cummins Engines

American Bosch and Barber Colman governors are used on Cummins Engines. Consult the manufacturers publications for the adjustment of these governors.

## Pierce Governor

### Operation

The shaft, to which the terminal lever, yoke and spring retaining arm are fastened, is a pivot point. Around this pivot point is a clockwise (as seen from the spring end) movement of the weights on the yoke. This pivot point also has a counterclockwise (also seen from the spring end) movement of the spring tension on the arm equal in length to a vertical line from the center of the shaft (pivot point) to the line of action of the spring tension. The linkage to the fuel pump is made so that the clockwise (weight) action makes the fuel decrease. The counterclockwise (spring) action increases fuel. When the engine is at idle, the spring force holds the throttle wide open. When the engine is running the system is in balance and the two movements are equal. Fig. 9-16.


Fig. 9-16, (F5185). Pierce governor adjustments.

A decrease in speed, because of an added load, results in a decrease of the clockwise (weight) movement. The counterclockwise (spring) movement then opens the throttle until it (the counterclockwise movement) again balances the clockwise (weight) movement. As the throttle opens, the spring starts to come together. The spring movement is decreased until a balance is reached.

An increae in speed because of a decrease in the load gives an increase of the clockwise (weight) movement which closes the throttle. When the throttle is closed, the spring tension is increased.

The two movements will again balance when the tension is equal.

The droop is adjustable by changing the length of the movement arm through the spring tension action. When the movement of the arm is short, a great spring expansion will be required before the counterclockwise (spring) movement increases to the new equal value. With a longer movement arm, a smaller expansion of the spring will be required to make them equal. If the spring expansion is large, throttle travel will also be large. Large throttle travel, per speed change, means less droop. Small throttle travel, per speed change, means more droop. A short movement arm will give low droop, and a long movement arm will result in a large amount of droop.

### Installation and Adjustment

The linkage must move freely. A ball end on the control rod must be in use. The control rod must be loose when the ball ends are tightened.

The angle of the levers is also important. One end of the control rod is fastened to the throttle lever, and the other end to the Pierce governor terminal lever. The throttle lever must be at a 90° angle to the control rod when the unit is running at no-load. This will increase the no-load stability.

The length of the control rod can be changed to make the angle position of the throttle lever correct with the throttle shaft. In making the length adjustment, make sure the engine will be at full throttle when the governor terminal lever is at the "full throttle" position. This can be done by fastening the rod to the throttle lever. Hold the lever at full throttle, then adjust the length to the point that the terminal lever must be changed a little off of its "full throttle" position to install the capscrew which fastens the control rod to the terminal lever. The control rod will then be under a little tension.

The throttle lever length, or distance from the center of the throttle shaft to the hole in the throttle lever, is also important. A very short radius will decrease the droop and will not permit the correct high governed speed. A longer radius wil increase the droop, but will not permit the correct low governed speed (not enough travel).

For the best performance, the full range of the terminal lever travel of the governor must be in use. Many changes must be tried to find the best throttle lever radius. Change the radius 1/8 inch [3.17 mm] at a time.

### Lubrication

The governor is lubricated by converter pressure from the line to the pressure gauge. The oil goes in the top of the governor. An orifice is required to control the flow to the governor. The oil then drains through the governor and flows back into the converter.

### Speed Adjustment

There are two adjustment screws at the back of the governor which are in use to set the speed(s), Fig. 9-16. Tightening the lower screw increases the spring tension, and makes the same increase in speed. For a dual speed setting, the upper screw is in use to set the higher speed. For the single speed settings, turn out the upper screw completely. For example, if a tailshaft speed of 1200 rpm is needed, this setting would be done with the lower screw and then the upper screw will be tightened also. If a dual setting is required, at 1200 and 1800, the 1200 rpm setting will be made with the lower screw. Then the speed adjustment lever would be held up against the stop (full spring tension) by the upper screw, and the adjustment made on the upper screw until the 1800 rpm setting is reached.

### Droop Adjustment

Adjust the droop with the screw which is attached to the governor spring and the speed adjustment screw. When a no-load speed of 1200 rpm is set, and the droop is to much, reduce it as follows:

1. Tighten the droop screw two or three turns. This will raise the no-load speed since the spring tension is increased.
2. Again set the 1200 rpm no-load, loosen the spring tension with the speed adjustment screw.

These two steps result in the original speed setting of 1200 rpm, but the droop is decreased by the change in the angle of the lever. The movement arm through which the spring tension is applied is shortened.

To increase the droop, turn out the droop screw and the speed will drop. Returning the unit to the

correct speed through the increased tension by the speed adjustment screw makes a longer movement arm and increased droop.

#### Bumper Screw

The small screw, on top of the governor, is the bumper screw. Its only function is to take out the no-load surge. In making the first settings, this screw must be turned out so it does not contact the yoke inside the governor. The no-load speed will not be raised correctly if this is not done. When the load is applied, fuel will not be increased until it is beyond an open space of speed.

After the correct speed and droop settings have been set, run the engine at no-load governed speed. Turn the bumper screw down slowly until contact is felt with the yoke. Do not raise the speed.

#### Governor Spring and Weights

Some times it is not possible to get a speed setting which is low enough with the spring and the weight that is in the governor. This shows that the spring has too much tension. A spring with less tension must be installed. If the speed can not be set high enough, install a spring with more tension.

The correct spring in use changes with the weights in use and the speed setting. The heavy weights require a spring with high tension and the lighter weights require a spring with less tension.

#### Air Actuated VS, SVS and MVS Governors

On engine applications that require an SVS or MVS governor that has a set speed, an air actuated cylinder is available. This air cylinder has a one inch stroke and is mounted to the governor in a position to push on the governor throttle lever. The short throttle lever, Part No. 187126, must be in use with the air cylinder to stop problems with the travel length, RPM range and alignment. An air line, under a minimum of 60 PSI [414 kPa] air pressure, with a 1/8 NPT is required to activate the governor.

The "Bimba" air cylinder is on the PT (type G) VS fuel pumps. Install the air cylinder on the bracket. Tighten the retaining nut to a torque of 15-20 ft. lb. [21-27 N•m].

The air cylinder must be held with a wrench on the opposite end when tightening the retaining nut or installing the fitting into the air cylinder. Air lines to the air cylinder must be supported to keep from damaging the air cylinder.

## Oil Actuated Acceleration Retarder

Some engines in fire pump application use an oil cylinder to slow down the acceleration when the engine is started cold. The oil cylinder is mounted on the MVS governor and connected to the oil galley. The engine will start but the cylinder will not permit high speeds until the engine oil pressure comes up to the set level of the cylinder. This makes sure the engine has lubrication before full power is applied to the engine.

## Hourmeters — Mechanical

Mechanical hourmeters run off of the fuel pump tachometer drive and are revolution counters. To record one hour on an 1800 rpm hourmeter, the engine must run for 108,000 revolutions in one hour (1800 rpm × 60 minutes).

The mechanical hourmeter must be the same as the average engine rpm which the engine will run over a set period of time. Make sure you check the hourmeter drive for full or half engine speed.

If the engine speed is increased or decreased for any long period of time, the engine maintenance schedule must be adjusted.

When an 1800 rpm engine is run at an average speed of 1200 rpm, the mechanical hourmeter will only show 40 minutes for each hour of running (1200 rpm × 60 minutes = 72,000 revolutions).

## Electronic Tachometer

The magnetic insert type of electronic tachometer is in the older types of the fuel pump housing. This insert replaces the tachometer drive that is mechanically gear driven. The insert senses the rotation of the gear teeth of the tachometer drive and sends changing frequency voltage to an electric tachometer which is calibrated to read the engine speed (rpm).

A magnetic insert can also be mounted in the flywheel housing.

A tachograph can not be driven from the fuel pumps that have an electronic insert.

### Installation

1. Install the insert with the O-ring in the groove in the fuel pump housing, Fig. 9-17.

1. Insert, Part No. 210808
2. O-Ring, Part No. 145504
3. Magnetic Pick-Up Points

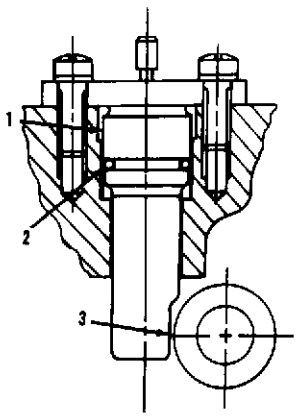



Fig. 9-17, (F5254). Insert assembly mounted in the fuel pump.

2. Install the insert into the housing bore with the sensor points toward the tachometer drive gear (center of pump).
3. Use a socket extension to push the insert into position. This will prevent cutting the O-ring.

**Note:** Do not use a gasket between the insert and the housing.

4. Tighten the insert to the housing. Do not tighten the capscrews too much. Do not use lock-washers. The plastic insert can be damaged.

**Note:** Do not twist the insert during removal. The magnetic sensors can be damaged.

5. The tachometer is made to run on 12 volts. Do not use with a 24 volt system unless a series parallel system is in use to make the voltage 12 volts, Fig. 9-7.

# Calibration Instructions

The purpose of fuel pump testing and calibration is to make adjustments before the pump is installed on the engine. This will make sure the fuel pump performance is within the fuel delivery specifications. The fuel pump delivery can be checked and some adjustments can be made on the engine. The PT (type R) fuel pump calibration is in Bulletin No. 3379101.

The pressures of the fuel in this section refer to the following:

1. The fuel pressure is the pressure in the fuel pump.
2. The calibration pressure is the pressure of the fuel on the fuel pump test stand.
3. The fuel rail (not manifold) pressure is the pressure of the fuel after it leaves the fuel pump and through the engine.

## Service Tools

The following service tools are used to calibrate or check a fuel pump.

**Service Tools (Or Equivalent) Required**

| Tool Number | Tool Name |
|---|---|
| ST-435 | Fuel Pressure Gauge |
| ST-589 | Pressure Regulator Setting Tool |
| ST-844 | Gear Pump Block Plate |
| ST-984 | Idle Adjusting Tool |
| ST-1241 | Plunger Protrusion Checking Tool |
| 3375014 | Fuel Filter Replacement Adapter |
| 3375015 | Fuel Filter Replacement Adapter Gasket |
| 3375137 | AFC Plunger Adjusting Tool |
| 3375140 | AFC No-Air Needle Valve Adjusting Tool |
| 3375187 | Fuel Pump Test Stand Audit Kit |
| 3375204 | Throttle Shaft Ball Installation Tool |
| 3375355 | Throttle Lever Movement Template |
| 3375364 | Test Stand Test Oil — 55 Gallon Drum |
| 3375698 | Fuel Pump Test Stand |
| 3375855 | Throttle Movement Gauge |
| 3375981 | Idle Adjustment Tool |

**Desirable (Or Equivalent) Service Tools**

| Tool Number | Tool Name |
|---|---|
| ST-774 | Hand Tachometer |
| ST-848 | Fuel Pump Test Stand |
| ST-998 | Fuel Flow Sight Glass |
| ST-1111 | Seal Leakage Tester |
| ST-1224 | Overspeed Stop Adjustment Tool |
| 3375362 | Fuel Flow Sight Glass |
| 3375515 | AFC Air Pressure Pump |
| 3375793 | Test Stand Hose Update Kit |
| 3375807 | No. 16 Hose Adapter Assembly |
| 3375808 | No. 16 Fuel Flow Sight Glass |

## Pump Hookup

1. Install the correct drive coupling to the test stand. The drive shaft coupling of the fuel pump and the test stand must be of the same design, Fig. 10-1 and 10-2.
2. Before mounting the fuel pump, check the location of the front cover holes. Change the adapter plate of the test stand, if necessary.
3. Apply SAE-30 oil to the front cover tachometer drive gears to have enough lubrication during the calibration, Fig. 10-3.

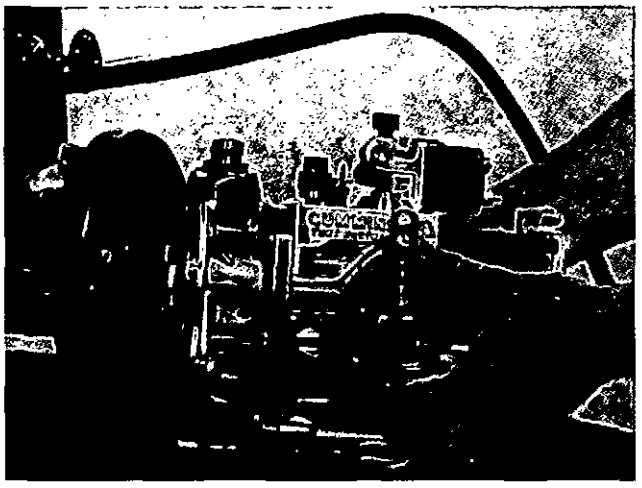


Fig. 10-1, (F5168). Mount the fuel pump with the buffer type drive.

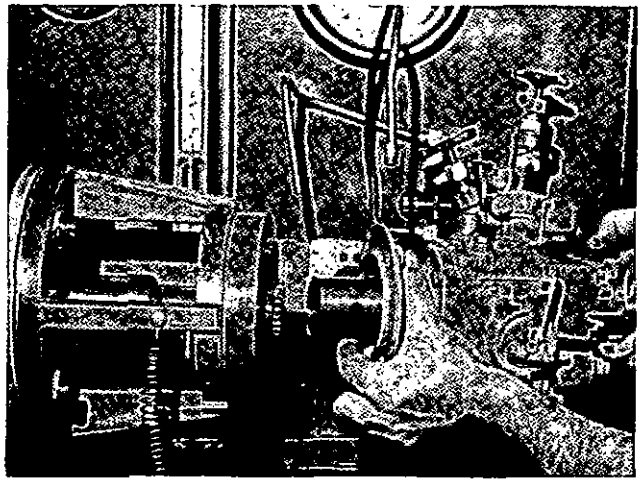


Fig. 10-2, (F5169). Mount the fuel pump with the spline drive.

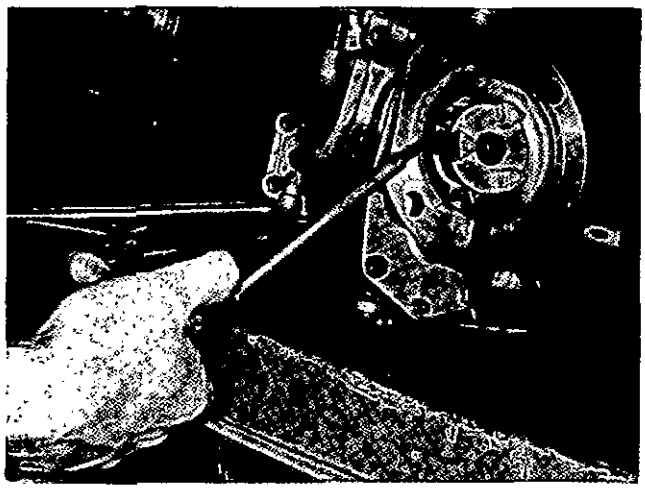


Fig. 10-3, (F5320). Lubricate the tachometer drive gears in the front cover.

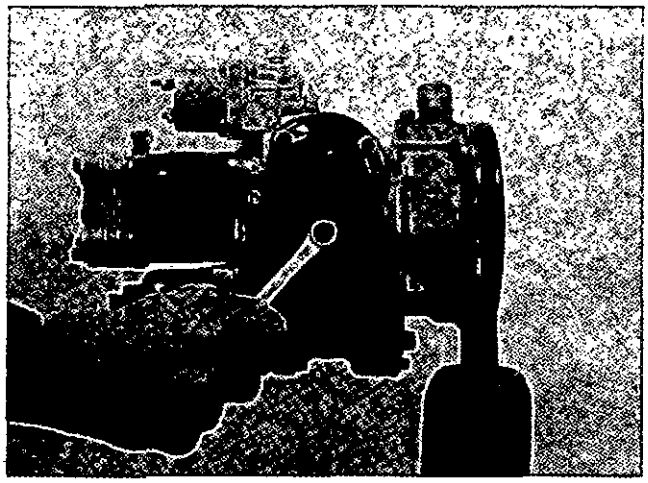


Fig. 10-4, (F5321). Install the Service Tool 3375137 on the AFC fuel pump.

Fig. 10-5, (F5102). Connect the suction line of the gear pump.

**Note:** Lubrication must also be applied to the tachometer gears of the front cover before installing the fuel pump to the engine.

4. If the fuel pump has an Air Fuel Control (AFC), remove the AFC cover plate. Replace it with the plunger adjustment Service Tool No. 3375137, Fig. 10-4.
5. Mount the fuel pump on the test stand mounting plate. Leave 1/16 inch [1.587 mm] between the fuel pump coupling and the drive coupling of the test stand.

**Note:** To get the 1/16 inch clearance, you can adjust the test stand coupling.

6. Put some clean test oil into the inlet hole of the gear pump so the pump suction will start faster. Connect the suction line, Fig. 10-5.
7. Fill the fuel pump housing with clean test fuel through the plug hole on the top of the pump. This can be the fuel inlet fitting on the small vee engine. Install the plug or fitting.
8. Connect the line to the fuel pump shutoff valve. Remove the pipe plug to the rear of the AFC cavity on the VS and PT (type H) pumps. Connect the gear pump pressure line, if required.
9. Connect a 0 to 60 in.-Hg [0 to 1524 mm Hg] or a 30 psi [207 kPa] air pressure line to the air hole of the service tool. This air line must have a regulator. It is used for the AFC plunger adjustment.

10. Set the air pressure to 50 in.-Hg [1270 mm Hg] or 24.5 psi [169 kPa].
11. Install a No. 4 hose to the check valve drain on the gear pump, if used. Drain it into the pan under the pump.

**Caution: Never operate a gear pump that has a cooling kit drain line check valve with a plug in the drain hole. The check valve must be installed when calibrating the fuel pump.**

**Note:** Never remove the fuel pressure damper during testing or on the engine. This will make quick changes in the fuel pump pressure and accelerate wear.

12. Use the digital tachometer that attaches to the drive shaft of the test stand to get most accurate speed readings.
13. The ST-848 Test Stands with the 60-cycle current require only that the reverse or forward start button be pressed for right or left hand pumps, Fig. 10-6.
14. The ST-848 Test Stands with the 50-cycle current require a change in the motor brush location to reverse the motor for left hand fuel pumps, Fig. 10-7. Loosen the cover screws and turn the cover to the correct position.
15. Remove the fuel filter from the fuel pump, if used. Replace it with a fuel filter adapter, Service Tool No. 3375014, and gasket Tool No. 3375015.
16. Make sure the fuel pump screen and magnet are clean.

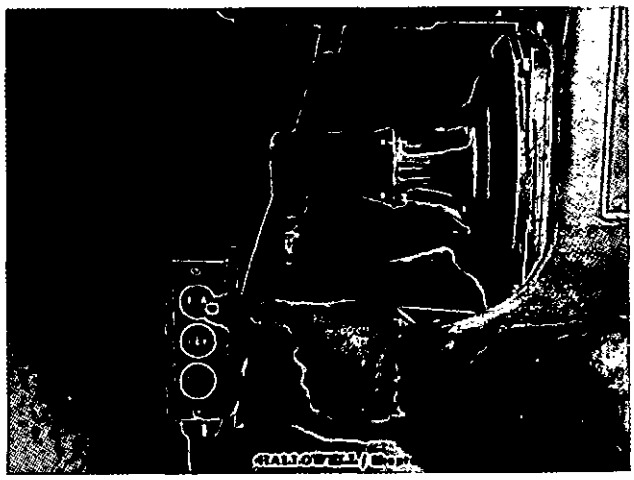


Fig. 10-6, (F5170). Start the 60 cycle motor.

Fig. 10-7, (F5103). 50 cycle motor brush location to reverse motor.

## Check the Pump Name Plate

### Marking Locations Now in Use

Make sure the name plate on the fuel pump correctly describes the fuel pump to be calibrated, Fig. 10-8.

1. The first item in the top line is the Control Part List. **0449.**
2. The next four spaces will be the Base Fuel Pump Code. 0449 **3645.**
3. The next eight spaces will be the serial number of the fuel pump. 0449 3645 **221175 A.** The letter A that follows the serial number is the latest code revision.
4. The first seven spaces on the bottom line will be the Assembly Number of the Fuel Pump. **3015901.**
5. *The next five spaces on the bottom line* give the Shop Order Number of the engine. 3015901 **21365.**
6. On the fuel pumps with a torque modification device, a second nameplate will have the regulator code number and setting in thousandths of an inch.

**Note:** On the fuel pumps that are used with a hydraulic governor, the assembly number will be for the fuel pump only.

7. The last four spaces on the bottom line will be the unit number of the fuel pump. 3015901 21365 **100.**

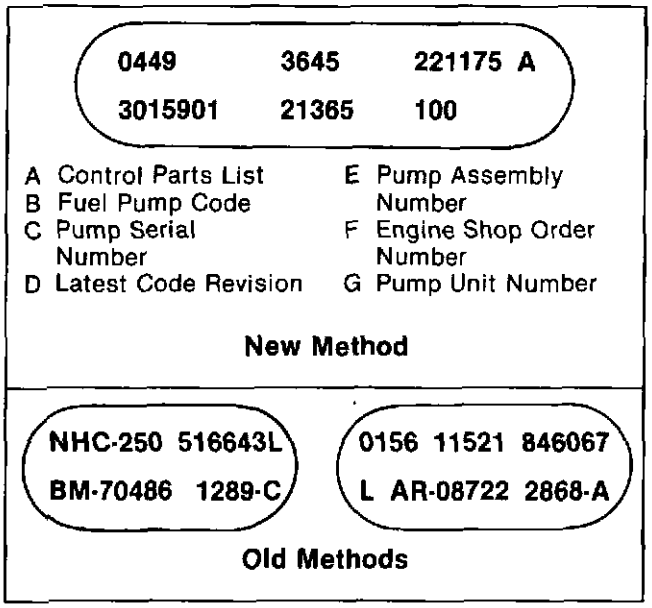



Fig. 10-8. Fuel pump name plate.

8. Check the gear pump for right hand or left hand rotation of the fuel pump. Some V type of engines that are right hand rotation use a fuel pump with a left hand rotation.

### Marking Locations of Old Name Plates

1. The first item on the top line is the Control Parts List. 0156.
2. The next five spaces will be the Shop Order number. 0156-11521.
3. The next six or eight spaces will be the fuel pump Serial No. 0156-11521-846067 or 0101-11521-DP205361.
4. The first space on the bottom line will be an "L" when the pump is left hand rotation.
5. The next seven spaces will be the fuel pump assembly number. 0156-11521-846067 L-AR08722.
6. The last six spaces on the second line will be the calibration code number and suffix letter. 0156-11521-846067 L-AR08722-2868-A.

## Air Signal Attenuator (ASA) Valve

When the ASA valve is in the AFC cover, calibrate the fuel pump without the ASA value and the flow value that is in the cover.

When the hydraulic ASA valve is in the top of the fuel pump housing, fill the valve with test fluid when calibrating the fuel pump. Drain the valve into the test stand splash tray.

### Hydraulic ASA Valve Test

The hydraulic ASA valve is in the top of the fuel pump housing. This valve can be tested. Use the test stand, Part No. 3375698, or install a 500 cc/min., flow meter in the ST-848 test stand to test the valve. The part number of the 500 cc/min. flow meter is 3375904.

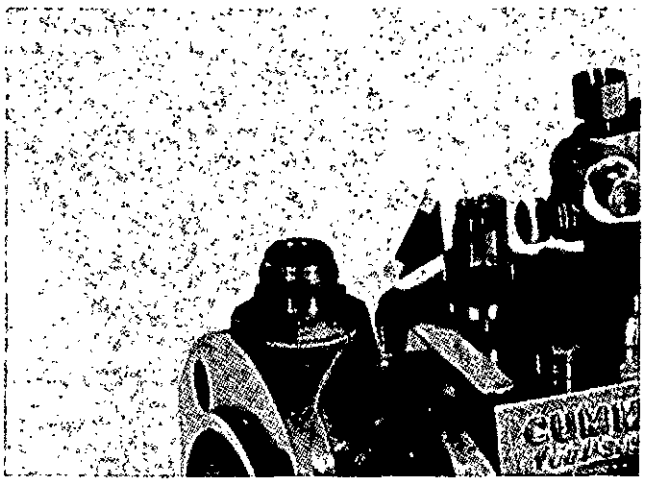


Fig. 10-9, (F5381). Air signal attenuator in the housing.

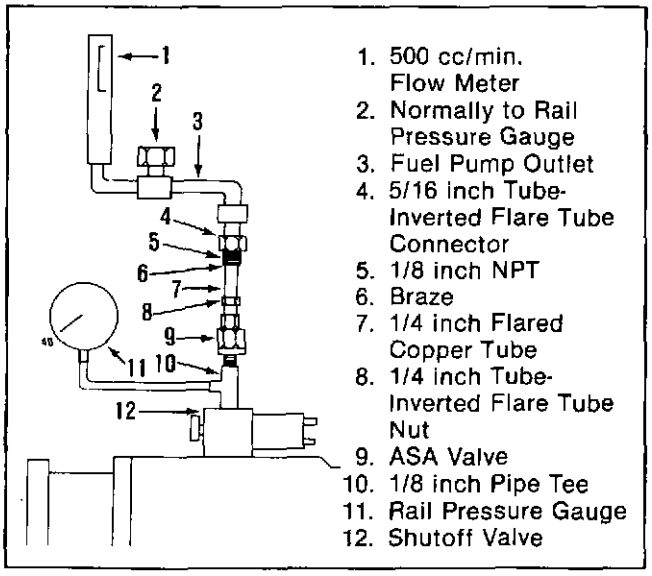



Fig. 10-10, (F5396). ASA valve installed on the fuel pump test stand.

1. Install the ASA valve in the pipe tee in the shutoff valve, Fig. 10-10.
2. Adjust the fuel pump speed to get a 40 psi pressure.
3. Read the flow through the hydraulic ASA valve on the cc/min. flow meter. If the flow is under 400 cc/min., the ASA valve is dirty and must be disassembled and cleaned. If the flow is over 500 cc/min., the orifice, Part No. 177293, in the ASA valve must be changed, Fig. 10-11. Check the flow of the ASA valve again after it is assembled.

**Note:** *If the check ball in the ASA valve is missing,* it will cause a high reading.

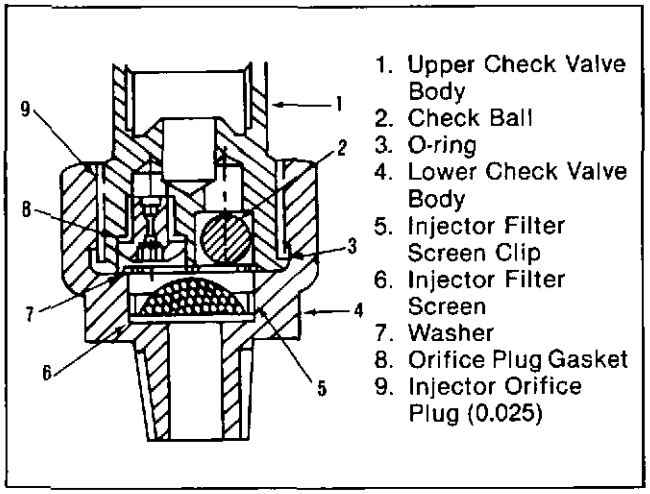



Fig. 10-11, (F5397). Hydraulic ASA parts.

## Torque Limiting Valve (TLV)

To calibrate the fuel pump, energize the coil or remove the plug on the end of the valve. Turn the sleeve down to the bottom. This will hold the armature in the open position.

## Fuel Pump Run In

1. Remove the throttle shaft from the old type of housing. The screw adjustment plunger type of throttle shaft is held in the housing by a retaining ring on the inside end of the shaft.
2. Inspect the restriction plunger to make sure the hole in the throttle shaft is completely open, Figs. 10-12 and 10-13. This is not necessary if the calibration is to be checked as a troubleshooting step. Install the shaft if it was removed.
3. Move and hold the throttle control lever to the full fuel position. Adjust the throttle stop screws to make sure the fuel port in the throttle is fully open. The fuel port must align with the fuel passage in the fuel pump body. It is not necessary to adjust the throttle stop screws if the calibration is to be checked as a troubleshooting step.

**Note:** On the AFC fuel pumps, the front throttle stop screw is for throttle travel adjustments. The rear screw is for throttle leakage adjustments. This is the opposite of the old type of PT (type G) fuel pumps.

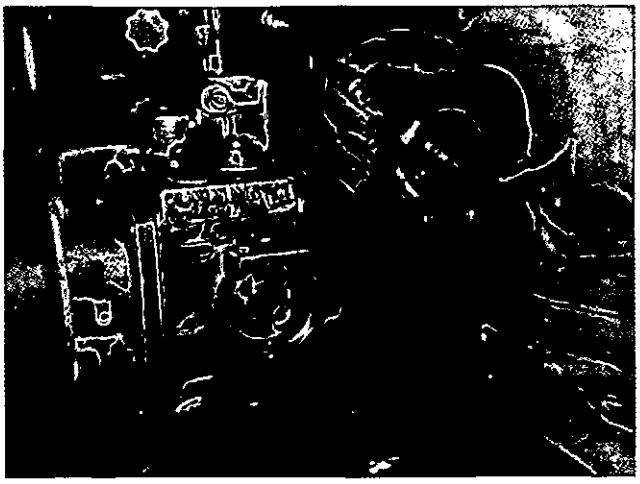


Fig. 10-12, (F5104). Shim the throttle restriction plunger open.

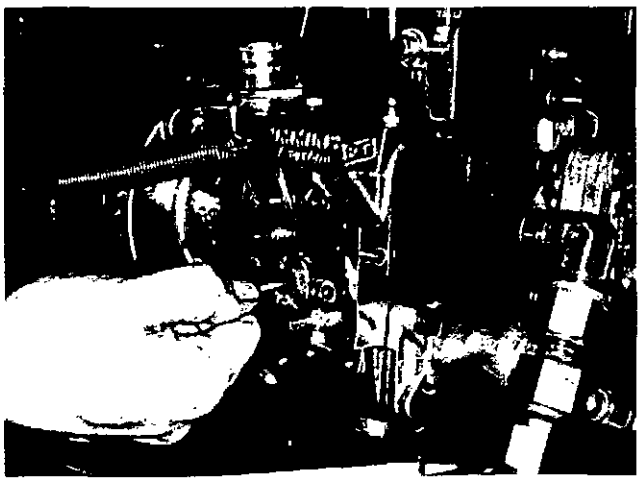


Fig. 10-13, (F5326). Adjust the internal fuel adjustment screw of the throttle shaft.

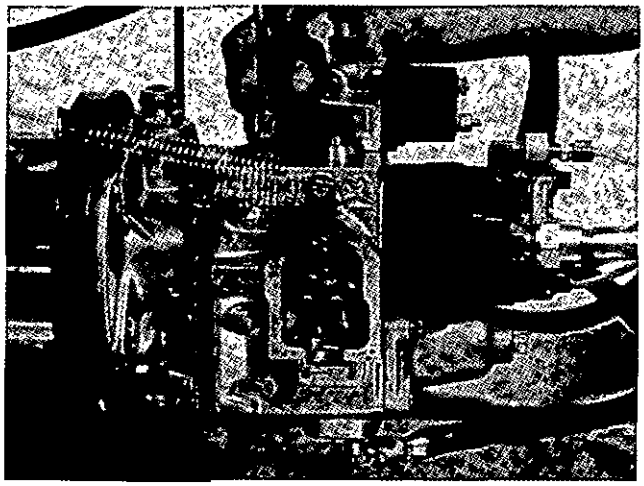


Fig. 10-14, (F5171). Open the shutoff valve.

4. Turn the knob on the shutoff valve of the fuel pump clockwise to make it open, Fig. 10-14.

**Note:** Make sure the shutoff valve is closed after the fuel pump is calibrated.

5. Open the flow control valve of the test stand.
6. Move the throttle lever to the open position. Hold the lever open with a spring.
7. Start the test stand. Run the fuel pump at 500 rpm. Check the gear pump suction.
8. Increase the test stand rpm to 100 rpm under the pump rated speed.
9. If the pump is rebuilt or has been opened, run it for two or three minute to flush it out. This will also remove all of the air from the system.
10. Before starting the calibration, check the pump fuel flow in the flow meter for air. If air is in the system, correct the leak before continuing the test.
11. The test oil for fuel temperature must be 90 to 100° F [32 to 38° C].
12. Set the suction restriction of the fuel pump at 8 inch [21 cm] Hg. vacuum during the run-in period. This setting will help to find the test stand or fuel supply line restriction and air leaks.

## Calibration Codes

The PT (type G) fuel pump calibration codes are in Bulletin Nos., 3379182, 3379068, 3379077 and 983533. These manuals are available from your Cummins Distributor, if you do calibrations. The distributor can calibrate your fuel pumps.

## When Using the Calibration Tables, Check the Following:

1. Look at all of the lines of each pump calibration to get all of the values necessary.
2. The A or B etc., following the code number, is a small change made from the original release. This can be applied to all of the pumps with the same code number. When a large change is made, a new code is made.
3. At the check points, always set the rpm before adjusting the flow.
4. The part number of the governor plunger is a reference number to a series of plungers. The standard and oversize plungers are in Tables 2-1.
5. The fuel pump rpm for the V-555 engines will be slower than the engine rpm because the gears to the fuel pump rotate about 78% of the engine rpm.
   a. The exception to this is a V-555 engine with a V-504 rear gear arrangement.
6. The fuel pump code numbers that begin with B, C, E, etc. are made at the following locations:

| | |
|---|---|
| B Daventry | K Kirloskar |
| C Darlington | S Shotts |
| E Charleston | V Cummins Industrial Center |
| F Brazil | |
| G Germany | X Jamestown |

7. When ordering a fuel pump from the calibration tables, order the last letter change for that calibration. If a "dash A" is ordered and the calibration revision is a "dash B" or "C", the last revision will be sent from Cummins. An order for a fuel pump must have an assembly number and a fuel pump code number.
8. The fuel pump code CPL number must match the engine control parts list (CPL). This will assure that you are within the EPA, CARB or other certified configurations. Engine parts will not be in the fuel pump calibrations.

**Note:** Some engine applications require the check valves in the fuel lines. The engine rail pressure must be checked after the check valve.

9. *Fuel pump codes with the letter "B or C"*, following the engine speed, have a torque peak rating higher or lower than the standard. See the engine performance curve for the engine model. This letter is also put on the engine data plate after the engine speed.

## Throttle Leakage and Governor Plunger Change

In 1975 the throttle leakage was increased from 35 cc's to 75 cc's on all of the PT (type G) calibrations except the small "V" engines, locomotive engines and engines using "T" head injectors. The governor plungers were changed from Part No. 169660 (rail dump) to Part No. 182530 (no rail dump). These changes are necessary because of engine 'hesitation" and stalling problems.

Governor plunger Part No. 203350 replaced Part No. 182530 on most of the engines.

In 1980 the throttle leakage was changed from 75 to 110 cc's. This change was on all engines except the small "V", V/VT-903 and all of the generator sets.

## Fuel Pump Certification and Modifications

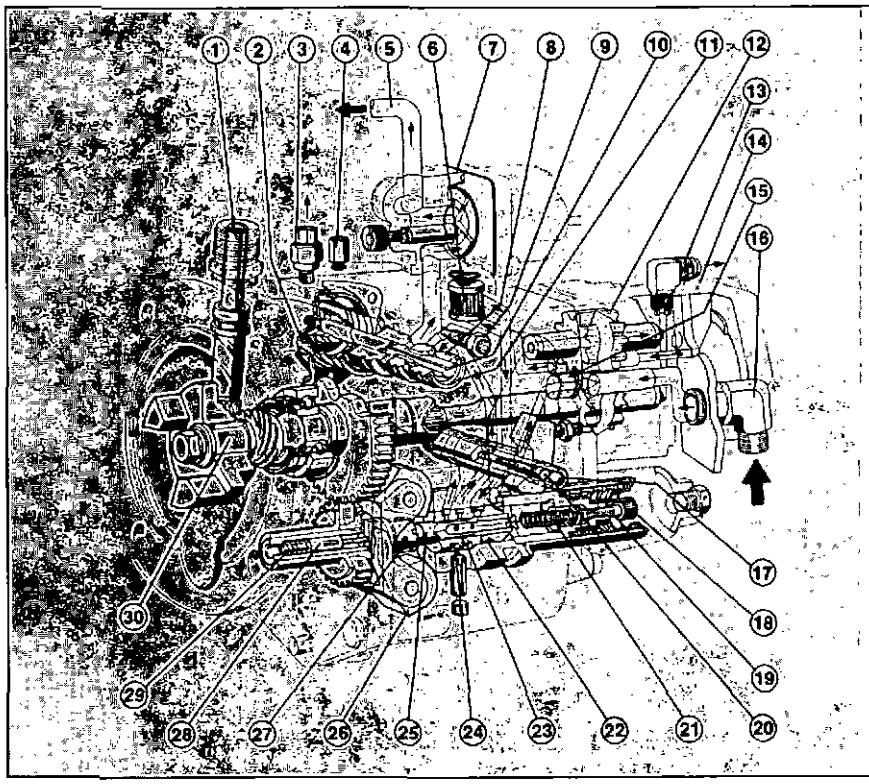
Abbreviations are used in the notes column of the calibration tables to show the calibrations that are emission certified.

Some of the abbreviations are as follows:

| | |
|---|---|
| EPA | U.S.A. Environmental Protection Agency |
| Calif. (CARB) | California Air Resources Board |
| BSAU | British Standards for Automotive |
| Austr. | Australia Certification |
| TUV | German Certification (Technische Uberwachungsverein) |

Modifications of the fuel pump are permitted with limits. The fuel pump assembly is not certified. Fuel pump parts can be changed to compensate for wear or operation conditions. Fuel pump performance is certified within the following limits:

AFC or aneroid setting values.
Fuel rates at rated speed.
Fuel rate at peak torque.



1. Tachometer Drive
2. AFC Piston
3. Hydraulic ASA
4. AFC Valve
5. Fuel to Injectors
6. Filter Screen
7. Shutoff Valve
8. AFC Fuel Barrel
9. AFC Needle Valve
10. AFC Plunger
11. AFC Barrel Spring
12. Gear Pump
13. Check Valve Elbow
14. Pulsation Damper
15. Pressure Regulator Valve
16. Fuel From Filter
17. Throttle Shaft
18. Idle Adjustment Screw
19. High Speed Spring
20. Fuel Adjustment Screw
21. Idle Spring
22. Gear Pump Pressure
23. Fuel Rail Pressure
24. Idle Pressure
25. Governor Plunger
26. Governor Weights
27. Torque Spring
28. *Governor Assist Plunger*
29. Governor Assist Spring
30. Main Shaft

Fig. 10-15, (FWC-37). PT (type G) AFC fuel pump cross-section and fuel flow. Wall Chart No. 3379081.

Idle speed (low).
Governor cut off speed (high idle).

The fuel rate in millimeters cubed per stroke ($mm^3/s$) is used in certification. This value can be in the fuel rate column in parenthesis ( ).

## Calibration Procedure — PT (type G) AFC Standard Governor

### Set the Governor Cut Off Speed

Fuel pump code number 3650 is used for reference purposes.

1. Close the idle orifice and the leakage valves. Open the flow control valve.
2. Increase the pump speed to the engine rated speed.
3. Make sure you have 50 in.-Hg. [1270 mm HG] or 24.5 psi [169 kPa] air pressure to the AFC.
4. Close the flow control valve until the flow meter indicates the flow in the calibration data tables on line 16. For example: 390 for code 3650. There must be no air in the flow meter.
5. Adjust the vacuum valve in the suction line of the fuel pump to get 7 inch [18 cm] Hg. on the vacuum gauge, Fig. 10-16.
6. If you can not get 7 inch [18 cm] Hg. of vacuum, check for restriction in the test stand filter of the fuel supply line.
7. If you can not get and hold the flow value, check the idle plunger (fuel button) and the governor cut off rpm. Replace the idle plunger (button) with a new one as listed in the fuel pump code. Make sure the adapter, Part No. 144676, is in use with the idle plungers code number 170 and over.

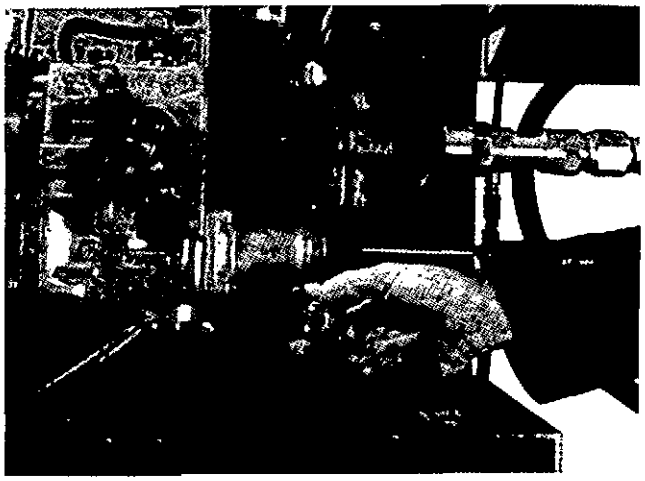


Fig. 10-16, (F5327). Adjust the vacuum valve in the fuel pump suction line.

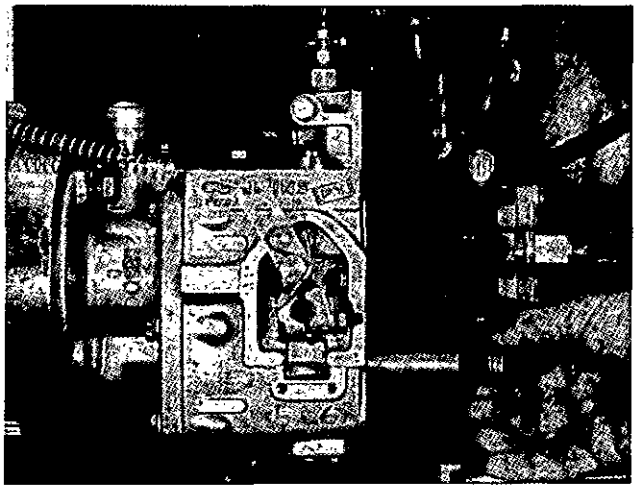


Fig. 10-17, (F5328). Shim the governor spring for high speed.

8. Open the fuel pressure gauge valve. With the throttle in full fuel position, increase the pump speed to the rpm where the fuel pressure decreases 1 psi. This must be at the speed on line 8. For example: 2130/2150 rpm for code 3650.

**Note:** The standard V-555 fuel pumps are tested at 78% of the engine rpm. The fuel pumps on V-555 engines that have a V-504 rear gear arrangement are tested at 100% of the engine rpm.

9. If the speed is lower than the specification, add shims between the governor spring and spring retainer, Fig. 10-17. See Table 18-1 for the spring specifications. To lower the speed, remove the shims. Each 0.001 inch shim thickness will change the speed approximately 2 rpm. Shims are available in 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thickness. If over .150 in [3.81 mm] shims are required, replace the spring.
10. After changing the shims, install the cover. Run the pump and move the throttle lever from the front to the rear several times. This will remove the air in the pump. You can see the air in the flow meter.
11. After the air is removed, set the flow in the flow meter.

### Set the Throttle Leakage — AFC Standard Governor

**Note:** Make sure the fuel is up to 90 to 100° F [32 to 38° C] when setting the throttle leakage.

1. Run the test stand speed up to the pump rated speed.
2. Move the throttle lever toward the gear pump. Hold it tightly against the throttle stop.
3. Open the throttle leakage valve. Close the main flow and idle orifice valves.
4. Check the throttle leakage with the throttle leakage flow meter if the test stand is so equipped. Another method of checking the leakage is with a 200 cc container. Do not run the fuel pump at this setting any longer than necessary. This will keep the fuel temperature within limits.
5. The cc delivery must be the specification of the "Throttle Leakage" on line 10 of the calibration data. If not to specifications, turn the rear throttle stop screw in or out until the cc delivery meets the specifications. Fig. 10-18.
6. Check the leakage with a light and heavy lever load. If the leakage is decreased by the additional pressure in the throttle closed position, set the leakage under these conditions.
7. Tighten the locknut on the screw when the setting is correct. Check the leakage again after tightening the locknut.

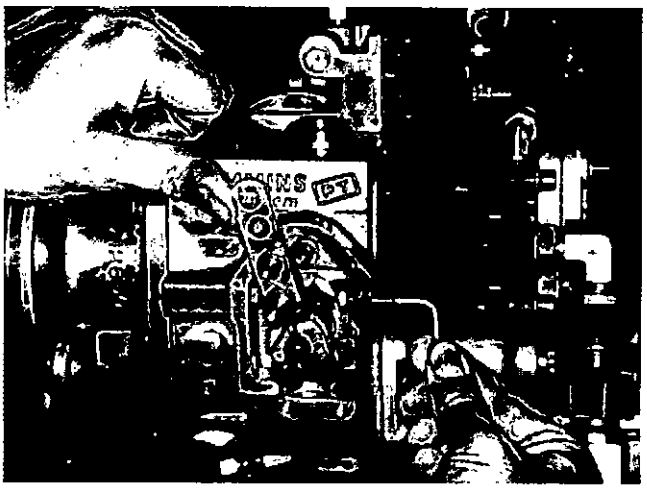


Fig. 10-18, (F5329). Set the throttle leakage.

8. Close the throttle leakage valve.
9. If the test oil temperature exceeds 100° F [38° C], idle the test stand and let the test oil cool. If the temperature exceeds 135° F [57° C], drain and replace the oil with new test oil.

### Set the Idle Speed — AFC Standard Governor

1. Run the test stand at the speed on line 12 or 13 of the calibration data tables.
2. Make sure the control valve for the main flow is closed. Open the idle orifice valve or leakage flow meter, if available. Fig. 10-19.

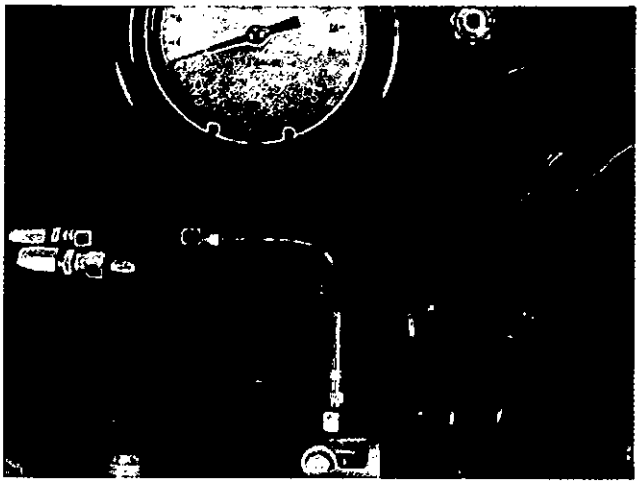


Fig. 10-19, (F5330). Open the idle orifice valve of the test stand.

**Note:** When checking a fuel pump, do not change the idle speed if the engine is idling properly.

3. Set the throttle lever in the idle position (toward the gear pump) and hold it tightly against the stop.
4. Check the cc per minute on the leakage flow meter or the pressure on the fuel pressure gauge. It must be the same as line 12 or 13 of the calibration data table. If the cc or pressure is low, turn the idle adjustment screw in with Tool No. ST-984 or 3375981 Idle Adjustment Tool. This screw is inside the governor spring assembly housing. To lower the pressure turn out the screw. For example: 21 psi @ 500 rpm or 190 cc @ 600 rpm on Pump Code 3650. Fig. 10-20.

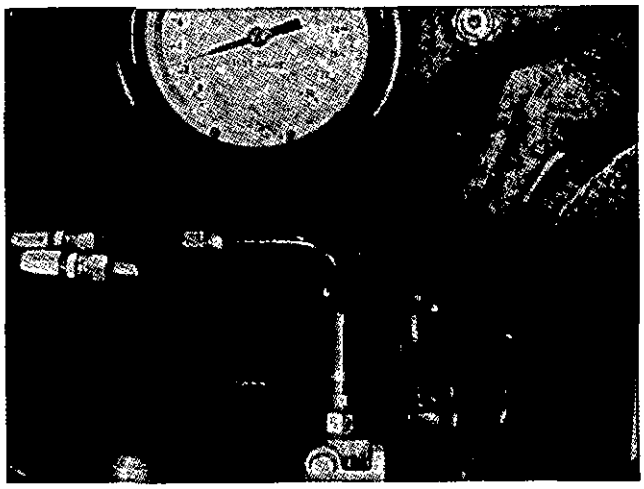


Fig. 10-19, (F5330). Open the idle orifice valve of the test stand.

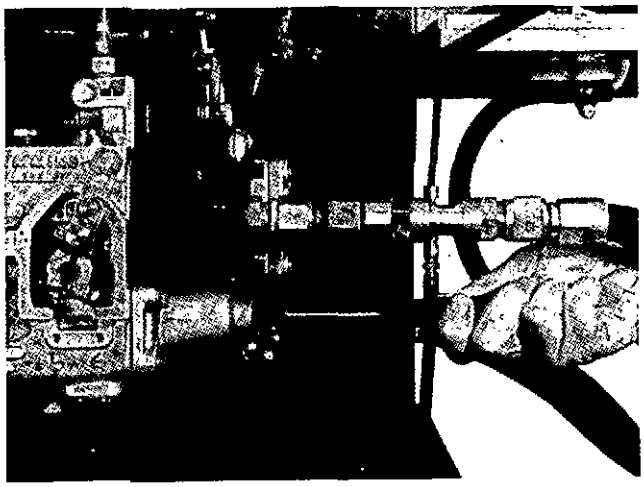


Fig. 10-20, (F5331). Adjust the lower governor idle speed.

5. When you remove the idle adjustment tool, install the pipe plug. Tighten the pipe plug 40 to 50 in. lb. [4.5 to 5.6 N•m] torque.

**Note:** Sometimes when high weight assist settings are in use the screw will hit the bottom of the guide and the pressure will still be low. Add one more spring seat washer on the spring end of the idle screw.

### Adjust the Calibration Pressure and Adjust the Throttle Travel

### AFC Standard Governor

1. Use a throttle lever travel template Service Tool 3375355, or 3375855. Set the throttle lever idle position centerline at 27-29 degrees from the vertical (toward gear pump) throttle shaft centerline. Tighten the throttle lever retaining capscrew and nut, Fig. 10-21.
2. Move the throttle lever to the full open position. It must be on the vertical centerline (the result is a 28 degree idle to full open throttle movement). Tighten the locknut on the screw of the front throttle stop. The lever position can now be changed as needed for the linkage. **Do not adjust the rear throttle screw from the value set under the throttle leakage.**

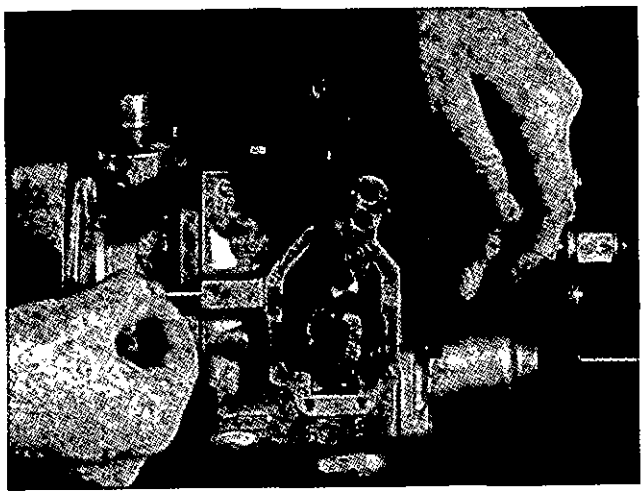


Fig. 10-21, (F5332). Adjust the screw for the front throttle stop to set the throttle travel.

3. Close the idle orifice and leakage flow meter valve. Open the main flow valve. Move the throttle to the full fuel position.
4. Run the test stand speed up to the rated speed of the pump. See line 15 of the calibration data tables. For example: 2100 rpm on Code 3650.
5. Adjust the fuel flow meter to the flow on line 16 of data. Check the fuel pressure on the fuel manifold pressure gauge. Adjust the suction restriction of the fuel pump to the 7-in. Hg or as close as possible.
6. Adjust the fuel calibration pressure to the pressure on line 15 of the calibration data tables. Turn the fuel adjustment screw inside of the throttle shaft to make this adjustment. Fig. 10-22. Check the suction restriction. Make sure it is set at 7-in. Hg.

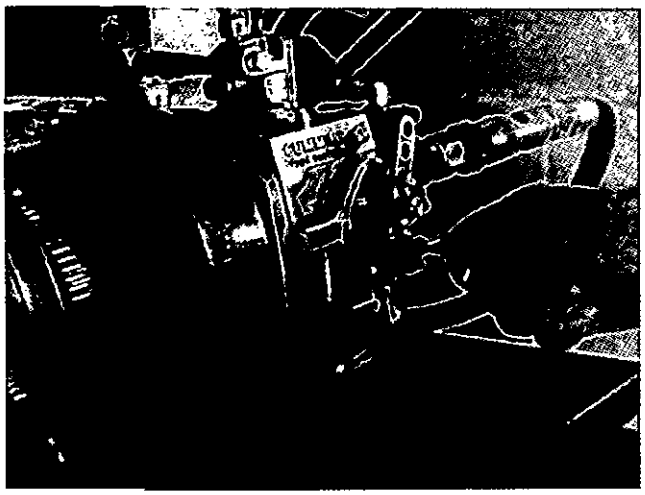


Fig. 10-22, (F5333). Set the calibration pressure with the fuel adjustment screw in the the throttle shaft.

**Note:** When the fuel check valve is in the supply line, the fuel pressure connection must be after the check valve when checked on the engine.

7. If the torque requirement to turn the fuel adjustment screw is less than 1-1/2 in. lb., a new screw must be installed.

**Note:** For a special throttle travel requirement, other than the 28 degree lever travel, use the same procedure except use the degree of travel as required. See line 11 in the calibration data tables for the throttle travel settings.

**Note:** The calibration pressure of a fuel pump that has a Torque Modification Device (TMD) is set differently. The pressure, set with the adjustment screw in the throttle shaft, is set at the torque peak speed. The fuel pressure, at the rated speed, is set at the number one check point. This is changed by adding or removing shims in the TMD at 0.005 inch [0.13 mm] at a time.

### Compare the Check Point Pressure — AFC Standard Governor

1. Lower the speed to the specification on line 17 in the calibration data. (1300 rpm on Code 3650).
2. Adjust the flow meter to the specification on line 18. For example: 320 lb./hr. @ 1300 rpm on Code 3650.
3. Check the pressure on the pressure gauge for the fuel manifold pressure. On line 17 of Code 3650, this is 124 to 130 psi.
4. If the pressure is above or below the specification, check the torque spring on the governor plunger. It can be off its seat, wrong or improperly shimed, or the wrong spring. See the part number on line 28 in the calibration data. If the spring is changed, calibrate the fuel pump again. Check the governor cutoff and the fuel rail pressure. The torque spring shims are available in 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thickness. Install a new spring if the shims exceed 0.060 inch [1.52 mm]. See Table 18-6 for the torque spring specifications.
5. Lower the test stand speed for the low speed *check point. See line 19 and 20 of the calibra*tion data. If it is out of specifications, adjust the flow meter and check the pressure. This is 1000 rpm, 260 flow and 86 to 92 psi for Code 3650. Check the weight assist protrusion (see Step 6 following) on line 21. This is .750 for code 3650.

**Note:** The weight assist protrusion in the tables is a reference point. This can be changed to get the corrected pressure at the lowest rpm check point.

6. If the fuel pressure is low, at the lowest rpm *check point, add shims behind the weight* assist plunger in the governor weight carrier. To lower the pressure, remove the shims. Shims are available 0.007 and 0.015 inch [0.18 and 0.38 mm] thick.

**Note:** The appropriate protrusion of the weight assist plunger can be checked with Tool No. ST-1241 Plunger Protrusion Checking tool.

**Caution: The weight assist plunger must be installed with the smallest end toward the governor weights.**

7. Check governor cutoff, calibrating and check point pressures and flows before proceeding.

### Checking and Setting the Air Fuel Control (AFC)

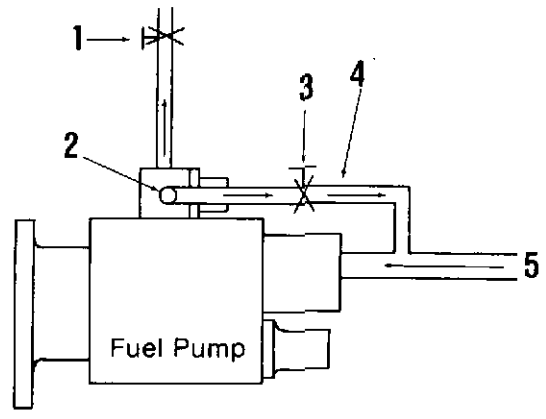
This method checks the fuel pressure delivery of the fuel pump through a restriction set by a needle valve. This restriction is the same as the average engine flow characteristics. This method makes the adjustment of both the no-air and AFC calibration easier, more accurate and faster than before.

### AFC Testing Plumbing Change

A 1/4 inch needle valve and two pieces of No. 4 flexible wire hose are required with the test stand equipment.

1. Install a short No. 4 flexible line into the side of the shutoff valve and into the needle valve. This line must not be over 6 inches, [152 mm] long, Fig. 10-23.
2. The outlet hose from the needle valve can be returned into the fuel pump inlet line or be drained to the test stand tank.

**Note:** This valve must be closed during the calibration of the fuel pump. This valve is only used on the no air and AFC adjustments as described below.




1. Flow Valve in the Test Stand
2. Side Plug in Shutoff Valve
3. Needle Valve (1/4 inch)
4. No. 4 Flexible Hose
5. Fuel Inlet

**Note:** Install the 1/4 inch needle valve as close to the shutoff valve as possible.

Fig. 10-23, (F5398). No air setting and checking plumbing.

### Checking and Adjusting the AFC Plunger Setting

1. Set the test stand speed at the AFC calibrating speed. Line 36 of Code 3650 is 1600 rpm.
2. Move the throttle to the open position.
3. Set the AFC bellows pressure at 50 inch HG (25 psi) [172 kPa].
4. Close the idle and leakage valves of the test stand. Adjust the main flow valve of the test stand and the 1/4 inch needle valve to get the AFC plunger setting flow and pressure values. Code 3650, 62 psi at 200 pph on line 37.

**Note:** Do not change the flow valve setting of the test stand during the remainder of the test.

5. Loosen the locknut and turn the no-air screw all of the way down. Use service tool 3375140.
6. Close the 1/4 inch needle valve completely.
7. Lower the AFC bellows air pressure to 0 in. Hg. Let the fuel pressure and the flow meter go to zero (0). Increase the air pressure to the inches Hg in the calibration data. This is 8 in. Hg for Code 3650.

**Caution: The plunger setting must always be reached while increasing the air pressure on the AFC bellows. If the bellows pressure is adjusted too high, lower the pressure to 0 in. Hg. Wait until the flow goes to or near zero before increasing it to the correct setting.**

8. Use the AFC control plunger tool, 3375137, to loosen the plunger locknut. Turn the plunger in or out to get the fuel pressure specification, ±2 psi [14 kPa]. This is 62 psi for code 3650. Fig. 10-24.

**Note:** The air pressure must be off of the bellows when the AFC plunger is adjusted.

**Caution: The AFC plunger is easy to break when tightening the locknut. Use caution and tighten to 25 to 35 in. lb. [2.8 to 4.0 N•m] torque. The large**

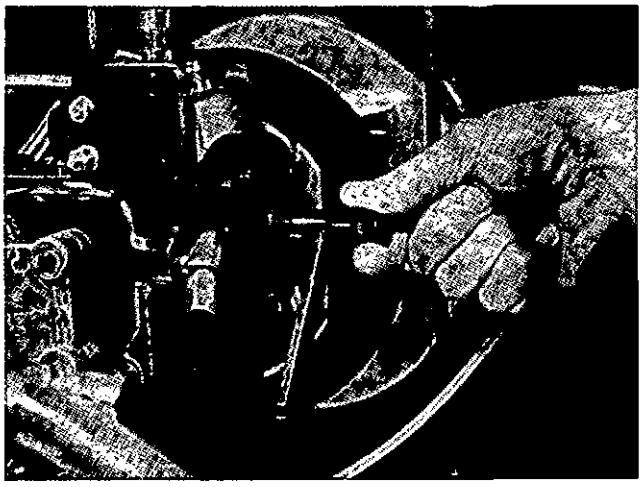


Fig. 10-24, (F5399). Set the AFC plunger position with the service tool 3375137.

**and small hexagon sockets of service tool 3379137 must be fully retracted after the plunger locknut is loose. Failure to do this will cause the wrong pressure reading. If the AFC piston position is changed while adjusting the plunger, repeat the sequence beginning with Step 7.**

9. After the plunger is tightened, check the pressure and flow to make sure they are correct.
10. Lower the air pressure to zero ("0") and remove the adjustment tool.
11. Install the cover plate with standard sloted capscrews at the top and a lockwire type of capscrew in the bottom. Tighten the capscrews to 30 to 35 in. lb. [3.4 to 4.0 N•m] torque.

### Checking a Calibrated Pump

1. Check the AFC pressure. This pressure is correct if it is within ±10 psi [69 kPa] of the original specifications, when checking the pressure. Line 37 of code 3650 is 62 psi. The checking pressure must be within 52 to 72 psi for this code.
2. If the pressure is out of specifications, it must be reset.

### Checking and Adjusting the No Air Setting

1. Set the test stand speed to the no air calibration speed. Code 3650, line 39 is 1600 rpm.
2. Move the throttle lever to the open position.
3. Set the AFC bellows pressure at 50 in. Hg (25 psi) [172 kPa].
4. Adjust the main flow valve of the test stand and the 1/4 inch needle valve. Check the no air flow and pressure values. Line 40 of code 3650 is 65 psi at 215 pph flow.

**Note:** Do not change the flow valve setting of the test stand during the remainder of this test.

5. Close the 1/4 inch needle valve completely.
6. Remove all of the air pressure from the AFC bellows.
7. If the no air pressure is out of the specifications, use the adjustment tool 3375140 to set the needle valve. Line 40 of Code 3650 is 65 psi and 215 pph flow, Fig. 10-25.

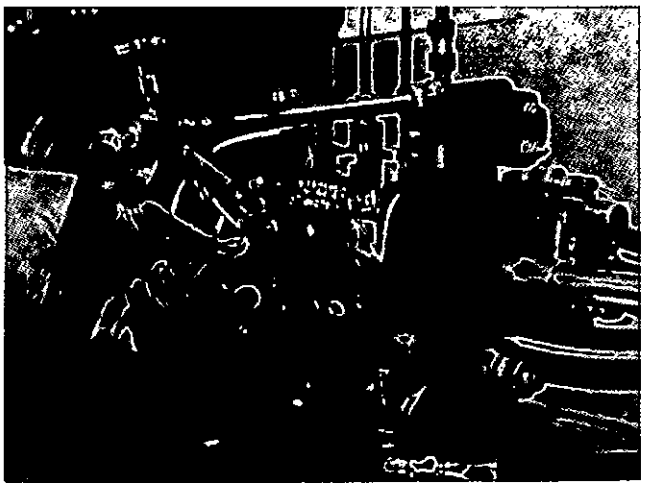


Fig. 10-25, (F5334). Adjust the no air needle valve.

8. Use the adjustment tool to tighten the locknut of the needle valve. Check the setting again.

**Note:** The no air needle valve must be turned down when setting the AFC plunger.

### Checking a Previously Calibrated Fuel Pump

1. Read the rail pressure of the fuel pump. The pressure is correct if it is within the calibration checking specifications.
   a. When checking a fuel pump that has been on an engine, the limits can change ±7 psi.
   b. When checking a fuel pump from one test stand to another test stand, the limits can change ±5% of the specifications.

**Note:** The cover plate for the throttle shaft is not to be installed until after the engine adjustments.

### Check the Pressure Valve in the Gear Pump

1. Run the fuel pump at 600 rpm. Loosen the plug in the rear of the spring pack cover. Fuel will flow out of the plug opening, Fig. 10-26.

**Caution: Do not remove the plug in the spring pack cover when the pump is running above idle speed.**

2. If the pressure valve sticks in the closed position, high pressure will be in the main housing. This high prssure can push out the main shaft seals or make the front cover gasket leak.
   a. The pressure valve can be checked by

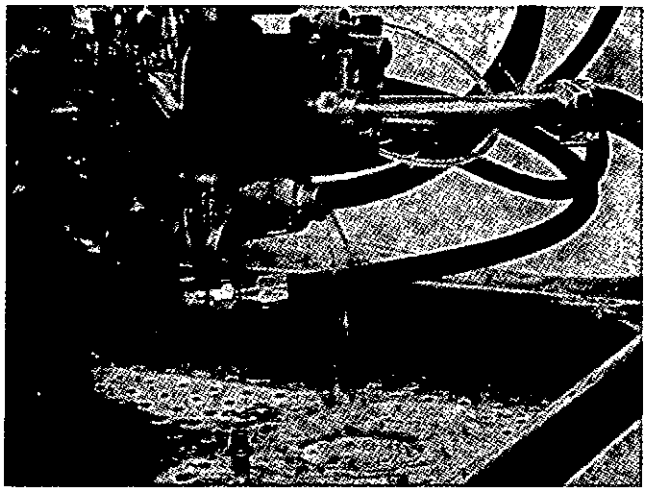


Fig. 10-26, (F5272). Remove the plug in the spring pack cover with the pump at 600 rpm.

installing a pressure gauge in a pipe plug that goes to the large cavity of the main housing.

b. Run the pump at the rated speed. Close the throttle and check the pressure.

c. The pressure inside the housing must not be more than 15 psi [103 kPa].

## Fuel Pumps with PT (type G) AFC-VS (Variable Speed) Governor

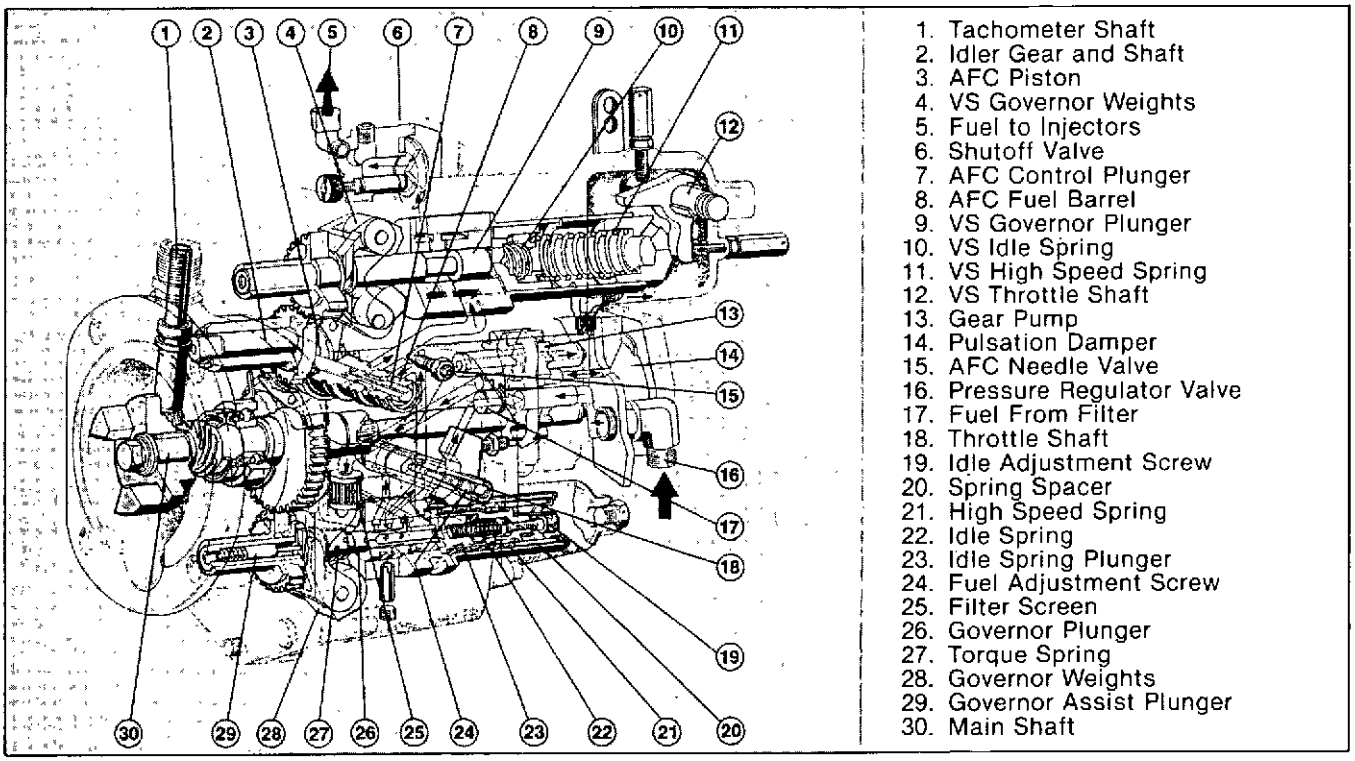
The VS (variable speed) fuel pump can have one or two throttle levers.

1. When the pump has only one lever, it is on the VS governor, Fig. 10-27.
2. The fuel pump calibration is different with one or two levers.
3. The VS governor can also be used with a torque converter governor or a road speed governor.
4. Most of the fuel pump codes for the VS governor are in the 8000 thru 9500 series of numbers.
5. Most of the fuel pump codes for the road speed governors are in the 7900 series of numbers.

**Note:** Fuel pump code 8902 is used for the example of this calibration.

### Calibrating the PT (type G) AFC-VS Fuel Pump

1. Install the fuel line to the shutoff valve of the fuel pump. This line must be attached to the same fuel outlet connection that is in use when the fuel pump is on the engine. A possible flow



1. Tachometer Shaft
2. Idler Gear and Shaft
3. AFC Piston
4. VS Governor Weights
5. Fuel to Injectors
6. Shutoff Valve
7. AFC Control Plunger
8. AFC Fuel Barrel
9. VS Governor Plunger
10. VS Idle Spring
11. VS High Speed Spring
12. VS Throttle Shaft
13. Gear Pump
14. Pulsation Damper
15. AFC Needle Valve
16. Pressure Regulator Valve
17. Fuel From Filter
18. Throttle Shaft
19. Idle Adjustment Screw
20. Spring Spacer
21. High Speed Spring
22. Idle Spring
23. Idle Spring Plunger
24. Fuel Adjustment Screw
25. Filter Screen
26. Governor Plunger
27. Torque Spring
28. Governor Weights
29. Governor Assist Plunger
30. Main Shaft

Fig. 10-27, (FWC-38). PT (type G) fuel pump with Variable Speed Governor and Air Fuel Control.

restriction, through the shutoff valve, can cause a wrong calibration.

2. Adjust the throttle stop screws of the standard automotive governor. The throttle lever must have full movement in both directions. The throttle shaft port must be wide open. Do not tighten the locknuts.
3. Loosen the locknuts of the adjustment screws for the throttle stop in the VS governor.
4. Turn the screws out until the lever moves freely. Tighten the locknuts on the screws.
5. Close the test stand idle and leakage valves. All the valves turn clockwise to close. Open the main flow and the vacuum gauge valves completely.
6. The lower throttle lever of the pump housing turns counterclockwise to open. The VS throttle lever turns clockwise to open. Attach a solid piece of wire to the throttle lever of the VS governor to hold it full open. The throttle lever of the VS governor can not be held open with a weak spring.
7. Increase the pump rpm to the maximum speed. Run the pump until all of the air is out. Look at the flow meter.

**Checking the Pressure Valve in the VS Fuel Pump**

1. Run the test stand at the maximum pump speed.
2. Loosen the adjustment screw locknuts of the top VS throttle shaft, Fig. 10-28.

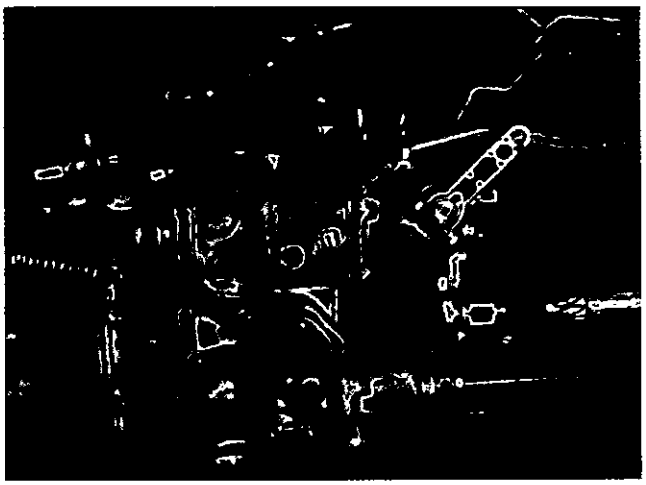


Fig. 10-28, (F5336). Check the pressure valve in the VS housing.

3. If the pressure valve is adding fuel pressure inside the housing, fuel will leak around the screw.
4. The valve can also be checked while running the pump at 600 rpm.
   a. Loosen the plug in the spring pack cover of the lower governor.
   b. Do not remove this plug when the fuel pump is running at rated speed.
5. The fuel pressure inside the housing and spring pack cover changes. It is between 1/2 and 5 psi [3.4 and 34 kPa] from 600 rpm to rated speed.
6. The pressure valve can be tested. Use the same procedure as previously stated in "Check the Pressue Valve in the Gear Pump."

**Set the Governor Cut Off Speed**

**AFC-VS Governor**

1. Close the idle, leakage and pressure valves. Open the flow control valve.
2. Increase the pump speed to the engine rated speed.
3. Make sure you have 50 in. Hg [1270 mm Hg] or 24.5 psi [169 kPa] air pressure to the AFC.
4. Close the flow control valve until the flow meter is the same as line 16 in the calibration data. The flow code 8902 is 410 pph. There must be no air in the flow meter.
5. Adjust the vacuum valve in the suction line of the fuel pump to get 5 inches [12.7 cm] Hg on the vacuum gauge.
6. If you cannot get 5 inches [12.7 cm] Hg of vacuum, check for a restriction in the test stand filter or the fuel supply line.
7. If the flow valve can not be reached and held, check the idle plunger (fuel button) and the governor cut off rpm. Make sure the adapter, Part No. 144676, is in use with the plungers code 170 and over.

**Note:** The lower governor cut off speed is normally set 5% above the VS (upper) cut off speed.

8. Open the gauge valve for the fuel pressure. With the lower throttle lever in the full fuel

position, increase the pump speed until the point at which fuel pressure decreases 1 psi. This must be at the speed on line 8. The lower governor cut off of code 8902 is 2195 to 2215.

9. If the speed is too low, add shims between the governor spring spacer and the retaining ring. Check Table 18-1 for the spring specifications. To reduce the speed, remove the shims. Each 0.001 inch shim thickness will change the speed approximately 2 rpm. Shims are available 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thick, Fig. 10-29.

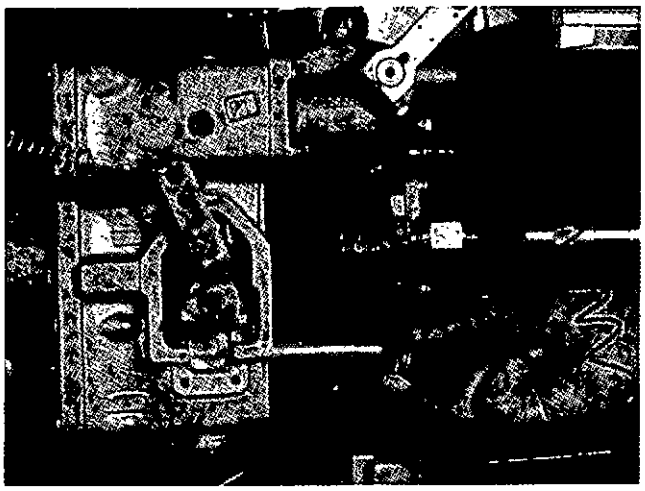


Fig. 10-29, (F5337). Shim the governor spring for high speed.

**Note:** When the spring pack cover is installed, open the flow control valve wide open. Move the throttle lever front and rear with the pump running. The flow meter must not have any air in it. After the air is out, set the flow meter flow.

10. When the pump is running at the rated rpm, turn the VS maximum speed screw (top screw) in until the pressure starts to decrease, Fig. 10-30.
11. Set the VS governor cut off speed as listed in calibration data. The VS governor cut off for code 8902 is 2120 to 2140 rpm.
12. Check by increasing the rpm until the pressure starts to decrease.

**Set the Throttle Leakage — Dual Lever**

**AFC-VS Governor**

Make sure the fuel is up to 90 to 100° F [32 to 38° C]

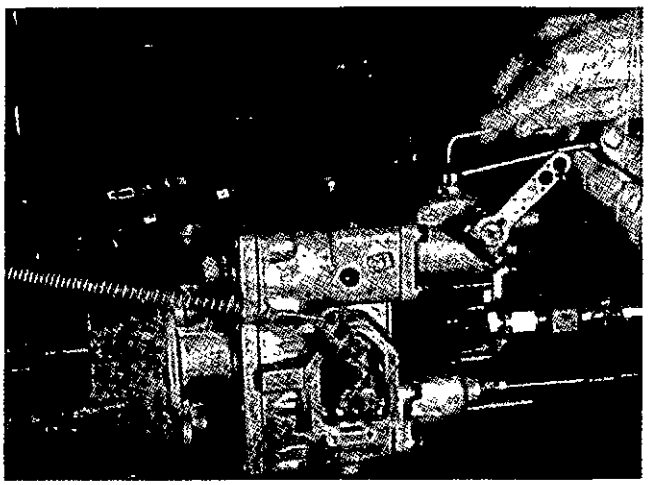


Fig. 10-30, (F5338). Set the VS rated governing speed.

when setting the throttle leakage.

1. Open the throttle leakage valve. Close the main flow and idle valves.
2. Move the lower throttle toward the gear pump and hold it agaist the stop.
3. Run the test stand speed at the pump rated speed.
4. Check the throttle leakage with the throttle leakage flow meter, if the test stand is so equipped. For another method, use a 200 cc container to hold the fuel delivery for one minute. Do not run the test stand at this setting any longer than necessary. This will keep the fuel temperature within the limits.
5. The cc delivery must be the same as the "Throttle Leakage" on line 10 in the calibration data. Turn the rear throttle stop screw in or out until the cc delivery meets the specifications.
6. Check the leakage with a light and heavy lever load. If the leakage is changed by the additional pressure in the throttle closed position, set the leakage under these conditions, Fig. 10-31.
7. Tighten the locknut when the setting is correct and check again.
8. Close the throttle leakage valve.
9. If the test oil temperature exceeds 100° F [38° C] slow the stand down and let the test oil cool. If the temperature exceeds 135° F [57° C], drain and replace the test oil with new test oil.

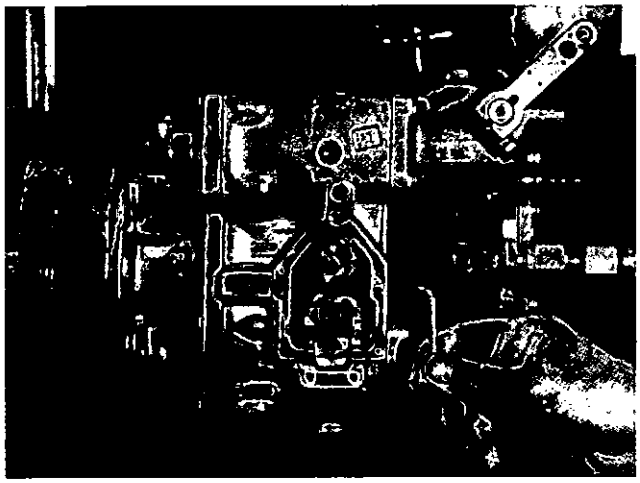


Fig. 10-31, (F5339). Set the throttle leakage screw.

**Note:** Throttle leakage is not normally set on the VS section of a dual lever VS fuel pump. If this setting is required, see the following procedure.

### Set the Throttle Leakage — Single Lever

### AFC-VS Governor

1. Set the throttle leakage on the lower throttle shaft. Use the same procedure as the dual lever VS fuel pump.

**Note:** This is required to set the position of the fuel port in the lower throttle shaft.

2. Set the 28° throttle travel on the lower throttle shaft. Tighten the locknut on the lower throttle shaft to hold the shaft in the 28° open position.

**Note:** The throttle leakage is adjusted by adding or removing shims between the VS governor spring plunger and the retaining ring in the VS spring assembly housing.

3. Remove the VS spring assembly cover.
4. Remove the VS throttle lever plunger and the VS maximum speed spring.
5. Remove the retaining ring from the VS spring assembly housing.
6. Install approximately 0.100 inch [2.54 mm] of shims between the governor spring plunger and the retraining ring. Use the thickest shims to prevent buckling.

**Note:** These shims are the same as the lower governor maximum speed shims. This adjustment is limited to 0.002 inch [0.05 mm] because of the shims. The leakage can vary ± 15 cc.

7. Assemble the spring assembly and replace the cover.
8. Use the dual lever procedure to check the throttle leakage.
9. Install or remove the shims to adjust the leakage.

### Set Idle Speed

### AFC-VS Governor — Dual Lever Pump

1. Close the control valve for the main flow. Open the idle orifice or flow meter valve.
2. Move the lower throttle lever to the idle position (toward gear pump). Hold it against the stop.
3. Run the test stand at the speed on line 12 in the calibration data tables. (Idle speed psi @ rpm)
4. Check the pressure on the pressure (rail) gauge for the fuel manifold. It must be the same as the calibration data table. If the pressure is low, turn the idle adjustment in with ST-984 or 3375981 Spring Pack Adjusting Tool. This screw is inside the governor spring housing. To lower the pressure, turn the screw out. This is 37 psi @ 500 rpm or 190 cc @ 630 rpm on pump code 8902, Fig. 10-32.

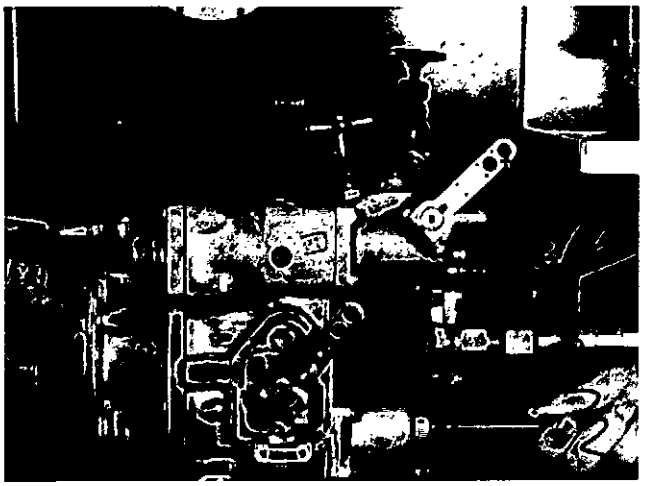


Fig. 10-32, (F5340). Set the idle speed with ST-984.

**Note:** Sometimes when high weight assist settings are used, the screw will hit the bottom of the guide and the pressure will still be low. Add one more spring seat washer on the spring end of the idle screw.

5. Return the lower throttle lever to the full fuel position. Move the VS upper throttle lever to the idle position and hold.
6. Adjust the rear VS throttle adjustment screw. This will set the idle at the same speed as the lower governor or to the specifications. Tighten the locknut on the jam nut.

### Set Idle Speed

### Single Lever VS Pump

1. Move the VS throttle lever to the idle position and hold.
2. Decrease the stand rpm to the idle rpm in the calibration data. Close the main flow valve and open the idle orifice or flow meter valve.
3. Set the idle adjustment screw in the standard automotive governor about mid-way of the travel.
4. Adjust the rear VS governor throttle screw to the psi in the calibration, Fig. 10-33.

### Adjust the Calibration Pressure and Adjust the Throttle Travel on a Dual Lever Pump

### AFC-VS Governors

1. Use a throttle lever template Service Tool No. 3375355, a protractor or Tool No. 3375855. Set the idle position of the automotive throttle lever centerline at 27-29 degrees from the vertical (toward the gear pump) throttle shaft centerline, Fig. 10-34. Tighten the retaining capscrew and nut of the throttle lever.

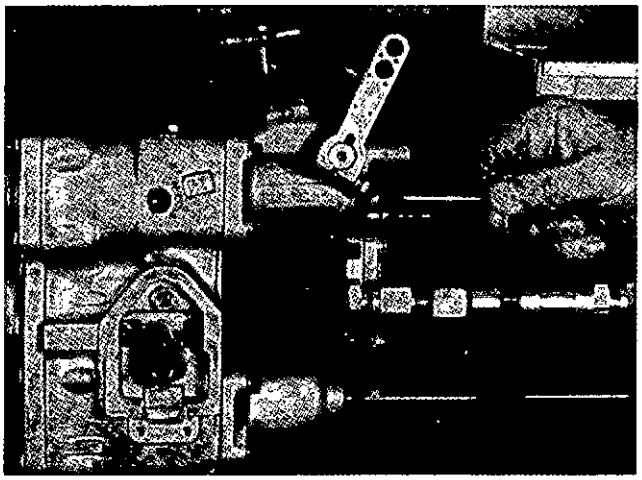


Fig. 10-33, (F5341). Set the VS idle speed.

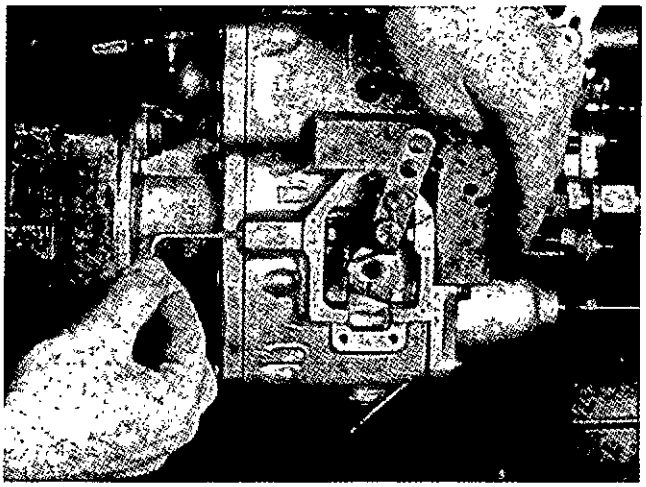


Fig. 10-34, (F5342). Set the throttle travel.

2. Move the automotive throttle lever to the wide open position. It must be on a vertical centerline. This makes a 28 degree-idle to wide open throttle travel. Tighten the locknut on the front adjustment screw. The lever position may now be changed for the linkage. **Do not adjust the rear throttle screw from the value set under throttle leakage.**
3. Close the idle orifice and leakage flow meter valve. Open the main flow valve. Put both of the throttles in the full fuel position.
4. Run the test stand speed up to the rated speed of the pump. See line 15 in the calibration data tables. This is 2100 rpm on code 8902.
5. Adjust the fuel flow meter to the flow in the calibration data on line 16. Check the fuel pressure on fuel manifold (rail) pressure gauge. Adjust the suction restriction of the fuel pump to 7 in [178 mm] Hg or as close as possible.
6. Adjust the fuel calibration pressure to the "Calibration Pressure @ rpm and Flow" on lines 15 and 16 of the calibration tables.

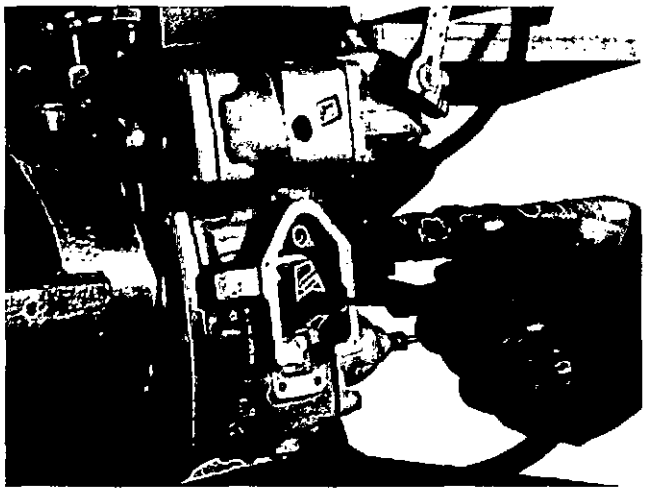


Fig. 10-35, (F5343). Adjust the fuel adjustment screw inside the throttle shaft.

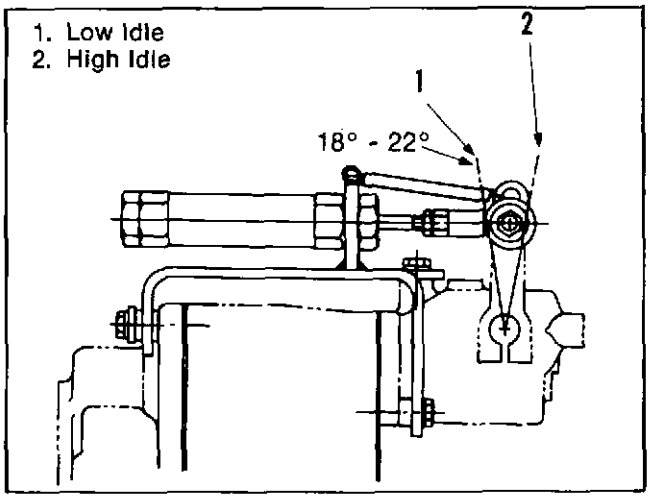



Fig. 10-36, (F5373). Air cylinder kit, Part No. 3017333, on a VS fuel pump.

Adjust the fuel adjustment screw inside the throttle shaft, Fig. 10-35.

7. If the torque required to turn the fuel adjustment screw is less than 1 - 1/2 in. lbs. [.17 N•m] a new screw must be installed.

**Note:** For a special throttle travel, other than 28 degrees, use the same procedure except use the degree of travel as required. Refer to line 11 in the calibration data tables for the settings. Some PT (type H) fuel pumps use two air cylinders to activate the VS throttle movement. This VS throttle can be set at 16 to 22 degrees travel, check the calibration data.

### Installation and Adjustment Procedures for the Air Cylinder Kit, Part No. 3017333

1. Install the cap nuts and locknuts all the way on the two air cylinders. Install the actuating assembly onto the fuel pump, Fig. 10-36.
2. Apply air prssure to the braking cylinder to retract the piston. Set the lever in a vertical position. This is one half or midway of the lever travel. Tighten the VS throttle lever to the throttle shaft.
3. Keep the braking cylinder compressed and the VS throttle lever iin the low idle position. Adjust the throttle cylinder cap nut. Set the gap 0.015 to 0.030 inch [0.38 to 0.76 mm] between the throttle roller and the cap nut. Tighten the locknut.
4. Remove the air to the cylinders. Set the cap nut on the brake cylinder to give the brake speed requirement on the shop order. Tighten the locknut.
5. Add air pressure at 80 psi [552 kPa] to the throttle cylinder. Check that the VS throttle stop is against the adjustment screw for the VS high idle.
6. Remove the air to the throttle cylinder. Add air at 65 psi [448 kPa] to the brake cylinder. Check to make sure that a 0.010 inch [0.25 mm] minimum gap is between both of the capnuts and the throttle lever rollers. Make sure the VS throttle stop is against the adjustment screw for the VS low idle.

**Note:** If steps five and six are not as above, change the position of the throttle lever on the throttle shaft and repeat steps three through six.

7. Both of the cylinder filter screens must have a vent to the air intake piping of the engine.
   a. This vent must attach to the engine between the air cleaner and the turbocharger.
   b. This will prevent an early failure of the cylinder filters.

### Adjust the Calibration Pressure

#### AFC Single Lever VS Pump

1. Move the throttle lever of the VS governor clockwise to the full fuel position. Hold the lever with a wire. Close the idle orifice valve and open the main flow valve.

2. Increase the rpm to the calibration psi @ rpm in the calibration tables line 15.
3. Adjust the main flow valve until the flow meter is to the flow on line 16.
4. Set the vacuum at 7 inch [18 cm] Hg and the flow meter at the flow requirement before each check. (rated speed only.)
5. Turn in the fuel adjustment screw in the automotive throttle shaft until it is the value on line 15 in the calibration table, Fig. 10-35.

**Note:** The lower automotive throttle lever was secured in the full open position when setting the throttle leakage.

**Compare the Check Point Pressure**

**AFC-VS Governor**

1. Reduce the speed to the rpm on line 17 in the calibration table.
2. Adjust the flow meter to line 18 for the check point flow. For example: 330 lb./hr. @ 1400 rpm on Code 8902.
3. Check the pressure at the manifold pressure gauge. Line 17 is 118 to 124 psi on Code 8902.
4. If the pressure is above or below, check the torque spring on the governor plunger. It may not be seated, the improper amount of shims, or the wrong spring. See the part number in the calibration table. If the spring is changed, calibrate the fuel pump again. The torque spring shims are available 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thick.
5. Reduce the speed to line 19 in the calibration table. If it is out of the specifications, adjust the flow meter and check the pressure. Check the weight assist protrusion.
6. If the fuel pressure is low at the check point for the lowest rpm, add shims behind the weight assist plunger. To decrease the pressure remove the shims. Shims are available 0.007 and 0.015 inch [0.18 and 0.38 mm] thick. Code 8902 is .840 inch.

**Note:** The weight assist protrusion in the tables is a reference point. This can be changed to get the correct pressure at the lowest rpm check point.

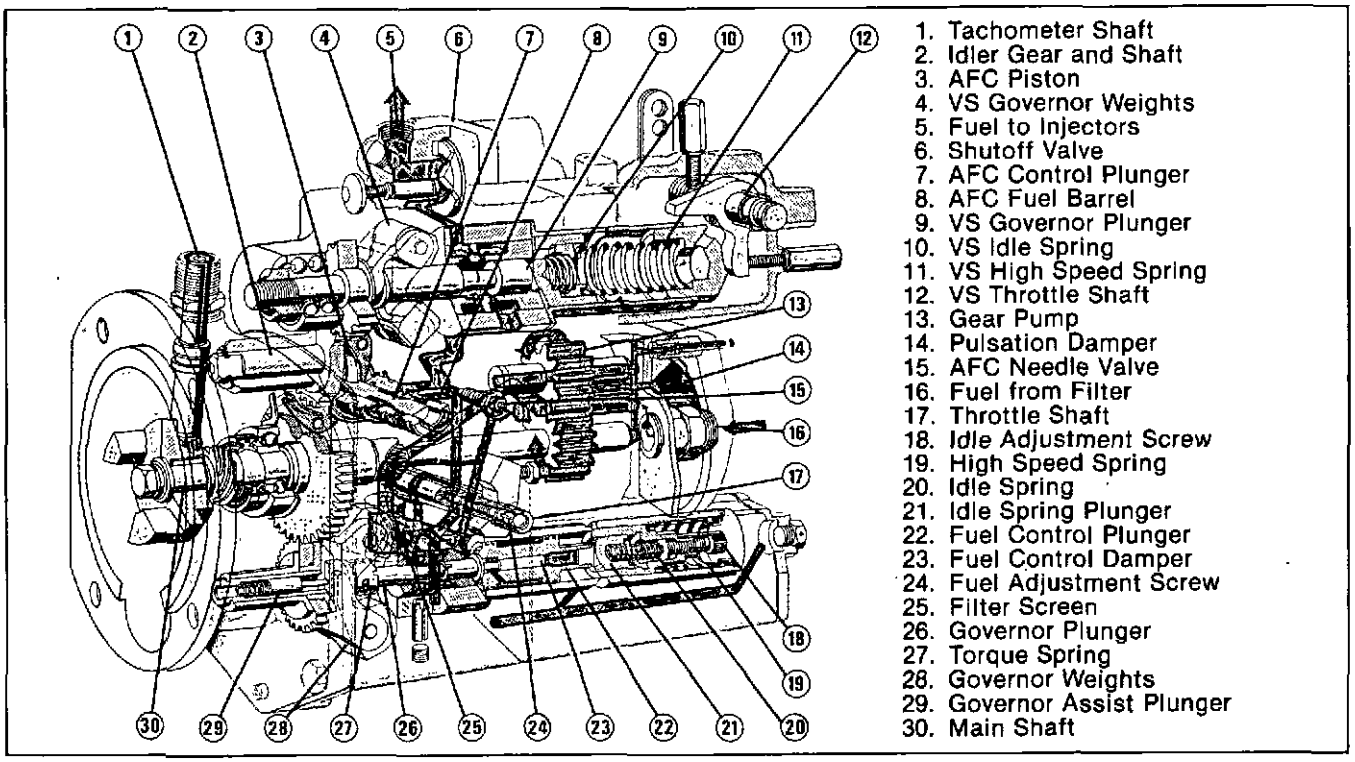



Fig. 10-37, (FWC-54). PT (type H) AFC-VS Fuel Pump.

**Note:** The plunger protrusion of the weight assist plunger for the governor can be checked. Use Tool No. ST-1241 Plunger Protrusion Checking Tool.

**Caution: The weight assist plunger must be installed with the smallest end toward the governor weights.**

### Checking and Setting the Air Fuel Control (AFC) Plunger and No Air Adjustment

This procedure is the same as the standard automotive governor.

## Fuel Pumps with PT (type H) AFC-VS (Variable Speed) Governor

The PT (type H) fuel pump can have one or two throttle levers.

1. When the pump has only one lever, it is on the upper governor, Fig. 10-37.
2. The fuel pump calibration is different with one or two levers.
3. The PT (type H) fuel pump can have an air cylinder to control the speed.
4. Most of the fuel pump codes for the PT (type H) fuel pump begin with a "B" prefix.

### Calibrating the PT (type H) AFC-VS Fuel Pump

1. Install the fuel line to the shutoff valve of the fuel pump. This line must be attached to the same fuel outlet connection that is in use when the fuel pump is on the engine. A possible flow restriction, through the shutoff valve, can cause a wrong calibration.

**Note:** The test stand must have or be converted to have a number 16 supply tube.

2. Adjust the throttle stop screws of the lower governor. The throttle lever must have full movement in both directions. The throttle shaft port must be wide open. Do not tighten the locknuts.
3. Loosen the locknuts of the adjustment screws for the throttle stop in the VS governor.
4. Turn the screws out until the lever moves freely. Tighten the locknuts on the screws.
5. Close the test stand idle and leakage valves. All the valves turn clockwise to close. Open the main flow and the vacuum gauge valves completely.
6. The lower throttle lever of the pump housing turns counterclockwise to open. The VS throttle lever turns clockwise to open. Attach a solid piece of wire to the throttle lever of the VS governor to hold it full open. The throttle lever of the VS governor can not be held open with a weak spring.
7. Increase the pump rpm to the maximum speed. Run the pump until all of the air is out. Look at the flow meter.

**Note:** Fuel pump code B-144 is used for the example of this calibration.

### Set the Governor Cut Off Speed

### PT (type H) AFC-VS Governor

1. Close the idle, leakage and pressure valves. Open the flow control valve.
2. Increase the pump speed to the engine maximum speed.
3. Make sure you have 50 in. Hg [1270 mm Hg] or 24.5 psi [169 kPa] air pressure to the AFC.
4. Close the flow control valve until the flow meter is the same as line 16 in the calibration data. The flow for code B-144 is 1720 pph. There must be no air in the flow meter.
5. Adjust the vacuum valve in the suction line of the fuel pump to get 7 inches [18 cm] Hg on the vacuum gauge.
6. If you cannot get 7 inches [18 cm] Hg of vacuum, check for a restriction in the test stand filter or the fuel supply line.
7. If the flow value can not be reached and held, check the fuel control plunger and the governor cut off rpm.

**Note:** The idle spring plunger, in the PT (type H) functions as a spacer. It is smooth and will not change the fuel pressure.

**Note:** The lower governor cut off speed is normally set 5% above the VS (upper) cut off speed.

8. Open the gauge valve for the fuel pressure. With the lower throttle lever in the full fuel position, increase the pump speed until the point at which fuel pressure decreases 1 psi.

This must be at the speed on line 8. The lower governor cut off of code B-144 is 2220 to 2240.

9. If the speed is too low, add shims between the governor spring and the retainer. Check Table 18-1 for the spring specifications. To reduce the speed, remove the shims. Each 0.001 inch shim thickness will change the speed approximately 2 rpm. Shims are available 0.005, 0.010 nd 0.020 inch [0.13, 0.254 and 0.51 mm] thick, Fig. 10-38.

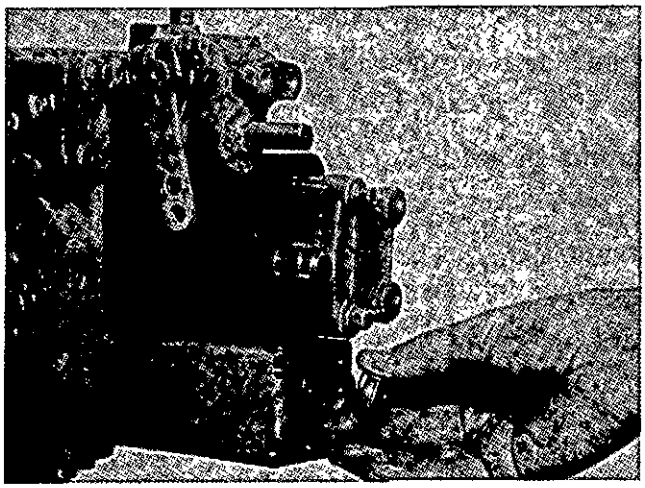


Fig. 10-38, (F5337). Shim the governor spring for high speed.

**Note:** When the spring pack cover is replaced, open the flow control valve wide open. Move the throttle lever front and rear with the pump running. The flow meter must not have any air in it. After the air is out, set the flow meter flow.

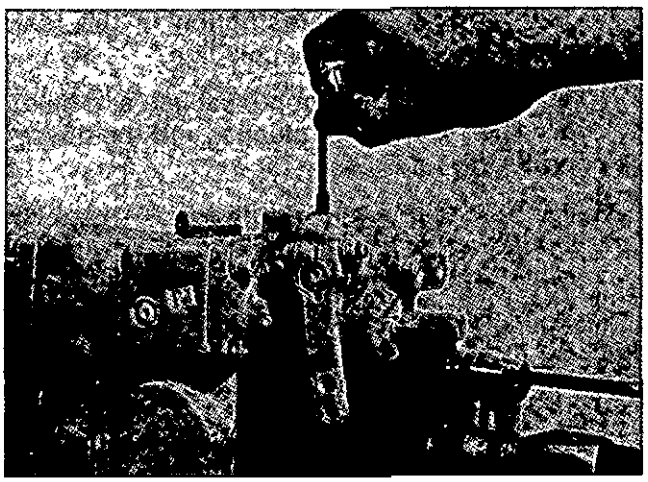


Fig. 10-39, (F5375). Set the VS maximum governing speed.

10. Run the pump at the rated rpm. Turn the VS maximum speed screw (top screw) in until the pressure starts to decrease, Fig. 10-39.
11. Set VS governor cut off speed as listed in calibration data. The VS governor cut off for code B-144 is 2110 to 2130 rpm.
12. Check by increasing the rpm until the pressure starts to decrease.

**Set the Throttle Leakage — Dual Lever PT (type H) AFC-VS Governor**

Make sure the fuel is up to 90 to 100° F [32 to 38° C] when setting the throttle leakage.

1. Open the throttle leakage valve. Close the main flow and idle valves.
2. Move the lower throttle toward the gear pump and hold it against the stop.
3. Run the test stand speed at the pump rated speed.
4. Check the throttle leakage with the throttle leakage flow meter, if the test stand is so equipped. For another method, use a 200 cc container to hold the fuel delivery for one minute. Do not run the test stand at this setting any longer than necessary. This will keep the fuel temperature within the limits.
5. The cc delivery must be the same as the "Throttle Leakage" on line 10 in the calibration data. Turn the rear throttle stop screw in or out until the cc delivery meets the specifications.
6. Check the leakage with a light and heavy lever load. If the leakage is changed by the additional pressure in the throttle closed position, set the leakage under these conditions.
7. Tighten the locknut when the setting is correct and check again.
8. Close the throttle leakage valve.
9. If the test oil temperature exceeds 100° F [38° C] slow the stand down and let the test oil cool. If the temperature exceeds 135° F [57° C], drain and replace the test oil with new test oil.

**Note:** The throttle leakage is not normally set on the VS section of a PT (type H) dual lever or on a single lever fuel pump. If this setting is required, see "Set

the Throttle Leakage — Single Lever, AFC-VS Governor".

### Set Idle Speed

### PT (type H) AFC-VS Dual Lever Pump

1. Close the control valve for the main flow. Open the idle orifice or flow meter valve.
2. Move the lower throttle lever to the idle position (toward gear pump). Hold it against the stop.
3. Run the test stand at the speed on line 12 in the calibration data tables. (Idle speed psi @ rpm)
4. Check the pressure on the calibration pressure gauge. It must be the same as the calibration data table. If the pressure is low, turn the idle adjstment in with ST-984 or 3375981 Spring Pack Adjusting Tool. This screw is inside the governor spring housing. To lower the pressure, turn the screw out. This is 10 psi @ 600 rpm or 310 cc @ 600 rpm on pump code B-144, Fig. 10-40.

**Note:** Sometimes when high weight assist settings are used, the screw will hit the bottom of the guide and the pressure will still be low. Add one more spring seat washer on the spring end of the idle screw.

5. Return the lower throttle lever to the full fuel position. Move the VS upper throttle lever to the idle position and hold.

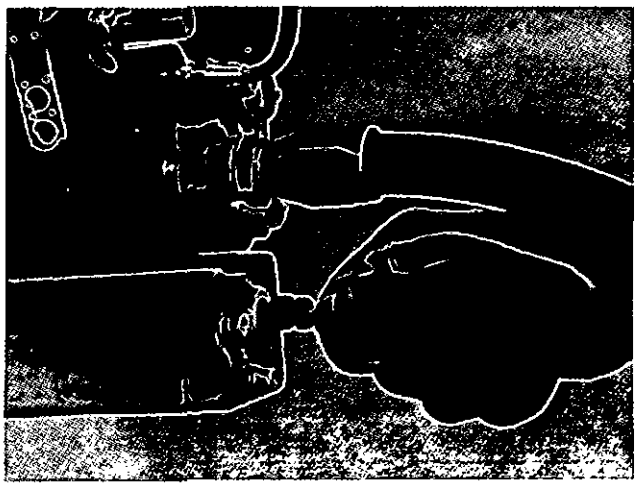


Fig. 10-40, (F5376). Set the idle speed with ST-984.

6. Adjust the rear VS throttle adjustment screw. This will set the idle at the same speed as the lower governor or to the specifications. Tighten the locknut and jam nut.

### Set Idle Speed

### Single Lever PT (type H) AFC-VS Pump

1. Move the VS throttle lever to the idle position and hold.
2. Decrease the stand rpm to the idle rpm in the calibration data. Close the main flow valve and open the idle orifice or flow meter valve.
3. Set the idle adjustment screw in the standard automotive governor about mid-way of its travel.
4. Adjust the rear VS governor throttle screw to obtain the pressure in the calibration, Fig. 10-41.

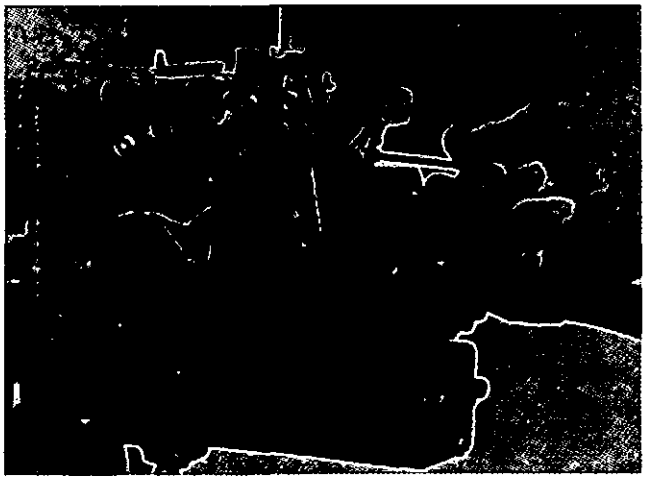


Fig. 10-41, (F5377). Set the PT (type H) AFC-VS idle speed.

### Adjust the Calibration Pressure and Adjust the Throttle Travel

### Dual Lever PT (type H) AFC-VS Governors

1. Use a throttle lever template Service Tool No. 3375355, a protractor or Tool No. 3375855. Set the idle position of the automotive throttle lever centerline at 27-29 degrees from the vertical (toward the gear pump) throttle shaft centerline, Fig. 10-42. Tighten the retaining capscrew and nut of the throttle lever.

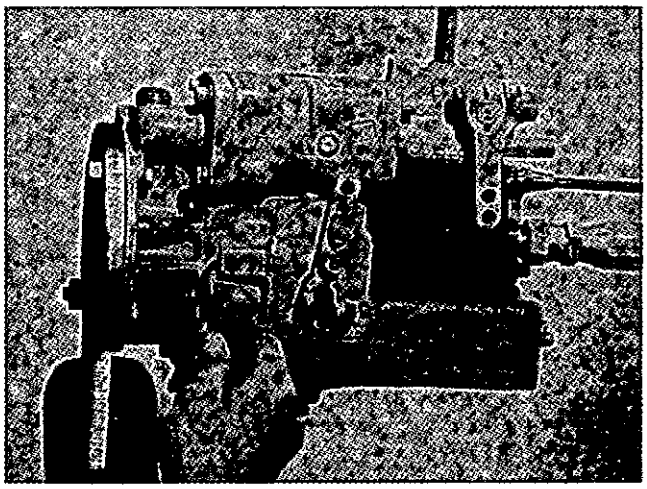


Fig. 10-42, (F5378). Set the throttle travel.

2. Move the throttle lever to the wide open position. It must be on a vertical centerline. This makes a 28 degree idle to wide open throttle travel. Tighten the locknut on the front adjustment screw. The lever position may now be changed for the linkage. **Do not adjust the rear throttle screw from the value set under throttle leakage.**
3. Close the idle orifice or leakage flow meter valve. Open the main flow valve. Put both of the throttle levers in the full fuel position.
4. Run the test stand speed up to the rated speed of the pump. See line 15 in the calibration data tables. This is 2100 rpm on code B-144.

**Note:** On the PT (type H) fuel pumps, make the approximate AFC no air setting with the needle valve before making the calibration pressure setting. Refer to the PT (type G) AFC no air procedure.

5. Adjust the fuel flow meter to the flow in the calibration data on line 16. Check the fuel pressure on fuel rail pressure gauge. Adjust the suction restriction of the fuel pump to 7 in. [18 cm] Hg or as close as possible.
6. Adjust the fuel calibration pressure to the "Calibration Pressure @ rpm and Flow" on lines 15 and 16 of the calibration tables. Adjust the fuel adjustment screw inside the throttle shaft, Fig. 10-43.
7. If the torque required to turn the fuel adjustment screw is less than 1-1/2 in. lbs. [.17 N•m] a new screw must be installed.

**Note:** For a special throttle travel, other than 28 degrees, use the same procedure except use the degree of travel as required. Refer to line 11 in the calibration data tables for the settings. Some PT (type H) fuel pumps use two air cylinders to activate the VS throttle travel. This VS throttle can be set at 16 to 22 degrees travel, check the calibration data.

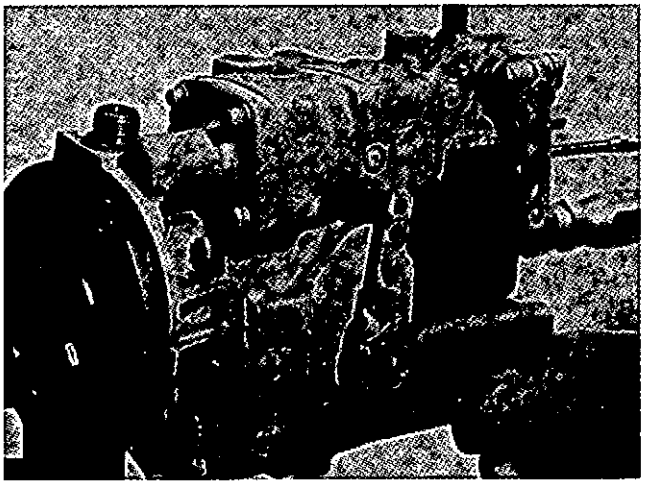


Fig. 10-43, (F5379). Adjust the fuel adjustment screw inside the throttle shaft.

### Installation and Adjustment Procedures for the Air Cylinder Kit, Part No. 3017333

1. Install the cap nuts and locknuts all the way on the two air cylinders. Install the actuating assembly onto the fuel pump, Fig. 10-44.

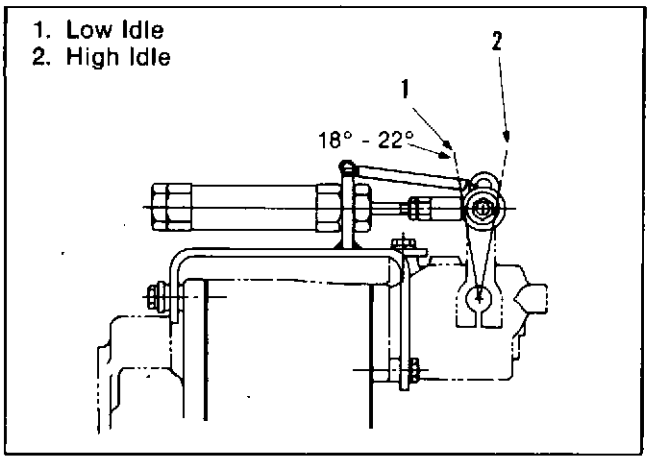



Fig. 10-44, (F5373). Air cylinder kit, Part No. 3017333, on a VS fuel pump.

2. Apply air pressure to the braking cylinder to retract the piston. Set the lever in a vertical position. This is one half of the lever travel. Tighten the VS throttle lever to the throttle shaft.
3. Keep the braking cylinder compressed and the VS throttle lever in the low idle position. Adjust the throttle cylinder cap nut. Set the gap 0.015 to 0.030 inch [0.38 to 0.76 mm] between the throttle roller and the cap nut. Tighten the locknut.
4. Remove the air to the cylinder. Set the cap nut on the brake cylinder to give the brake speed requirement on the shop order. Tighten the locknut.
5. Add air pressure at 80 psi [552 kPa] to the throttle cylinder. Check that the VS throttle stop is against the adjustment screw for the VS high idle.
6. Remove the air to the throttle cylinder. Add air at 65 psi [448 kPa] to the brake cylinder. Check to make sure that a 0.010 inch [0.25 mm] minimum gap is between both of the capnuts and the throttle lever rollers. Make sure the VS throttle stop is against the adjustment screw for the VS low idle.

**Note:** If steps five and six are not as above, change the position of the throttle lever on the throttle shaft and repeat steps three through six.

7. Both of the cylinder filter screens must have a vent to the air intake piping of the engine.
   a. This vent must attach to the engine between the air cleaner and the turbocharger.
   b. This will prevent an early failure of the cylinder filters.

**Adjust the Calibration Pressure**

**Single Lever PT (type H) AFC-VS Pump**

1. Move the throttle lever of the VS governor clockwise to the full fuel position. Hold the lever with a wire. Close the idle orifice valve and open the main flow valve.

**Note:** On the PT (type H) fuel pumps, make the approximate AFC no air setting with the needle valve before making the calibration pressure setting.

2. Increase the rpm to the calibration psi @ rpm in the calibration tables line 15.
3. Adjust the main flow valve until the flow meter is to the flow on line 16.
4. Set the vacuum at 7 inch [18 cm] Hg and the flow meter at the flow requirement before each check (rated speed only).
5. Turn in the fuel adjustment screw in the automotive throttle shaft until the pressure and flow are the same as line 15 and 16 in the calibration table, Fig. 10-35.
6. Tighten the locknuts when the correct value is rached.

**Compare the Check Point Pressure**

**PT (type H) AFC-VS Governor**

1. Reduce the speed to the rpm on line 17 in the calibration table.
2. Adjust the flow meter to the line 18 for the check point flow. For example: 1600 lb./hr. @ 1800 rpm on Code B-144.
3. Check the pressure at the calibration pressure gauge. Line 17 is 154 to 160 psi on Code B-144.
4. If the pressure is above or below, check the torque spring on the governor plunger. It may not be seated, the improper amount of shims, or the wrong spring. See the part number in the calibration table. If the spring is changed, calibrate the fuel pump again. The torque spring shims are available 0.005, 0.010 and 0.020 inch [0.13, 0.25 and 0.51 mm] thick.
5. Reduce the speed to line 19 in the calibration table. If it is out of the specifications, adjust the flow meter and check the pressure. Check the weight assist protrusion.
6. If the fuel pressure is low at the check point for the lowest rpm, add shims behind the weight assist plunger. To decrease the pressure remove the shims. Shims are available 0.007 and 0.015 inch [0.18 and 0.38 mm] thick. The reference point for code B-144 is .810 inch.,

**Note:** The weight assist protrusion in the tables is a reference point. This can be changed to get the correct pressure at the lowest rpm check point.

**Note:** The plunger protrusion of the weight assist plunger for the governor can be checked. Use Tool No. ST-1241 Plunger Protrusion Checking Tool.

***Caution: The weight assist plunger must be installed with the smallest end toward the governor weights.***

**Checking and Setting the Air Fuel Control (AFC) Plunger and No Air Adjustment**

This procedure is the same as the standard automotive fuel pump.

## PT (type G) AFC-VS Pump with Torque Converter Governor

1. Before calibrating the fuel pump, lock the torque converter governor open. Turn out the lower screw in the torque converter governor and turn in the middle screw.
2. Calibrate the pump the same as the VS governor with the single VS throttle lever.
3. When turning the throttle shaft in the main housing to set the fuel pressure, do not twist the fuel tube to the torque converter governor. Loosen the tube nut to release the tension, turn the shaft, then tighten.
4. Set the AFC air fuel adjustments as described in the calibration instructions for the standard pump.
5. The governor section of the torque converter must be adjusted after the fuel pump is mounted to the engine. The governor must be driven by a flexible drive cable from the torque converter. See the "Adjust on Engine" section for the setting proceudres.

## PT (type G) AFC-VS Fuel Pump With Torque Modification Device (TMD)

The calibration procedure is the same for the PT (type G) VS AFC fuel pump with the TMD as used for the PT (type G) VS fuel pump with a TMD. All of the inside parts are the same.

**Note:** The calibration pressure of a fuel pump that has a Torque Modification Device (TMD) is set differently. The pressure, set with the adjustment screw in the throttle shaft, is set at the torque peak speed. The fuel pressure, at the rated speed is set at the number one check point. This is changed by adding or removing shims in the TMD at 0.005 inch [0.13 mm] at a time.

## Dual Governor Pumps for Service

The PT (type G) VS and MVS Fuel Pumps with dual Governors for service parts were adjusted to run from the single throttle lever of the upper governor. When the "Screw Adjust Fuel Pump Throttle Shaft" was made, the automotove throttle shaft was used in all of the "VS" pumps. The "Stub Shaft" is not now used.

Because of the use of the pump when it is sent out as a service part, the following action is being taken:

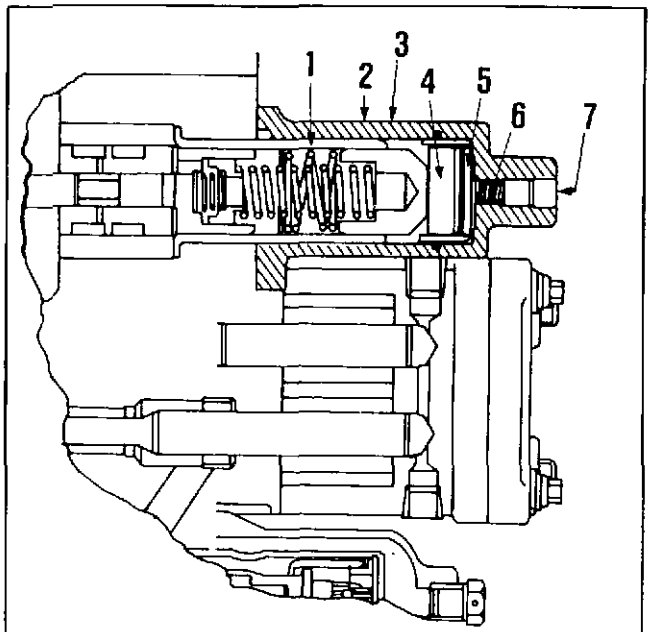
1. All PT (type G) VS, PT (type G) VS AFC and PT (type G) MVS fuel pumps sent out as service parts will have dual throttle levers. One lever is on the standard throttle shaft and one is on the upper VS or MVS governor shaft.
2. When a single lever is required, the lever is on the VS or MVS governor shaft. The main throttle shaft must be locked open by one of the following methods.
   a. On a PT (type G) VS fuel pump, turn the upper throttle shaft screw in until the throttle shaft will not turn.
   b. On a PT (type G) AFC VS fuel pump, turn the rear throttle stop screw in until the throttle shaft will not turn.
   c. On a PT (type G) MVS fuel pump, turn the front throttle stop screw in until the shaft will not turn.
3. Adjustments in step two may be done without calibrating the fuel pump again. The pressure settings must be made correctly at the original calibration operation.
4. After the final adjustment on the engine, *install the ball into the throttle shaft of the* AFC pump. Install the ball with the throttle shaft ball installing Service Tool No. 3375204.

## PT (type G) VS Fuel Pump with a Road Speed Governor

The road speed governor must be adjusted before the lower governor, Fig. 10-45.

1. Install an air supply hose, with a regulator, to the road speed governor. Set at 80 psi.
2. The lower governor must temporarily be set higher than the road speed governor.
3. Remove the maximum speed spring of the lower governor. Install the next higher rated spring and 0.140 inch [3.56 mm] shims.
4. Check the fuel pump code for the setting of the road speed governor (VS governor).
   a. Make sure the air pressure is set at 80 psi.
   b. Check the VS governor cut off.
   c. Add or remove the high speed shims in the VS governor. This will adjust the maximum rpm of the roadspeed governor.

**Note:** The setting of the road speed govrnor will change when the rear axle ratio, the transmission high gear or the tire size changes.




1. Return Spring, 3020409
2. Cover and Sleeve Assembly, 3020410
3. Shims, 70811
4. Road Speed Governor Piston, 3020408
5. Seal Assembly, 3018200
6. Set Screw, 3010183
7. Expansion Plug, 3008956

Fig. 10-45, (F5380). Road speed governor cross section Part No. 3020411 on a VS fuel pump.

5. Install the correct maximum speed spring in the lower governor.
6. Make sure the air pressure is set at 80 psi.
7. Calibrate the fuel pump in the normal procedure.
8. To adjust the speed of the vehicle when it is in high gear, remove the air hose.
   a. Remove the expansion plug in the rear of the cover. Adjust the setscrew in the rear of the cover of the road speed governor.
   b. Set the cut off break of the road speed 20 to 200 rpm below the lower governor. This will control the vehicle road speed.
9. This adjustment can be made on the vehicle. The vehicle must be on a chassis dynamometer.
10. Install the expansion plug in the rear of the cover.

## Calibrations when Flows are not Given

To calibrate this older type of fuel pump, install any Cummins fuel pump on the test stand.

Adjust the flow control valve to get 450 lb./hr. [204 kg/hr] flow. Adjust the speed control handle at the same time to get 50 psi [345 kPa].

Do not change the valve setting of the flow control. Adjust the fuel pump to get the correct pressure at the rpm requirement.

**Caution: The valve setting for the flow control must not be changed. It is a restriction that is the same for all less flow pump calibrations.**

See Bulletin No. 983533 for the fuel pump codes and the calibration procedure.

## Standard Governor — Not With AFC

### Set the Governor Cut Off Speed — PT (type G)

1. Close the idle, leakage and pressure valves. Open the flow control or needle valve wide open. See Fig. 10-46 for a PT (type G) fuel pump.
2. Increase the pump speed to the engine rated speed.
3. Adjust the vacuum valve in the suction line of the fuel pump to get 8 inch [203 mm] Hg on the vacuum gauge, Fig. 10-47.

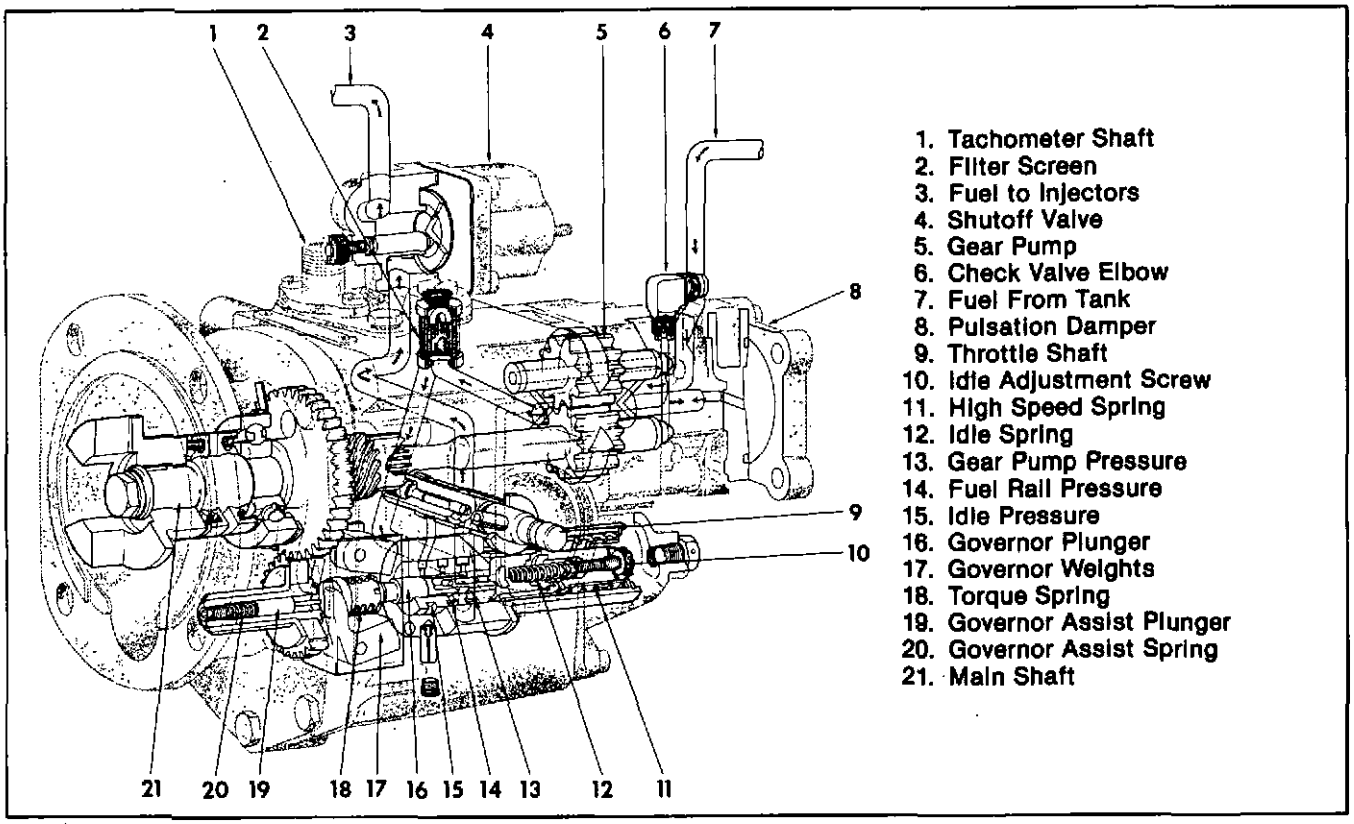



Fig. 10-46, (FWC-31). PT (type G) fuel pump cross-section and fuel flow.

4. If you can not get the 8 inch [203 mm] of vacuum, check for a restriction in the test stand filter of fuel supply line.
5. Close the main flow control valve until the flow meter is the flow on line 16 in the calibration table. There must be no air in the flow meter, Fig. 10-48. Do not change the vacuum when it changes at this setting.
6. If the flow value can not be reached and held, check the idle plunger (button) and the governor break cut off. The difference between the plungers is about 5 to 10 psi. Make sure the

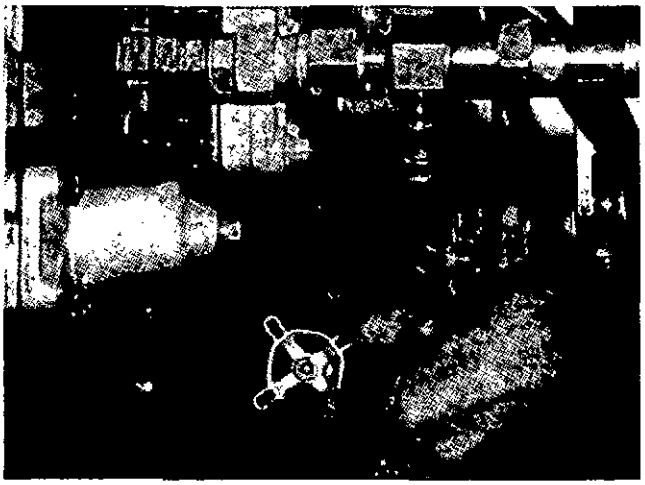


Fig. 10-47, (F5327). Adjust the vacuum on the suction restriction.

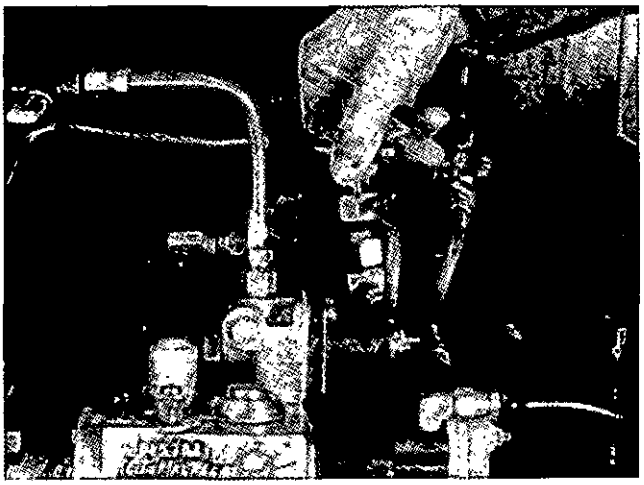


Fig. 10-48, (F5346). Adjust the manifold orifice valve flow.

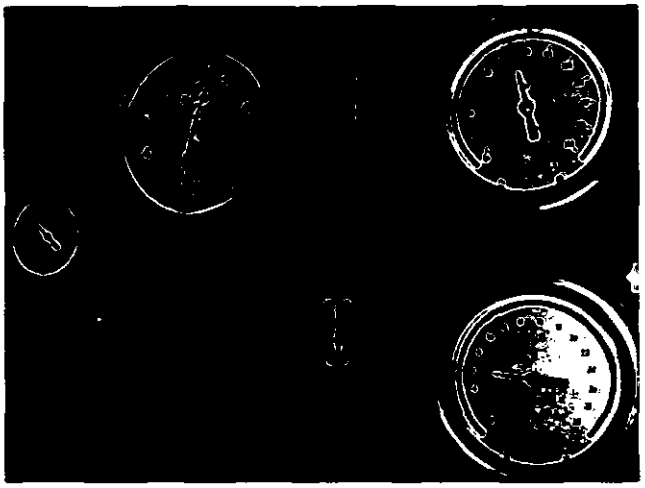


Fig. 10-49 (F5108). Check the governor cut off speed.

Part No. 144676, is in use with plungers code 170 and over. Inspect the fuel damper diaphragm.

7. Open the gauge valve for the fuel pressure. Put the throttle in the full fuel position. Increase the pump speed until the fuel pressure just begins to decrease (peak point). This must occur at the speed on line 8, "Governor Cut Off". For example: 2130/2150 rpm on a 2100 rpm pump. Fig. 10-49.

**Note:** The fuel pumps for the V-555 Engines are set at 78% of the engine rpm.

8. If the speed is lower than line 8, add shims between the governor spring and the retainer. See Table 18-1 for the spring specifications. To lower the speed, remove the shims. Each 0.001 inch shim thickness will change the speed approximately 2 rpm on an NH Engine, Fig. 10-50. Shims are available in 0.005, 0.007, 0.010 and 0.020 inch [0.13, 0.18, 0.25 and 0.51 mm].

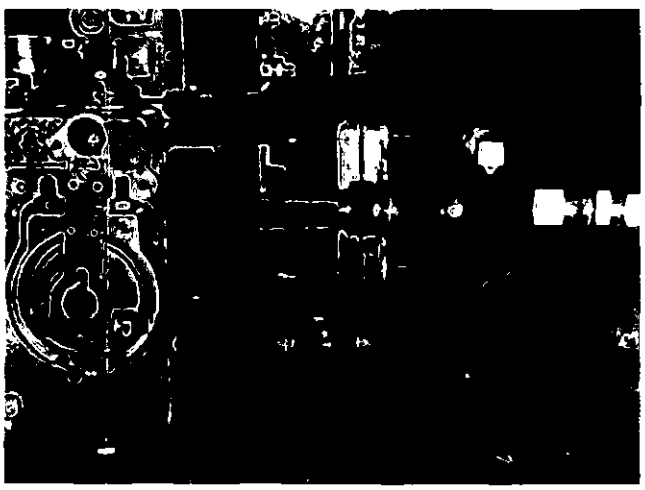


Fig. 10-50, (F5109). Shim the governor spring.

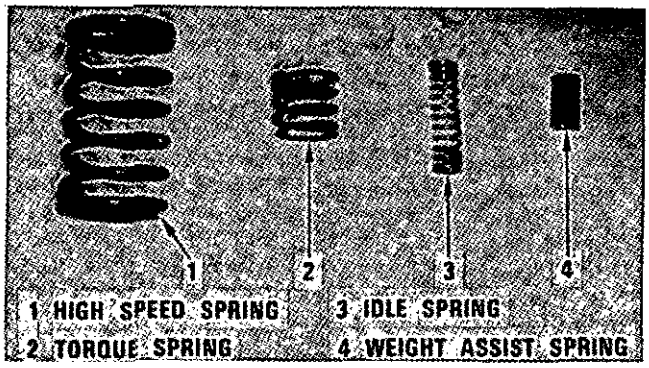
**Note:** When the pump is opened to make adjustments, turn the main control valve to the flow meter wide open. Move the throttle lever front to rear until the flow meter has no air. After the air is out, reset the flow meter as in step five.

### Set the Throttle Leakage

### PT (type G) Standard Governor

**Note:** Make sure the fuel temperature is up to 90 to 100° F [32 to 38° C] when setting the throttle leakage.

1. Make the throttle leakage setting on PT (type G) fuel pumps with the front throttle screw fully open.
2. Move the throttle lever toward the gear pump and hold it tightly against the stop.
3. Open the leakage valve in orifice block completely open. Close the main flow and idle valves.
4. Increase the test stand speed up to the pump rated speed.
5. Check the throttle leakage with the throttle leakage flow meter, if the test stand is so equipped. For another method, use a 200 cc container to hold the fuel delivery for one minute. Do not keep the test stand at this setting any longer than necessary. This will keep the fuel temperature within the limits, Fig. 10-45.
6. The delivery must be the same as the "Throttle Leakage" on line 10 of the calibration data. If it is not to specifications, turn the front throttle stop screw in or out until the cc delivery comes to the specifications, Fig. 10-53.
7. Check the leakage with a light and heavy lever load. If the leakage is changed by the additional pressure in the throttle closed position, set the leakage under these conditions.
8. If the test oil temperature exceeds 100° F [38° C], stop the test stand and let the test oil




1. High Speed Spring
2. Torque Spring
3. Idle Spring
4. Weight Assist Spring

Fig. 10-51, (F5240). Comparison of the fuel pump springs.

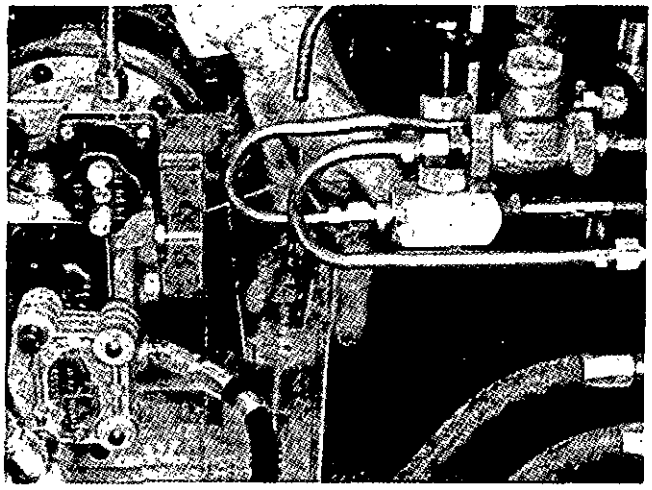


Fig. 10-52, (F5111). Measure the throttle leakage.

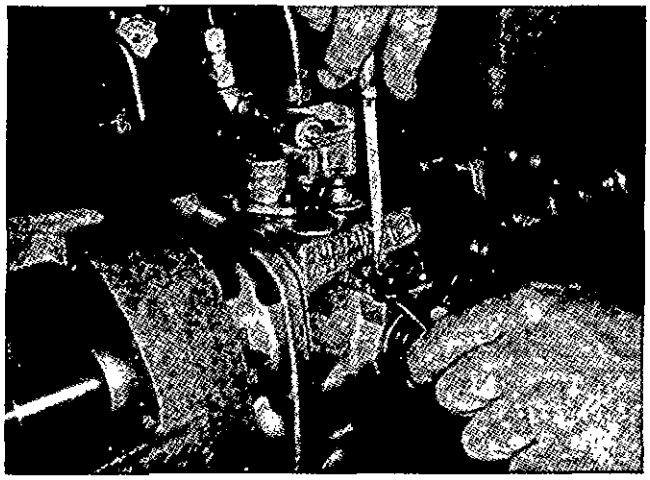


Fig. 10-53, (F5112). Adjust the throttle leakage rate.

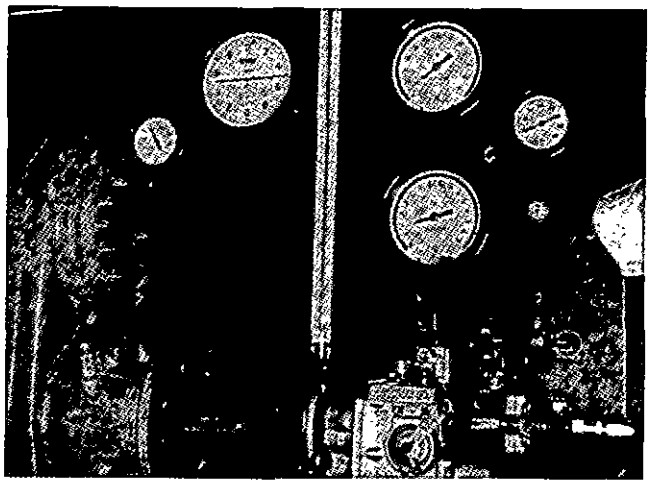


Fig. 10-54, (F5113). Open the idle orifice valve.

cool. If the temperature exceeds 135° F [57° C], drain and replace with new test oil.

9. Tighten the locknut on the screw when the setting is correct. Check the leakage again.
10. Close the throttle leakage valve.

### Set the Idle Speed

### PT (type G) Standard Governor

1. Close the control valve for the main flow and open the idle orifice valve, Fig. 10-57.
2. Move the throttle shaft to the idle position (toward the gear pump). Hold it against the stop.

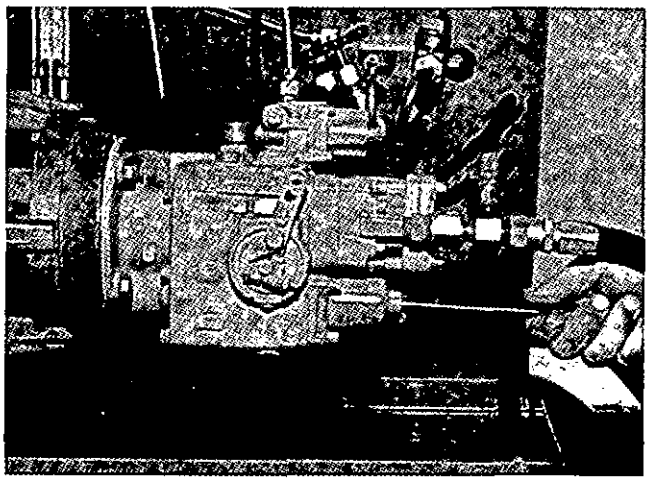


Fig. 10-55, (F5175). Adjust the standard governor idle.

3. Adjust the test stand to the idle speed on line 12 in the calibration table.
4. Check the pressure on the calibration pressure gauge. It must be the same as line 12. If the pressure is low, turn the idle and adjustment screw clockwise with 3375981 or ST-984. This screw is inside the spring pack cover, Fig. 10-55. To lower the pressure, turn the screw counterclockwise.

**Note:** Sometimes when high assist settings are in use the screw will hit the bottom of the guide and the pressure will still be low. Add another washer on the spring end of the idle screw.

**Adjust The Fuel Pressure With The Inside Throttle Shaft Plunger — PT (type G)**

1. Move the throttle to the full fuel position. If an MVS or SVS governor is in use, the governor levers must be in the rated speed position. Close the idle orifice valve and open the main flow valve.
2. Adjust the test stand speed up to the rated speed of the pump. See line 15 in the calibration tables.
3. Adjust the fuel flow meter to the flow on line 16 in the calibration table. Check the fuel pressure on the fuel calibration pressure gauge. Adjust the suction valve to 7 inches Hg or as close as possible.
4. To adjust the pressure to the specifications, stop the test stand and remove the throttle shaft, Fig. 10-56.
5. Remove the shims from the restriction plunger inside the throttle shaft and replace the assembly in the fuel pump. Adjust the suction restriction valve to 7 inch [18 cm] Hg after setting the inside throttle restriction. Repeat the pressure check and continue to remove or add the shims until the pressure is 3 to 6 psi [21 to 41 kPa] above line 15.
   a. After each adjustment, adjust the calibration flow. Keep the vacuum at 7 inch [18 cm] Hg.
   b. Some of the throttle shafts do not have a restriction plunger. Turn the rear throttle screw until the fuel manifold pressure and the pump rpm is the same as line 15. Tighten the throttle rear screw locknut.

**Adjust the Final Fuel Manifold Pressure With The Rear Throttle Screw — PT (type G)**

1. Adjust the throttle shaft that has the inside restriction plunger. Make sure the test stand is running at the speed on line 15. Turn in the rear throttle screw until the fuel pressure is down to the value on line 15, Fig. 10-57. Tighten the screw locknut.
2. Some Marine SVS governors use an overspeed stop.
   a. Tighten the adjustment screw of the

Fig. 10-56, (F564). Remove the shims from the restriction plunger.

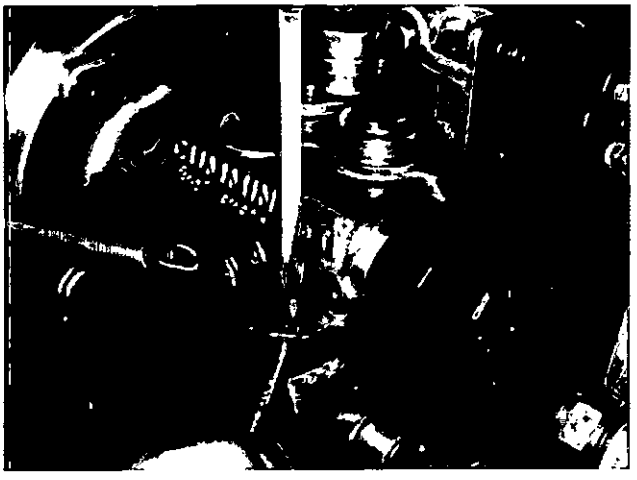


Fig. 10-57, (F5115). Final fuel manifold pressure adjustment.

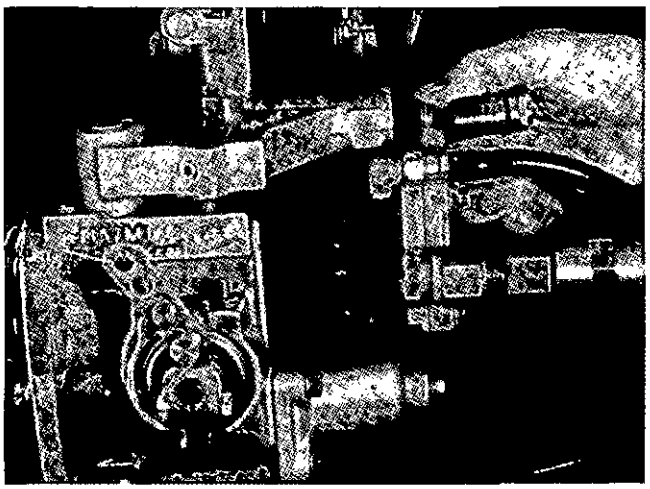


Fig. 10-58, (F5348). Shim the torque modification device.

standard throttle in the full open position after this adjustment.

3. For pumps without the inside plunger, as a stub throttle shaft, see Step 5b.
4. Check the governed speed and pressures again.

### Adjustments With The Torque Modification Device (TMD)

1. The throttle restriction plunger is set at 3 to 6 psi [21 to 41 kPa] above the specific rail pressure at torque peak rpm. (Normally 1300 rpm on Power Torque (PT)-270 Engines, pump code No. 2953.
2. Set the remaining throttle restriction at the same rpm with the rear throttle adjustment setscrews on the PT (type G) pumps.
3. Increase the pump speed to the rated rpm, normally 2100. Adjust the test stand flow if necessary and check the rail pressure.
4. The shims can be changed in the TMD at 0.005 inch [0.13 mm] at a time. This will adjust the fuel rail pressure at the rated speed, Fig. 10-58.

## Special Throttle Travel — PT (type G) Non AFC

On engines with hydraulic governors or other throttle lever travel requirements, the throttle shaft adjustments of the fuel pump are different.

1. Use a protractor, Tool No. 3375855 or ST-1162. Set the idle position centerline of the fuel pump lever at 55 degrees from the vertical on the centerline of the fuel pump throttle shaft. Tighten the throttle lever screw. Set the centeline of the fuel pump lever in the maximum position at 27 degrees from the vertical. Tighten the rear adjustment screw. Check the travel of the throttle lever centerline. It must be 28 degrees, or to the correct specifications, between the idle and the full throttle, Fig. 10-59.

**Note:** Do not adjust the front throttle stop screw to set the throttle lever travel. This screw sets the throttle leakage.

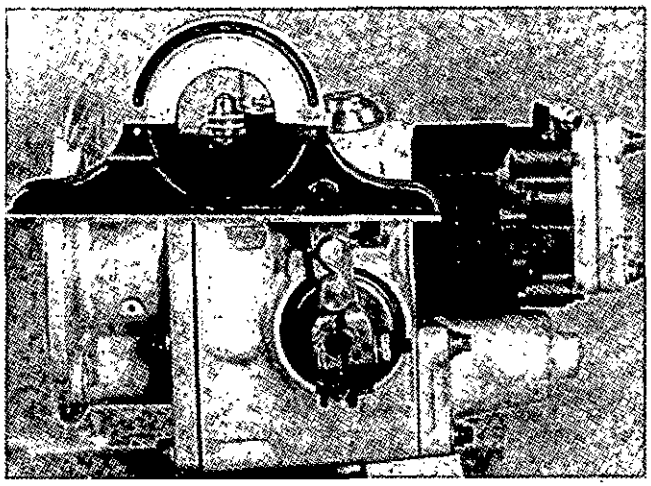


Fig. 10-59, (F5239). Set the throttle travel with a protractor.

2. Adjust the restriction plunger of the throttle shaft by shims until the correct pressure is reached.

### Compare the Check Point Pressure — PT (type G)

1. Lower the speed to "Check Point (1)", line 17 of the calibration table.
2. Adjust the flow meter to the specification of that check point.
3. Check the pressure at the calibration pressure gauge. The check point pressure must be within the range of line 17 of the table, Fig. 10-60.
4. If the pressure is above or below the range, check the torque spring on the governor

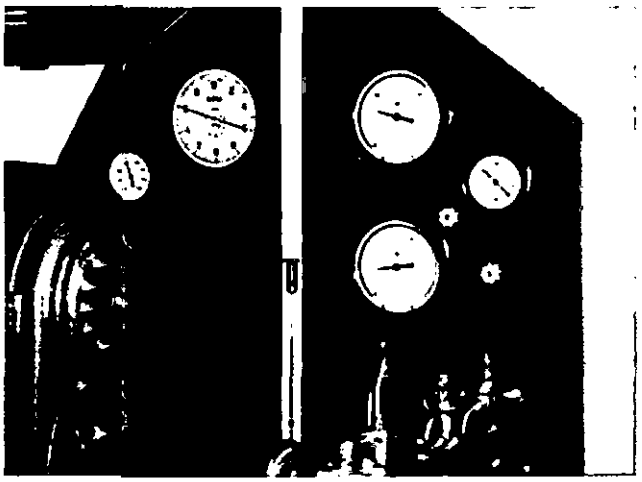


Fig. 10-60, (F5116). Check point pressure readings.

plunger. It can not be seated, not the correct shims, or the wrong spring. Check the part number in the calibration table. If the spring is changed, calibrate the fuel pump again. Check the weight assist protrusion or the pressure to see if it is changing the check point pressure. Torque spring shims are available in 0.002, 0.005, 0.010 and 0.020 inch [0.051, 0.127, 0.254 and 0.508 mm].

**Check Point 2-PT (type G)**

This check applies to fuel pumps with the weight assist plunger. Use this check to make sure the shims are correct. This will change the engine low speed torque, Fig. 10-61.

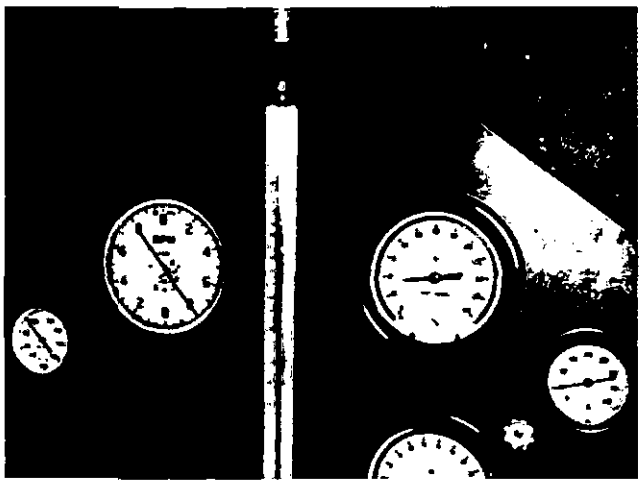


Fig. 10-61, (F5117). Check the weight assist effect.

1. Lower the pump speed to the rpm on line 19. Adjust the flow meter, if required.
2. The fuel rail pressure must be within the range of the calibration table.
3. If the fuel pressure is low, add shims behind the weight assist plunger in the governor weight carrier. To lower the pressure remove the shims. If adjustments are required, check all of the pump calibration again. Shims are available in 0.007 and 0.015 inch [0.18 and 0.38 mm].

**Note:** The plunger protrusion of the governor wieght assist can be checked and set by using Tool No. ST-1241 Checking Tool. The dimension in the calibration data is a reference dimension. This can be changed to get the correct pressure at the lowest rpm check point.

**Caution: The weight assist plunger must be installed with the smallest end toward the governor plunger.**

4. When the SVS or MVS governors are used with a power takeoff, raise the fuel pump speed to the intermediate speed. Move the governor lever to the low speed position. Adjust the low speed screw to get the power takeoff speed, if required.

## Run-In Period of the MVS and SVS Governors

1. Mount the pump the same as the standard type of pump.
2. Use a wire to hold the MVS or SVS throttle lever in the full fuel position.
3. Turn out the MVS and SVS adjustment screws of the throttle lever until they do not change the throttle movement. Tighten the locknuts.
4. Run in the pump the same as the standard pump.

## Calibration Procedure — VS Governor

### VS Governor With Standard Automotive Throttle Lever

1. Install the fuel outlet line to the fuel pump shutoff valve. This line must be installed in the hole opposite the fuel inlet. If it is installed in the side of the valve, it can cause a flow restriction and a calibration that is not correct.

2. Adjust the throttle screws so that the throttle lever has full movement in both directions. Do not tighten the locknuts.
3. Loosen the VS throttle lever adjustment screws. Turn them out until they do not stop the lever travel. Tighten the screws with the locknuts, Fig. 10-62.
4. Close the idle, leakage and pressure gauge valves. All of the valves turn clockwise to close. Open the main flow and vacuum gauge valves completely.
5. The throttle lever of the standard governor turns counterclockwise to open. The VS throttle lever turns clockwise. Attach a spring to

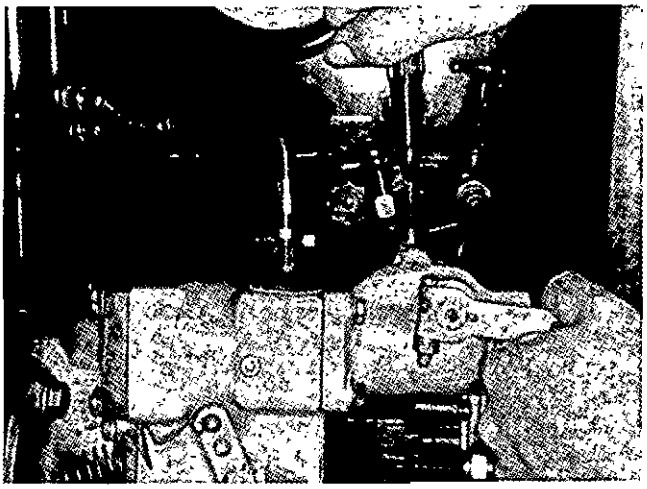


Fig. 10-62, (F5271). Turn out the VS throttle lever adjustment screw.

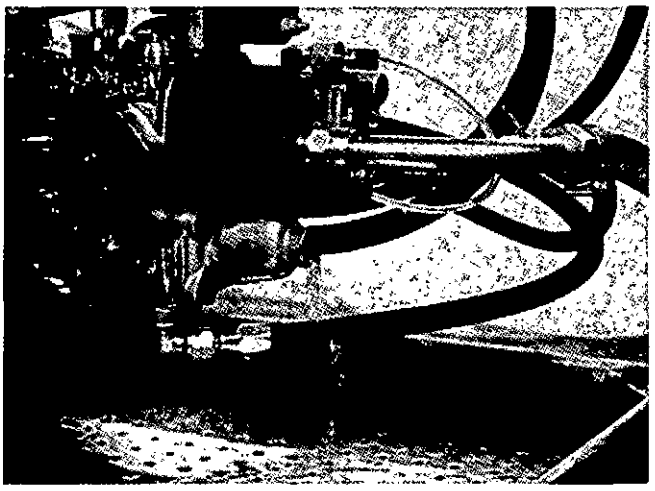
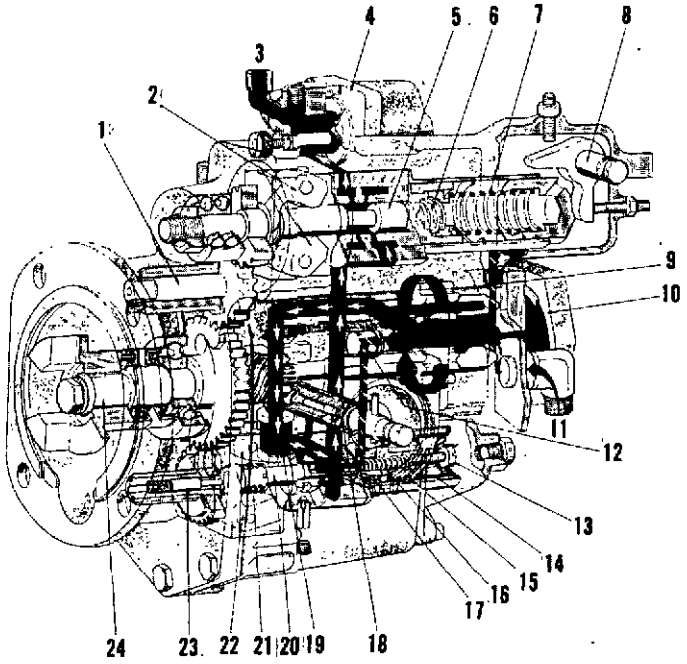


Fig. 10-63, (F5272). Spring pack cover plug removed, pump at 600 rpm.




1. Idle Gear and Shaft
2. VS Governor Weights
3. Fuel to Injectors
4. Shutoff Valve
5. VS Governor Plunger
6. VS Idle Spring
7. VS High Speed Spring
8. VS Throttle Shaft
9. Gear Pump
10. Pulsation Damper
11. Fuel from Filter
12. Pressure Regulator Valve
13. Idle Adjustment Screw
14. Spring Spacer
15. High Speed Spring
16. Idle Spring
17. Idle Spring Plunger
18. Throttle Shaft
19. Filter Screen
20. Governor Plunger
21. Torque Spring
22. Governor Weights
23. Governor Assist Plunger
24. Main Shaft

Fig. 10-64, (FWC-35). PT (type G) VS fuel pump cross-section and fuel flow.

the throttle lever of the standard governor. Attach a solid piece of wire to the VS governor throttle lever. Hold them both full open. The VS governor throttle lever can not be held with a spring.

6. Increase the pump rpm to the rated speed. Run the pump until all of the air is out by watching the flow meter.

**Check the Pressure Valve — PT (type G) VS**

1. Run the test stand at the maximum pump speed.
2. Loosen the adjustment screw locknuts of the top VS throttle shaft.
3. If the pressure valve is adding fuel pressure inside the housing, fuel will leak around the screw.
4. The valve can also be checked while running the pump at 600 rpm.
   a. Loosen the plug in the spring pack cover of the lower governor, Fig. 10-63.
   b. Do not remove this plug when the fuel pump is running above idle speed.
5. The fuel pressure inside the housing and the spring pack cover is between 1/2 and 5 psi [3.4 and 34 kPa] from 600 rpm to rated speed.

**Set the Governor Cut Off — PT (type G) VS**

1. Set the lower governor cut off the same way as the standard calibration. Set the cut off to the value in the fuel pump calibration on line 8.
2. Run the pump at the rated rpm. Turn the VS maximum speed screw (stop screw) in until the pressure starts to drop. Set the VS governor cut off to the value on line 9 in calibration table. Tighten the locknut.
3. Check the cut off by increasing the rpm until the pressure starts to drop.

**Set the Throttle Leakage — PT (type G) VS**

Set the throttle leakage the same way as the standard PT (type G) pump calibration. Adjust the top screw of the lower throttle shaft to set the leakage. See line 10 of the calibration table.

**Set the Idle Speed — PT (type G) VS**

1. Set the idle speed the same way as the standard PT (type G) fuel pump. Hold the VS lever in the full fuel position.
2. Move the standard throttle lever to the full fuel position. Move the VS throttle lever to the idle position and hold.
3. Adjust the rear VS throttle adjustment screw to set the idle. Set at the same speed as the standard governor when a special speed is not required. Tighten the locknut on the jam nut.

**Adjust the Fuel Calibration Pressure — PT (type G) VS**

Adjust the fuel calibration pressure the same way as the standard PT (type G) fuel pump.

**Compare the Check Point Pressures — PT (type G) VS**

Compare the same way as the standard PT (type G) fuel pump.

**Weight Assist Pressure Check — PT (type G) VS**

See "check point 2" in the standard PT (type G) fuel pump calibration procedure.

## PT (type G) VS Governor With "Stub" Throttle Shaft

See the VS governor procedure with the standard throttle lever for the pump hook-up and the pressure valve check.

**Set The Governor Cut Off**

1. Set the governor cut off the same way as the standard fuel pump.
2. Run the pump at the rated rpm. Adjust the VS maximum speed screw (top screw) until the pressure starts to drop. Tighten the locknut.

**Set the Idle Speed — VS Governor With A "Stub" Throttle Shaft**

1. Lower the test stand rpm to the idle rpm on line 12 in the calibration table. Close the main flow valve and open the idle orifice valve.
2. Move the VS throttle lever to the idle position and hold.

3. Turn in the idle adjustment screw in the spring assembly of the governor to the middle of the adjustment.
4. Adjust the rear VS governor throttle screw to the psi on line 12.

#### Adjust the Fuel Calibration Pressure — VS Governor With A "Stub" Throttle Shaft

1. Move the VS governor throttle lever to the full fuel position and hold it with a wire. Close the idle orifice valve. Open the main flow valve.
2. Increase the speed to the rpm on line 15.
3. Adjust the main flow valve until the flow meter is the same as line 16.
4. Set the vacuum at 7 inch Hg and the flow meter at the flow requirement on line 16 before each check.
5. The fuel pressure must be the same as line 15 in the calibration table. If not, adjust the "stub" shaft screws. Turn in the bottom screw while turning out the top screw. Tighten the "stub" shaft locknuts.

#### Compare the Check Point Pressures

Compare the same way as the standard fuel pump.

#### Weight Assist Pressure Check

See "check point 2" in the standard fuel pump calibration procedure.

#### VS Governor With Torque Converter Governor

1. Before calibrating the fuel pump, lock the torque converter governor open. Turn out the lower governor screw of the torque converter and turn the middle screw to the bottom.
2. Calibrate the pump the same way as the VS governor with a "stub" shaft.
3. When turning the "stub" shaft setscrews, to set the manifold pressure, do not twist the fuel tube to the torque converter govenor. Loosen the tube nut to take off the tension, then tighten again.
4. The governor section of the torque converter governor must be adjusted after the fuel pump is mounted to the engine. The governor must be rotated by a flexible drive cable from the engine torque converter. See the "Adjustment on Engine" section of this manual for the setting procedures.

## Calibration Procedure — MVS Governor

### MVS Governor With A Standard Throttle Lever

#### Set the Standard Governor Cut Off

1. Set the governor cut off the same way as the standard fuel pump.
2. Run the pump at the maximum rpm. Turn the MVS maximum speed screw (top screw) in until the pressure starts to drop.
3. Turn out the screw one turn and tighten the locknut.

#### Set the Throttle Leakage

Set the throttle leakage the same way as the standard fuel pump.

#### Set the Idle Speed

1. Set the idle speed the same way as the standard fuel pump. Hold the MVS Lever in the fuel position.
2. Return the standard throttle lever to the full fuel position.
3. Move the MVS throttle lever to the idle position and hold.
4. Turn the rear adjustment screw of the MVS throttle. Set the idle at the same speed as the standard governor when a special speed is not required.

#### Adjust the Fuel Calibration Pressure

Adjust the fuel calibration pressure the same way as the standard fuel pump.

#### Compare the Check Point Pressures

Compare the same way as the standard fuel pump.

#### Weight Assist Pressure Check

See "check point 2" in the standard fuel pump calibration procedure.

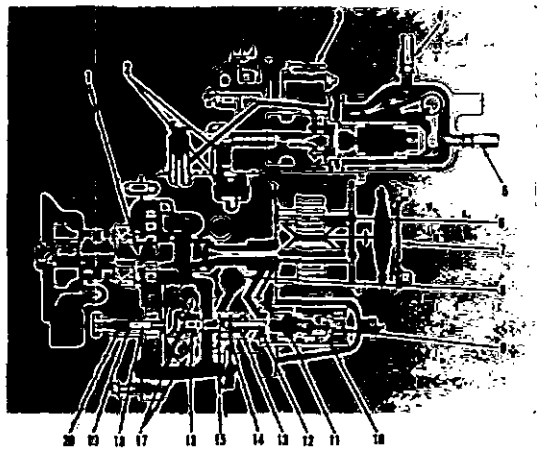
## MVS Governor With A "Stub" Throttle Shaft

### Set the Governor Cut Off

1. Set the governor cut off the same way as the standard fuel pump, Fig. 10-65.
2. Run the pump at the maximum rpm. Turn the MVS maximum speed screw (top screw) in until the pressure starts to drop.
3. Turn the screw out one turn. Tighten the locknut.

### Set the Throttle Leakage

1. Move the MVS throttle lever to the idle position and hold.
2. Open the leakage valve full open. Close the main flow valve. Run the pump at the rated speed.
3. Use a 200 cc container to check the fuel delivery for one minute.



1. Main Shaft
2. Filter Screens
3. Shutoff Valve
4. Maximum Speed Screw
5. Idle Speed Screw
6. Gear Pump
7. Pulsation Damper
8. Throttle Shaft
9. Idle Adjustment Screw
10. Maximum Speed Spring
11. Idle Spring
12. Governor Plunger
13. Gear Pump Pressure
14. Fuel Rail Pressure
15. Idle Pressure
16. Torque Spring
17. Governor Weights
18. Governor Assist plunger
19. Shims
20. Governor Assist Spring

Fig. 10-65, (FWC-9). PT (type G) fuel pump with MVS governor.

4. If the delivery is low, remove the shims between the idler plunger and the retaining ring in the MVS governor housing. The thinnest shim is 0.005 inch [.13 mm]. Sometimes it is not possible to get the exact leakage. Do not use a leakage of 15 cc over the calibration value. Other shims are available in 0.010 and 0.020 *inch [0.25 and 0.51 mm].*

**Note:** Make sure to keep all of the 1-1/2 inch [38 mm] outisde diameter shims between the governor barrel and the spring assembly housing. If any of the shims are lost, the following procedure must be followed. Remove the O-ring fuel oil seals from the adapter plate. Use the adapter plate to hold the spring assembly housing against the governor barrel. Install shims between the spring assembly housing and the govenor barrel. There must be 0.003 to 0.006 inch [0.076 to *0.152 mm] between the adapter plate and the* MVS housing when it is held by hand pressure. Remove the adapter plate. Install the O-ring fuel oil seal in the adapter plate. Assemble the MVS governor on the fuel pump.

5. If the test oil exceeds 100° F [38° C] temperature stop the test and let it cool.

### Set the Idle Speed

1. Close the main flow valve. Open the idle valve. Adjust the test stand rpm to the idle rpm requiement.
2. Turn the MVS Idle adjustment screw of the throttle lever until it does not stop the throttle travel.
3. Turn the idle screw of the lower governor out until it does not touch the retaining clip. When the clip does not touch the idle screw, the screw will turn easier.
4. Set and hold the MVS lever in the idle position. Adjust the rear MVS screw until the idle pressure is 10-12 psi [69-83 kPa] above the specifications. Tighten the idle screw locknut immediately after the adjustment is made. This will prevent air from entering the system, Fig. 10-66.
5. Adjust the lower idle screw until the idle pressure is correct.

**Note:** The MVS idle adjustment pressure is lowered as the standard idle screw is adjusted in because

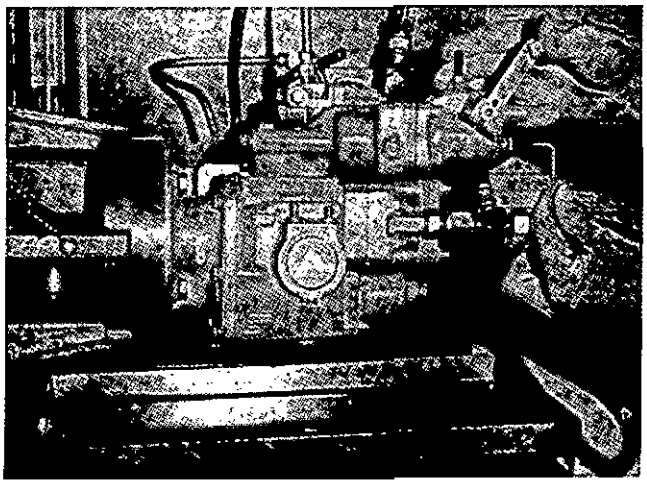


Fig. 10-66, (F5176). Adjust the MVS governor idle.

of the increasing gear pump pressure. This puts the governor in the best stability range of idle.

6. On the V6-140, V6-378, V8-185, V8-504, V555 Series Engines; use the Part No. 201116 Idle Spring. Turn the idle adjustment screw of the standard governor to the bottom. Set the engine idle with the idle adjustment screw of the MVS governor.

### Adjust the Fuel Calibration Pressure

1. Run the pump at the rated rpm.
2. Set the flow meter to the flow requirement.
3. Loosen the throttle screw of the front "stub" shaft. Tighten the rear throttle screw until the correct psi is reached. Tighten the locknuts on the adjustment screws.

### Compare the Check Point Pressures

Compare in the same way as the standard fuel pump.

### Weight Assist Pressure Check

See "check point 2" in the standard fuel pump calibration procedure.

## MVS Governor Leakage

The following check can be used on fuel pumps when the engine does not decelerate or when the fuel pump has too much throttle leakage.

1. Install a fuel pump to get fuel pessure from the test stand. This pump must have the ability to reach 220 to 230 psi [1517 to 1586 kPa] when the fuel calibration pressure valve of the test stand is closed.
2. Close the holes in both sides of the screen bore of a filter cap with silver solder.
3. Install the filter cap with the closed holes and the screen assembly in the bore of the MVS housing.
4. Install a tee with a tube into the fuel line of the test stand. Attach the tube to the 1/8 inch pipe tap hole at the filter cap end of the housing. You can use a drill and tap to put threads in the top of the filter cap.
5. Remove the retaining ring of the governor spring plunger from the spring assembly housing.
6. Move the MVS lever to the minimum speed position.
7. Close the fuel calibration pressure valves of the test stand. Increase the speed to near the rated speed. Fuel will flow from the gear pump suction. The solenoid must be manually open for this check. Check the fuel outlet temperature.

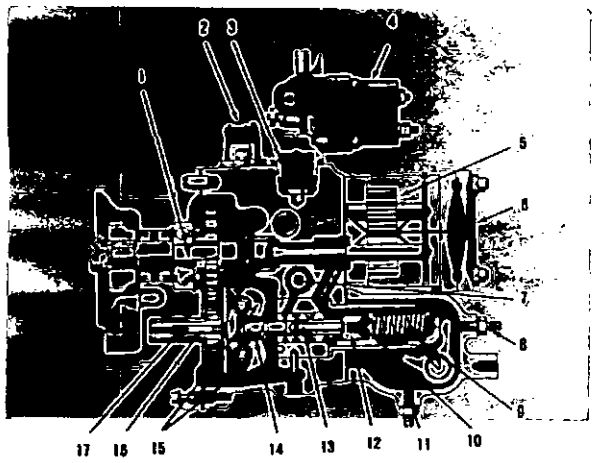
**Note:** Install a short tube in the fuel outlet of the solenoid to drain the fuel.

8. When the fuel temperature reaches 85 to 95° F [29 to 35° C] move the MVS governor lever to the maximum speed position. Increase or lower the pump speed until the calibration prssure gauge shows 220 to 230 psi [1517 to 1586 kPa]. Measure the leakage from the solenoid outlet tube. This leakage must not exceed 10 cc per minute.
9. If leakage is above 10 cc per minute, install a new plunger in the sleeve and check the leakage again. If the leakage is still too high change as follows. Remove the shims from between the governor spring plunger and the retaining ring in the spring assembly housing.
10. Install the retaining ring of the governor spring plunger in the spring assembly housing.
11. Remove the filter cap with the silver solder and install a cap with the side holes open.

## SVS Governor With Standard Throttle Lever

### Set Governor Cut Off

1. Follow the first seven (7) steps under the standard fuel pump calibration.
2. Adjust the cut off speed with the SVS high speed screw in the bottom of the SVS governor, Fig. 10-67. If the screw runs out of adjustment and the speed is still too low, change the shims. Add shims between the governor spring and the throttle plunger.
3. Tighten the locknut.




1. Main Shaft
2. Tachometer Connection
3. Filter Screen
4. Shutoff Valve
5. Gear Pump
6. Pulsation Damper
7. Throttle Shaft
8. Idle Speed Screw
9. Maximum Speed Spring
10. Idle Speed Spring
11. Maximum Speed Screw
12. Idle Plunger Button
13. Governor Plunger
14. Torque Spring
15. Governor Weights
16. Weight Assist Plunger
17. Weight Assist Spring

Fig. 10-67, (FWC-10). PT (type G) fuel pump with SVS governor.

### Set the Throttle Leakage

Set the throttle leakage the same way as the standard fuel pump.

### Set the Idle Speed

1. Close the main flow valve. Open the idle valve. Adjust the test stand rpm to the idle rpm requirement.
2. Hold the throttle lever of the standard governor in the idle position. Hold the SVS lever in the high speed position.
3. Add shims between the idle plunger and the idle spring to increase the psi. Remove the shims to lower the psi.
4. Move the standard throttle lever to the full fuel position.
5. Adjust the rear SVS screw to get the correct SVS idle speed, Fig. 10-68.

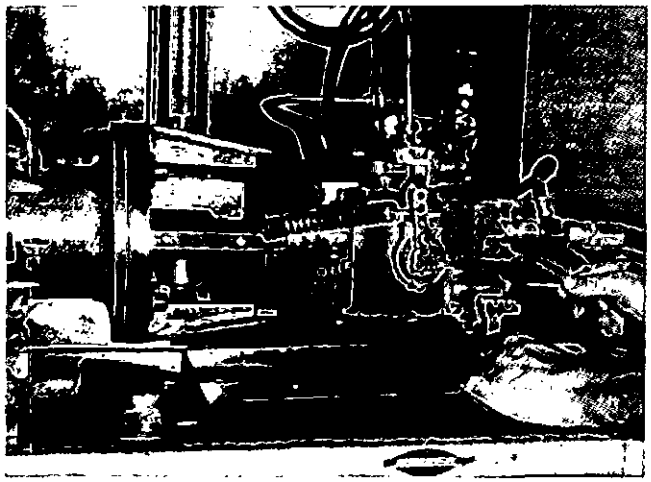


Fig. 10-68, (F5177). Adjust the SVS governor idle.

**Caution:** Do not set the SVS governor to idle under 1100 rpm on fuel pumps that have two throttle levers.

### Adjust the Fuel Calibration Pressure

Adjust the fuel calibration pressure the same way as the standard fuel pump.

### Compare the Check Point Pressures

Compare the same way as the standard fuel pump.

### Weight Assist Pressure Check

See "Check Point 2" in the standard fuel pump calibration procedure.

## SVS Governor With "Stub" Throttle Shaft

### Set the Governor Cut Off

1. Follow the first seven (7) steps under the standard fuel pump calibration.

2. Adjust the cut off speed with the SVS high speed screw, Fig. 10-67. If the screw runs out of adjustment and the speed is still too low, change as follows. Add shims between the governor spring and the throttle plunger.
3. Tighten the locknut.

### Set the Throttle Leakage

This is not required on this governor.

### Set the Idle Speed

1. Close the main flow valve. Open the idle valve. Adjust the test stand rpm to the idle rpm requirement.
2. Hold the SVS throttle lever in the idle position.
3. Adjust the rear SVS screw to get the correct idle speed.

**Note:** The idle speed can be set below 1100 rpm on the single lever pumps.

### Adjust the Fuel Calibration Pressure

1. Increase the fuel pump speed to the rated rpm.
2. Set the flow meter to the flow requirement.
3. Loosen the throttle screw of the "stub" shaft. Tighten the rear throttle screw until the correct psi is reached. Tighten the locknuts.

### Compare the Check Point Pressures

Compare the same was as the standard fuel pump.

### Weight Assist Pressure Check

See "Check Point 2" in the standard fuel pump calibration procedure.

## PT (type R) Fuel Pump Calibration

The PT (type R) fuel pump calibration procedure and the fuel pump codes are in bulletin No. 3379101.

## Check the Pump Seals

These checks are used on fuel pumps that do not have a pressure valve.

1. Run the test stand at 500 rpm. Close the vacuum valve in the suction line of the fuel pump until the vacuum gauge indicates 15 inches vacuum. The fuel flow control or needle valve must be open during this check.
2. Put a small amount of light cup grease over the vent or "weep" hole. This hole is near the seal bore of the main shaft in the fuel pump cover, Fig. 10-69.
3. If the lubricant is pulled into the hole at the 15 inch vacuum setting, the seal will not permit good engine performance. Replace the seal.
4. The above check can also be done on the throttle shaft to check the shaft O-ring. Put some lubricant on the throttle bushing around the shaft outside diameter.
5. Fill the seal bore of the housing tachometer with test oil from the test stand. If the fluid is pulled into the pump, replace the seal.
6. If the fuel pump has an MVS or SVS governor, air leakage can occur at the speed control shaft or the speed adjustment screws. The adjustment screws and the screw covers must always have copper gaskets.
7. During the above checks, look at the flow meter for air in the meter. This can or can not show air leakage into the pump. Air can be entering the lines between the tank and the pump. A slow leak will not show up quickly as air in the meter. Check the fuel level in the tank. Low fuel can cause air bubbles.
8. Leakage can occur at the gear pump to pump housing gasket, if the gear pump is not in the correct position.

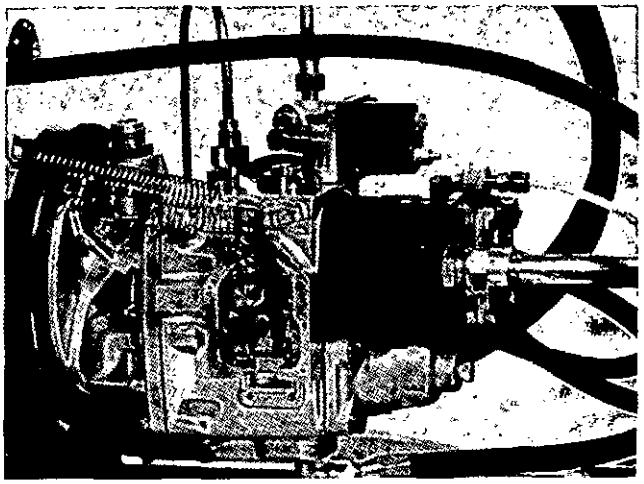


Fig. 10-69, (F5172). Check the "weep" hole for fuel leakage.

9. Tighten all of the capscrew, hose connections, pipe plugs and the filter screen cap. Check the VS filter plug O-ring.

## Check the Pump Housing for Leaks

1. Fill the fuel pump with clean fuel or test oil.
2. Remove the suction fitting at the gear pump. Install a fitting so an air pressure hose can be attached.
3. The air supply line must have a valve and a guage to control the air pressure at a maximum of 20 psi [138 kPa].
4. Apply 20 psi [138 kPa] air pressure; do not exceed 20 psi [138 kPa] or damage to the fuel oil seals can result.
5. Put fuel or test oil over the pump. Check carefully for air bubbles, which are leaks. Dry the pump or a specific area and check for wet leakage. Do not use this check for fuel oil seals.

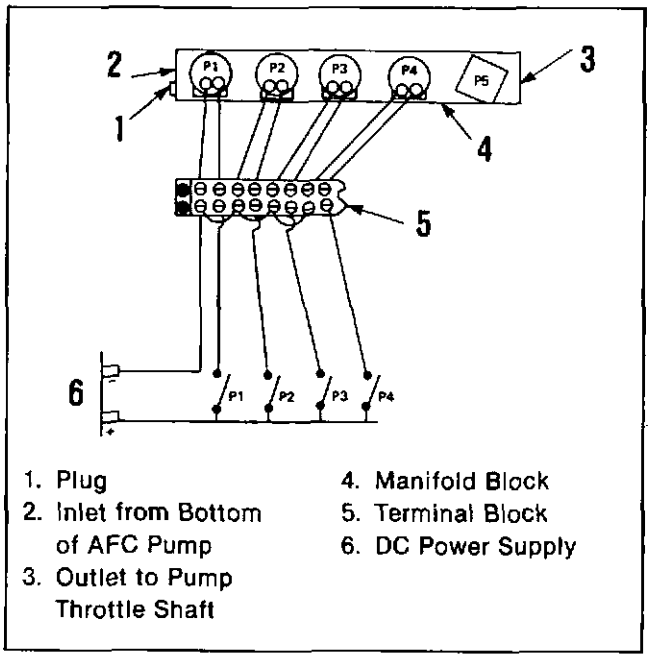
## Multiple Unit Throttle Control

### Changing the Control

The manifold block is the same on all units. The solenoid control valves can be changed to match the voltage requirements. The orifices must be changed according to the fuel pump (code) used on the engine. The orifices control the resulting horsepower.

**Caution: If a throttle control is changed in the field it is very important that the block be marked with the new fuel pump code number. This will identify the orifices used in the assembly.**

1. Install the orifice plugs in the multiple unit throttle control valve manifold under the solenoid valves. See the fuel pump code for the correct orifice plugs. There are two orifice plug holes at each location except Position 5.
2. The Orifice plugs available are in the Injector Manual, Bulletin No. 3379071, Table 5-2, under "Flanged Part Number". Service Tool 1332-1 or 1332-2 must be used to check each orifice size. **Do not rely on sizes determined by parts number only.**
3. Where a "blank" orifice is specified, use Part No. 173085. The gasket, Part No. 173086, is used below each of the orifice plugs.




1. Plug
2. Inlet from Bottom of AFC Pump
3. Outlet to Pump Throttle Shaft
4. Manifold Block
5. Terminal Block
6. DC Power Supply

Fig. 10-70, (F5405). Wiring diagram for multiple unit throttle control.

4. The orifices are to be tightened to 8 to 10 in.-lbs. [11 to 14 N•m] torque.
5. The wiring diagram for the control is shown in Fig. 10-70.

### Calibration Instructions

The following test equipment and service tools are necessary for the calibration or troubleshooting of the fuel pump:

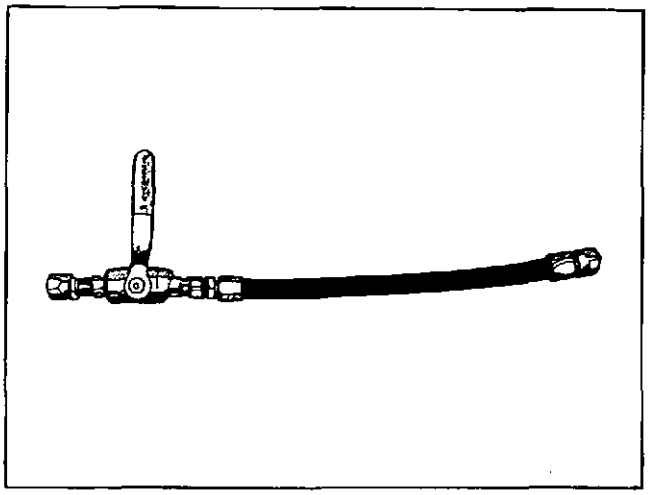


Fig. 10-71, (F5406). Jumper tube and valve.

1. ST-848 or 3375698 Fuel Pump Test Stand with the current test features.
2. Injector orifice size gauge, ST-1332 and torque wrench ST-1090 for orifice sizing and installation.
3. Jumper tube and valve, Tool No. 3375600. This tool is required to calibrate the fuel pump without the fuel manifold control attached to the pump, Fig. 10-71.

**Pump Hookup**

1. The fuel pump hookup is the same as the standard pump.
2. Make sure the throttle shaft is adjusted so the fuel port is wide open and temporarily locked in position with the throttle stop screws.
3. Install the jumper line from the bottom of the fuel pump (front outboard pipe plug hole) to the throttle shaft.

**Run In and Governor Cut Off Speed**

1. Make sure the throttle shaft is set wide open as previously described and the jumper line valve is open.
2. Make the run in and set the governor cut off speed the same way as the standard pump.

**Set the Idle Speed**

1. Close the main flow control valve, jumper line valve, and open the idle orifice valve.
2. Set the idle speed the same way as the standard pump.

**Adjust the Callbration Pressure**

1. Close the idle orifice valve, open the main flow valve and the jumper line valve.
2. Increase the test stand speed up to the rated speed of the pump. Adjust the flow to the calibration code.
3. If the calibration pressure is not to the specification in the calibration code, adjust the throttle to the calibration pressure with setscrews only. Do not turn the shaft more than the equivalent of one turn of the setscrew without loosening the tube nut to prevent the tube from twisting. When the pressure is correct, lock the throttle in position with the setscrews.

**Check Points and the AFC Settings**

Make these settings the same way as the standard pump.

**Calibration Pressure Adjustment to Verify Full Pressure**

1. Disconnect the jumper line from the outboard side of the valve and install the multiple unit throttle control in the line. The jumper line will go from the bottom of the pump to the inlet of the multiple unit throttle control and the outlet from the control to the jumper valve. Open the jumper valve wide open. If desired, the jumper line can be removed and the lines used on the engine.
2. Activate all of the solenoid valves to make them open. Check the calibration pressure against the fuel pump code. If the pressure is higher or lower than the code, adjust the throttle stop screws until the pressure is correct. Lock the throttle shaft in position. The unit and pump are now ready to seal and install on the engine.

## Gear Pump Test

1. Use a modified fuel pump that is made with only the parts required to drive the gear pump. If necessary, a full fuel pump can be used. Remove the governor plunger, weight assist plunger and spring assembly. Fill the pump housing with fuel. This will prevent any possible damage to the governor plunger or governor barrel. The gear pump can be mounted directly to the test stand with an adapter bracket.
2. Install a Tool No. ST-844 Gear Pump Block Plate, with a gasket on each side, between the gear pump and the fuel pump housing, Fig. 10-72.
3. Remove the gear pump damper from the gear pump. Install a copper tube from the orifice block to the gear pump pressure hole.
4. Install the fuel suction line to the suction side of the gear pump. Install a line from the

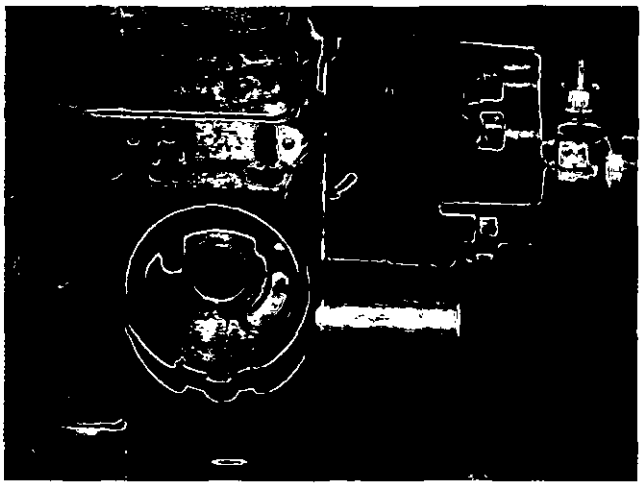


Fig. 10-72, (F5166). ST-844 gear pump block plate.

cooling kit drain connection of the gear pump to the fuel supply tank.

**Note:** Some old type of gear pumps do not have a drain hole. Use an old type of damper with a tapped hole for this connection.

5. Turn off the calibration pressure gauge to prevent damage from over pressure.
6. The valve in the suction line and the valve controlling the main flow orifice are to be fully open. All other valves must be completely closed. When the valves are in this position, fuel will go through the manifold.
7. Start the pump drive in the correct rotation. Run the pump at 400 to 450 rpm. The gear pump must start the fuel flowing at this speed without priming. Any gear pump that does not start the fuel flowing after 30 seconds, must be replaced. The remaining steps of this check do not need to be made on any pump that fails to start the fuel flowing.
8. Increase the pump speed. Adjust the pressure to 350 psi [2413 kPa].

**Table 10-1: Gear Pump Flow**

| Gear Pump | Minimum RPM | Total Flow |
|---|---|---|
| 7/16 [11.11] | 2100 | 625 lb./hr. |
| 3/4 [19.05] | 2100 | 1175 lb./hr. |
| 1 [25.40] | 1600 | 1175 lb./hr. |
| 1-1/4 [31.75] | 1400 | 1200 lb./hr. |
| PT-H | 1400 | 1900 lb./hr. |

Any gear pump with a delivery below the value in Table 10-1 must be replaced. Any gear pump which is wet to touch after this check must be replaced.

**Note:** The minimum total flow requirement will be higher for the NT high flow and other engines which are over 650 bhp at 2100 rpm. The requirement for replacing these pumps will be the ability to get the required fuel calibration pressure on the test stand.

9. Any gear pump, with a delivery above the minimum, is acceptable for fuel pump operation. It can be installed on a fuel pump for calibration.
10. The following check must be made if the gear pump delivery is just above the minimum in Table 10-1. The fuel pressure, before the throttle shaft, inside the fuel pump must be checked. This is the "unrestricted fuel pressure". This pressure must be 10 to 15% higher at the rated speed than the outside rail pressure.

**Note:** The idle plunger (counterbore-diameter) can be decreased in size to increase the amount of pressure available at the calibration setting.

**Caution: Use Step 10 only if the gear pump is worn which will prevent it from deliverying enough pressure for the correct calibration. Never change the idle plunger to exceed the 10 to 15% "unrestricted fuel pressure".**

# Recheck Specifications

1. When a PT (type G) fuel pump is calibrated on one test stand and rechecked on another test stand, the calibration values can change. This can occur because the test stands are not exactly the same. This is due to manufacturer tolerances, gauge tolerances, test oil viscosity changes, etc.
2. This change can also occur with a pump that is adjusted on the engine and then checked on a test stand.
3. The test stand audit program will reduce the test stand changes to an acceptable limit of ±2 psi [14 kPa]. This program will minimize the gauging and plumbing errors and improve the checking procedures.
4. A tolerance has been set on the fuel pump calibration values for rechecking the pump; (A) On another fuel pump test stand or; (B) On any fuel pump test stand after it has been calibrated on a test stand and then adjusted on the engine. These tolerances are on the following pages.
5. If the fuel pump is within the tolerances of Table 11-1, check the following:
   a. The injectors are not correctly calibrated and/or installed and/or adjusted.
   b. The engine air intake, exhaust or fuel suction restrictions are too high.
   c. The engine has the wrong parts for the fuel pump code. Check the CPL.
   d. The pump was adjusted on the engine to give the wrong fuel rail pressure and fuel rate.
   e. The test stand used for the recheck is not within the acceptable limits.

## Pump Specifications

1. Governor Cut Off or Break RPM.

   The governor cut off rpm is the speed where the fuel rail pressure starts to drop from the maximum pressure as the speed is increased.

   a. When checking from one test stand to another, the cut off speed can change ±10 rpm from the cut off rpm.

      Suction vacuum must be set at 7 inch Hg.

   b. Recheck from the engine test to the fuel pump test stand. The cut off speed can be from the rated speed to the maximum cut off speed +10 rpm.

      *Suction vacuum must be set at 7 inch Hg.*

2. Throttle Leakage.
   a. The throttle leakage is set with the throttle lever held firmly closed. The pump is run at the rated speed and the fuel leakage is measured for one minute.
   b. The recheck from one test stand to another can change ±15 cc from the publication value.
   c. The recheck from the engine to the fuel pump test stand can change ±25 cc/min.
3. Idle Speed Pressure
   a. The recheck from one test stand to another. The pressure can change ±10% or ±1 psi from the specifications, whichever is greater.
   b. If the engine has been idling properly, do not change the idle.
4. Calibration Pressure at Rated Speed.
   a. The recheck from one test stand to another can change ±2 psi from the publication specifications.

   The suction vacuum must be set at 7 inch Hg.

   b. The recheck after the engine adjustment can change ±2 psi from the on engine specification.
5. Calibration Pressure Check Point.

Recheck the pump at rated speed. Get the exact calibration pressure from the fuel pump code by adjusting the flow control valve.

Suction restriction must be set at 7 inch Hg.

a. The first and second check points can change ±2 psi from the calibration specification when being checked from one test stand to another.

b. When checking from an engine to the test stand, the pressure can change ±5% of the nominal value +2 psi from the published range.

6. AFC Plunger Setting

a. When checking from one test stand to another or from an engine to a test stand, the pressure can change ±10 psi.

7. AFC No Air Needle Valve Setting.

a. The no air setting can change ±5% from the publication value when checking between test stands.

**Note:** The service tools and procedures in Section Ten must be used to set the AFC.

b. This value can change ±7 psi when checking from an engine to a test stand.

8. Throttle Travel.

a. When checking between test stands or from an engine to a test stand, the travel can change ±1 degree.

**Table 11-1: Calibration Recheck Specifications (Example: Code 3512 shown in parenthesis)**

| Column I | Column II | Column III |
|---|---|---|
| **Check** | **One Test Stand To Another** | **Tested and Adjusted on Engine and Rechecked On Fuel Pump Test Stand** |
| Governor Break or Cut Off (1930/1950) | ±10 rpm from the Publication Values (1920/1960) | Governor Speed to the Maximum Cut Off Publication Value ±10 rpm (1900/1960) |
| Idle Pressure (60 psi @ 500 rpm) | ±10% of Publication Value or ±1 psi whichever is greater. (54/66 psi @ 500 rpm) | Do Not Change if it is correct on the engine. |
| Calibration Pressure at Rated Speed, Test Stand (180 psi) on Eng. Rail (167/185 psi) | Publication Value ±2 psi (178/182 psi) | Publication Value ±2 psi (165/187 psi) |
| Check Points | Publication Range ±2 psi | Publication Range ±(5% of Test Stand Recheck Value +2 psi) |
| No. 1 (121/127 psi)<br>No. 2 ( 86/ 92 psi) | (119/129 psi)<br>( 84/ 94 psi) | (113/135 psi)<br>( 80/ 98 psi) |
| AFC Plunger Setting (83 psi) | Publication Value ±10 psi (73/93 psi) | Publication Value ±10 psi (73/93 psi) |
| No-Air Setting (58 psi) | ±5% of Publication Value (55/61 psi) | Publication Value ±7 psi (Use Engine Flow Area Method of Checking (51/65 psi) |
| Throttle Leakage (75 cc/min.) | ±15 cc/min. (60/90 cc/min.) | Publication Values ±25 cc/min. (50/100 cc/min.) |
| Throttle Travel (27/29 deg.) | ±1 deg. from Publication Value (26/30 deg.) | ±1 deg. from Publication Value (26/30 deg.) |
| Air Signal Attenuator (3007434-Air) (8/10.4 units) | Same as Publication Value (8/10.4 units) | Same As Publication Value (8/10.4 units) |
| Air Signal Attenuator (3020760-Hyd) (400/500 cc/min. @ 40 psi) | Same as Publication Value (400/500 cc/min. @ 40 psi) | Same As Publication Value (400/500 cc/min. @ 40 psi) |

9. Checking the Air Signal Attenuator (ASA) in the AFC Cover.

   This is an air type of ASA. Use the test stand Tool No. 3375934 to test this value.

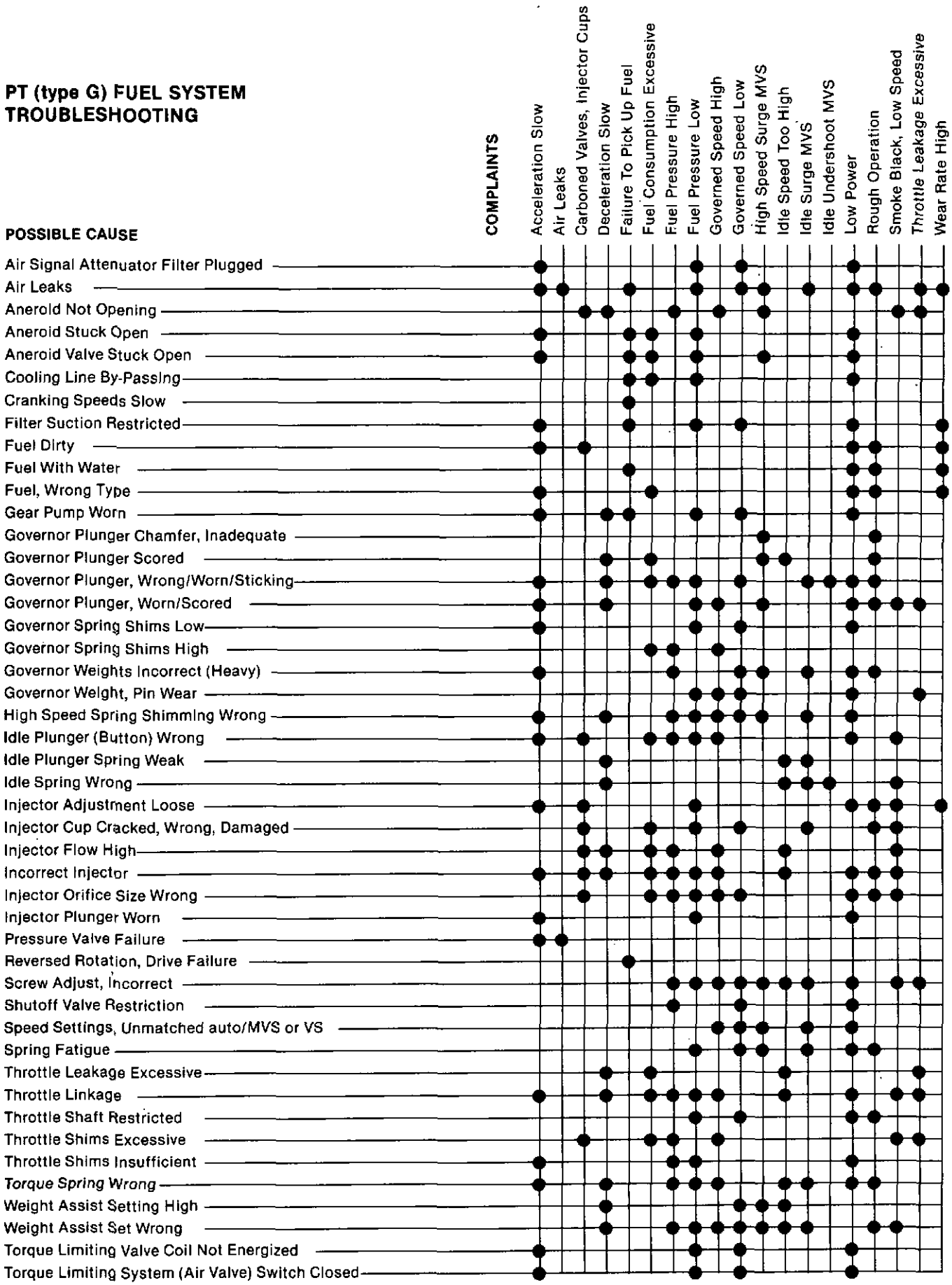
   a. The recheck limits are the same as the new valve limits. This valve must check between 8 and 10.4 units.

10. Check the Hydraulic ASA

    This ASA is in the top of the fuel pump housing.

    a. The recheck limits are the same as the new valve limits. This valve must check between 400 and 500 cc/min. @ 40 psi.

## PT (type G) FUEL SYSTEM TROUBLESHOOTING



# AFC Fuel Pump Troubleshooting

## PT (type G) AFC Fuel Pumps

The following chart can be used for the PT (type G) AFC fuel pumps. Before testing or troubleshooting any fuel system, make sure the operation of the pressure gauges, regulators, flow meters, tachometers, etc., are correct and are calibrated yearly.

The troubleshooting of the AFC (Air Fuel Control) falls within two basic conditions, fuel leakage and/or hard to drive.

**Fuel Leakage** — This is when the fuel runs out of the vent capscrew onto the ground. This will occur only in the old type of AFC pumps. The fuel pumps now being assembled do not have a vent capscrew or a glyd ring on the plunger. Some pumps now have a hydraulic ASA on the pump housing which will drain this fuel back to the fuel drain system. If excess leakage is present on a pump without a hydraulic ASA, install a line to the fuel drain system.

1. Some fuel in the AFC cavity will be there because the glyd ring seal is made with a very small controlled leakage (1 drop each 5 to 10 strokes). The evaporation of this leakage will occur before it runs on the ground.
2. Leakage in any amount does not change the performance — either acceleration or top end power. In fact, the seal can be removed completely with no effect on the engine performance if a drain line is installed.

**Hard to Drive** — Hard to drive is separated into two general areas with different conditions.

1. Starting and/or slow acceleration.
2. Low power and/or no acceleraiton.

**Note:** A service training film and booklet are available relating to driveability.

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| Fuel Leakage out of the vent capscrew in the front cover. | The AFC Barrel is out of location. | Check the AFC barrel retaining ring. Heavy Leakage. | Install a spring under barrel. Install retaining ring, shim if necessary. Make sure the barrel does not move. |
| | Damaged seal on the AFC plunger. | Check glyd ring and O-ring. Small leakage. Check barrel and plunger finish. | Install a vent line from the top of the housing to the fuel drain. |
| | Scratched AFC barrel plunger | Small leakage from vent screw. | Replace the barrel and plunger. Install vent line. |
| | Dirt enters from loose vent screw media. | Media loose in screw. | Remove vent screw. Install vent line. |

**Note:** Most of the fuel pumps in service that had the vent capscrew in the front cover have been changed to use the vent line to the fuel drain. This is the quickest way to correct this fuel leakage.

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| **Starting and/or Slow Acceleration** | | | |
| Hard starting or engine will not start. | The no-air needle valve is shut off, or set too low. | Apply 25 psi [172 kPa] air pressure to the AFC unit. | If the engine starts reset the no-air needle valve. |
| | | **Caution: Too much pressure will damage the bellows.** | If the engine does not start, the AFC is not at fault. |
| The no-air valve will not set to limits. | Set before the AFC plunger adjustment, not after. | Reset | Make the AFC adjustment then no-air valve. |
| | Pressure is set too high. | Reset | Loosen the jam nut, turn the valve (cw) until the pressure is correct, tighten the jam nut. |
| | Pressure is set too low. | Reset | Loosen the jam nut, turn the valve (ccw) until the pressure is correct, tighten the jam nut. |
| **Note:** After any calibration adjustment to the pump, adjust the AFC and no-air valve settings again. | | | |
| The AFC pressure will not set to limits. | The no air needle valve not hitting the bottom during adjustment. | Reset. Check the thread depth so the valve seats. | Loosen the jam nut on the valve. Turn the valve down against the seat. Check for no flow before adjusting the AFC. The bottom tap threads are 5/16-24 UNF. |
| | The pressure is set too high. | Reset. | Loosen the jam nut. Turn the AFC plunger (ccw) until pressure is correct. Tighten the jam nut. |
| | The plunger is sticking. | Differential pressure must not exceed 15 psi. | See "AFC Doesn't Repeat". (See Below) |
| The plunger and barrel are damaged. | The vent screw filter media is loose. | Media loose in the screw. | Remove the vent screw. Install a vent line. |

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| **Starting and/or Slow Acceleration (Continued)** | | | |
| The AFC does not repeat within the recheck limits. AFC recheck ±10 psi. No air recheck ±5%. | High plunger-to-barrel seal movement resistance. | Set AFC to limits. Increase the air to 25 psi [172 kPa] and decrease to the setting, record the value. Must not exceed 15 psi [103 kPa] difference in values. | Move the AFC plunger in and out several times. Check the barrel surface finish. |
| Slow acceleration. | Plugged vent capscrew. | Blow through freely. | Clean or replace each time it is removed, and at the "C" Maintenance Check. |
| | The AFC barrel is loose. | Add the parts noted, as necessary. | Correct the installation or add the 139585 Spring to the bottom of barrel *and add the S-16240* Snap Ring. |
| **Low Power and/or No Acceleration** | | | |
| The power is low. | The air pressure required to actuate the AFC is higher than the specifications. | Apply 25 psi [172 kPa] air pressure to the AFC unit. A large air leakage will be at the vent capscrew. | Replace the bellows. The bellow's action forces the air out. A small air leak will always occur. |
| | The AFC spring or the setting is wrong. | Check the AFC spring setting, and/or color code. | Adjust the AFC setting or change the spring. |
| | The AFC plunger is stuck in the starting position. | Apply 25 psi [172 kPa] to the AFC unit. Check for a rise in the fuel pressure as the throttle is moved forward. | Remove and check the plunger and barrel and clean. Check seals. |
| | The bellows is damaged. | Large air leak. | Install a new bellows. A small air leak can be the bellows action. |

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| **Low Power and/or No Acceleration (Continued)** | | | |
| The power is low. (Continued) | The power fall off is rapid near the torque peak. The AFC restricts early. | Check the AFC setting. | Reset. The AFC must be fully open at least 100 rpm below the torque peak. |
| | Check for a plugged filter vent capscrew. | Blow through freely. | Clean each time it is removed, and at the "C" Maintenance Check. |
| | The throttle travel is restricted. | Check the throttle travel. | Set at 28 degrees or the setting in fuel pump code. |
| The bellows leaks. Fuel leaks around the AFC cover. | Wrong use of the AFC service tool or the cover is to tight. | Bellows is damaged. Torque the cover capscrews. | Install the tool sockets over the nuts and tighten to 30/35 in. lb. [3.4 to 3.9 n•m] only. |
| | The bellows is upside down. Not aligned with the bolt pattern. | Visual check. | Change or replace the bellows. |
| | The bellows is damaged. | Visual Check. | Replace the bellows. |
| Fall Off in Power. | The AFC barrel has movement. | See Slow Acceleration. | |
| Engine will not accelerate correctly. | The air line to the AFC is leaking, closed, or not connected. | Check for a loose line, loose connections, or a closed line. | Tighten the connection lines or replace the line. |
| | The bellows is damaged. | Apply 25 psi [172 kPa] air pressure to the AFC. Air leakage is at the vent screw. | Replace the bellows. |
| Engine will not accelerate correctly. | The vent capscrew is closed. | Remove the screw and check the AFC operation. | Remove the vent screw. Install a vent line to the gear pump drain. |
| | The no-air needle valve is set low. | Reset. | Reset. |

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| **Low Power and/or No Acceleration (Continued)** | | | |
| Engine will not accelerate correctly. (Continued) | The AFC plunger does not move easily. | Remove the cover and check the plunger movement. Also see "AFC Doesn't Repeat". | Remove and check the plunger and barrel and clean. Check the seals. |
| | The AFC setting is wrong. Too much delay. | Check the plunger setting. | Reset to the specifications. |
| | Injector drain line closed. (AFC vented into the drain line.) | Loosen the AFC cover. The fuel is under pressure inside of the bellows. | Remove the restriction or replace the line. |
| | The fuel tank vents are closed. | Loosen the AFC cover. The fuel is under pressure inside of the bellows. | Remove the restriction. |
| Air leakage is at the AFC vent screw or in the fuel drain line. | The bellows is damaged. | Large air leakage from the vent screw. Air pressure in fuel tanks. | Replace the bellows. |
| | The AFC seal gasket (cork) is not compressed, or is damaged or missing. | A small air leakage is from the vent screw. | Tighten the nut on the piston assembly to 30 to 40 in. lb. [3.4 to 4.5 n•m]. |
| | | | Put the bolt in the center of the piston so the gasket will seat. |
| | | | Replace the gasket. |
| | The teflon tape seal on the AFC plunger threads. | Remove the plunger nut and check for tape or sealant. | Put some tape on the plunger threads. |
| Too much smoke. | The fuel pump flow is exceeding the calibration specifications. | Install the ST-435 pressure gauge to the pump shutoff valve. Apply 25 psi [172 kPa] air pressure to the AFC unit. Check the pressure against the calibration specifictions. | If the fuel pressure is within the specifications, the fuel rate is satisfactory. If above the specification, adjust the fuel pump pressure. |

| Condition | Possible Cause | Checking Procedure | Change |
|---|---|---|---|
| **Low Power and/or No Acceleration (Continued)** | | | |
| Also check:<br>Injectors<br>Turbocharger<br>Engine Timing | The AFC spring, plunger setting or no-air setting is wrong. | Check the pluner and no air settings on the test stand. | Change the spring. Adjust the plunger or the no-air needle valve. |
| The engine fuel pressure is low. | The AFC is not wide open. | With a gauge at the shutoff valve, idle the engine then snap the throttle wide open. | Reset the AFC. Can use for other pump problems as a troubleshooting aid on the engine. |
| Fuel leakage is out of the no air needle valve. | The no air needle valve O-ring is bad. | Check the O-ring for damage and the valve bore for a rough surface. | Replace the O-ring. Remove the rough surface as necessary using the correct tools. |

**Notes:**

1. When checking the AFC barrel inside diameter, a polished surface is normal. Deep scratches will cause leakage with a new seal. Replace the barrel and plunger.
2. The AFC plungers will have a polished surface. Little scratches are normal. Deep scratches require a plunger replacement.
3. When any fuel pump component is replaced, make sure it is clean and lubricated. When the AFC section is installed, use a torque wrench. Make the check described under "AFC does not repeat within the recheck limits".

# PT (type G) Fuel Pump Troubleshooting With the Fuel Pump Test Stand

This part of the manual must be fully understood by the fuel pump test operator.

This information will give the operator the ability to calibrate a fuel pump correctly. The fuel pump calibration on the fuel pump test stand, along with the injector calibration will make the fuel system very accurate. There have been reports of wrong calibrations. The cause of these errors come in three basic categories: (1) mechanic and/or operator error, (2) instrument errors or (3) bad maintenance.

1. **Mechanic Error**
   a. Wrong specifications and parts:
      1) Calibrating a specific fuel pump assembly to the wrong value.
      2) Calibrating a specific injector assembly to the wrong flow value.
      3) Not knowing how to use this bulletin and/or Bulletin Nos. 3379077, 3379101, 3379068 or 3379182.
      4) Use of a camshaft and pistons other than those shown in fuel pump calibration specifications or in the control parts lists.

**Note:** The pistons, camshafts and injectors are a part of the engine CPL. Make sure the correct combination of parts are used. See the CPL Bulletin No. 3379133. Not using the correct parts and calibration values can lead to a possible fine from the EPA or other regulatory agencies.

      5) Use of the wrong injector assemblies in a specific engine model.
      6) Use of the governor and torque springs other than those specified in the fuel pump calibration data.

   b. Engine Test
      1) The intake air to the engine has too much restriction.
      2) There is too much exhaust back pressure.
      3) The fuel supply to the engine has too much restriction.
      4) Air is in the fuel supply to the engine.
      5) Too much oil is in the engine crankcase.
      6) The injector adjustment is wrong.
      7) Dirt is entering the injector balance orifice.

2. **Instrument Errors**
   a. There is a bad fuel manifold pressure gauge on the engine and/or on the chassis dynamometer.
   b. The flow meters are not set correctly.
   c. The dynamometer load gauges are not set correctly.
   d. The tachometer is not correct.

3. **Bad or No Maintenance**
   a. The use of hose lengths, diameters and materials other than those which are specified. Fuel tubing or hoses to or from the engine which are not routed to the specifications.
   b. Filter assemblies which will change the fuel flow in the system.
   c. Important components of the test stand such as the check valve, gauge and hydraulic injector clamping that have little or no maintenance.
   d. Failure to make the checks with a properly mastered test stand.

## Problems and Changes — PT (type G)

The following pages are a list of the problems and the items to check. There will be no test stand errors if it has the correct maintenance and is audited regularly.

## No. 1 Problem
## Gear Pump will not pick up fuel at 450 rpm.

| | Cause | Change |
|---|---|---|
| Check 1: | The pump is turning in the wrong direction. | Check the pump for right or left hand rotation. Set the test stand rotation correctly. |
| Check 2: | The drive coupling is not engaged. | Join the fuel pump and the test stand drive couplings. |
| Check 3: | The flow valve is not open. | Open the flow valve of the test stand to let the fuel enter the gear pump. |
| Check 4: | The shutoff valve is not open. | Open the shutoff valve on top of the fuel pump. |
| Check 5: | The openings are not sealed correctly. | All of the openings must be sealed. Use new gaskets where it is necessary. |
| Check 6: | The suction connection is not tight or is damaged. | Tighten the suction connection or replace it, if it is damaged. |
| Check 7: | Closed fuel passages. | Clean the fuel passages so they are all open. |
| Check 8: | The gear pump is worn. | Replace the gear pump if it will not deliver the flow required. |

## No. 2 Problem
## Fuel will not clear in the main flow meter because of an air leak.

| | Cause | Change |
|---|---|---|
| Check 1: | The front fuel oil seal has a leak. This can be checked on a non-pressurized pump by filling the "weep hole" in front cover with grease. This will stop the air from entering. | Remove the fuel pump from the test stand. Remove the front cover and install new fuel oil seals in cover. |
| Check 2: | The suction connection is not tight or is damaged. This can be checked by putting test oil over the suction connection. | Tighten the suction connection or replace it if it is damaged. |

## No. 2 Problem (Continued)
## Fuel will not clear in the main flow meter because of an air leak.

| | Cause | Change |
|---|---|---|
| Check 3: | The main housing or the spring pack cover gasket has an air leak. | Replace the gaskets as required. |
| Check 4: | The tachometer drive oil seals have a leak. Check by putting test oil over the tachometer drive housing. | Replace the tachometer drive oil seal in the main housing. |
| Check 5: | The fuel level in the test stand tank is low. | Fill the fuel tank with Cummins test oil. |
| Check 6: | The throttle shaft O-ring or housing leakage can be checked by putting fuel oil over the housing. | Replace the O-ring on the throttle shaft or replace the housing if it has a leak. |
| Check 7: | The pressure valve does not operate | Replace the pressure valve. |

## No. 3 Problem
## The governor can not be adjusted correctly at the breaking point.

| | Cause | Change |
|---|---|---|
| Check 1: | The Governor Spring is not correct. | Replace the spring. See the calibration data and Table 18-1. |
| Check 2: | The weights are loose or broken. The welded weight pins or carrier is broken. | Replace with new parts as necessary. |
| | The governor weights are not correct for that specific pump. | The correct governor weights must be installed. |
| Check 3: | The drive tang of the governor plunger is broken. | Replace the drive tang on the plunger assembly. |

## No. 3 Problem (Continued)
## The governor can not be adjusted correctly at the breaking point.

| | Cause | Change |
|---|---|---|
| Check 4: | The governor barrel is not in housing correctly. This prevents the fuel passages from alignment. | Align the fuel passages to help the fuel flow restriction. This can be done by heating the housing in an oven at 300°F [149°C]. Remove the barrel and then install it in the housing again. |
| | The governor barrel is not held into position. | Make sure the fuel passages are aligned. Install the pin into the governor barrel. |
| Check 5: | The spring'assembly retaining ring is out of the groove. | The retaining ring must be in the groove to correctly adjust the governor. |

## No. 4 Problem
## The throttle leakage is above the limit in the calibration code.

| | Cause | Change |
|---|---|---|
| Check 1: | The leakage adjustment is too high. | Adjust the throttle leakage. |
| Check 2: | The throttle shaft is damaged or is the wrong fit in the throttle sleeve. | Install the next size larger throttle shaft, if necessary. The fit in the bore must be free when rotating or moving in or out of the bore by hand. If an oversize shaft does not correct the leakage, send the housing to a rebuild center. |
| Check 3: | The governor plunger is not a correct fit in the governor barrel. | Install the next size larger plunger. The fit in the bore must be free when rotating or moving in or out of the bore by hand. |

## No. 5 Problem
## The fuel calibration pressue is out of the specifications.

| | Cause | Change |
|---|---|---|
| Check 1: | The test stand is set at the wrong flow rate. | Set the test stand at the flow rate in the calibration code for the fuel pump being calibrated. |
| Check 2: | The throttle has the wrong restriction. | Set the throttle restriction to the correct values. |

## No. 5 Problem (Continued)
## The fuel calibration pressure is out of the specifications.

| | Cause | Change |
|---|---|---|
| Check 3: | Throttle travel not set correctly. | Set the throttle travel. |
| Check 4: | The fuel calibration pressure is too high or too low because of the wrong idle plunger (button) or of a bad surface. | Replace the idle plunger (button) with the correct plunger, if the wrong idle plunger was in use. Replace if surface is damaged. |
| Check 5: | The fuel calibration pressure is low. | Replace the damaged pulsation damper diaphragm. |
| Check 6: | The governor plunger is damaged. | Replace it with a new governor plunger. |
| Check 7: | The governor weight carrier assembly is not correct or broken. | Replace it with a corect new governor weight carrier assembly. |
| Check 8: | The gear pump does not transfer fuel or has low pressure. | Replace the gear pump. |

## No. 6 Problem
## The check point No. 1 pressure is out of the specifications.

| | Cause | Change |
|---|---|---|
| Check 1: | The flow reading is not correct. | Adjust the flow meter valve. |
| Check 2: | Check the lowest rpm check point. | Check the lowest check point under Problem No. 7 to make sure it is within the specifications before continuing. |
| Check 3: | The torque or governor spring is wrong. | Remove the front cover. Check for the correct torque and shim requirements in the calibration code. Check the free length of the spring. See Table 18-6. Check for the correct governor spring. |

## No. 6 Problem
## The check point No. 1 pressure is out of the specifications.

| | Cause | Change |
|---|---|---|
| Check 4: | The idle plunger or governor plunger is rough or has worn areas or is the wrong part number. | Replace it if necessary. |
| Check 5: | The wrong weights or the weight carrier assembly is worn. | Replace it with the correct new weight carrier assembly. |
| Check 6: | The gear pump delivery is low. | Check the gear pump delivery. |

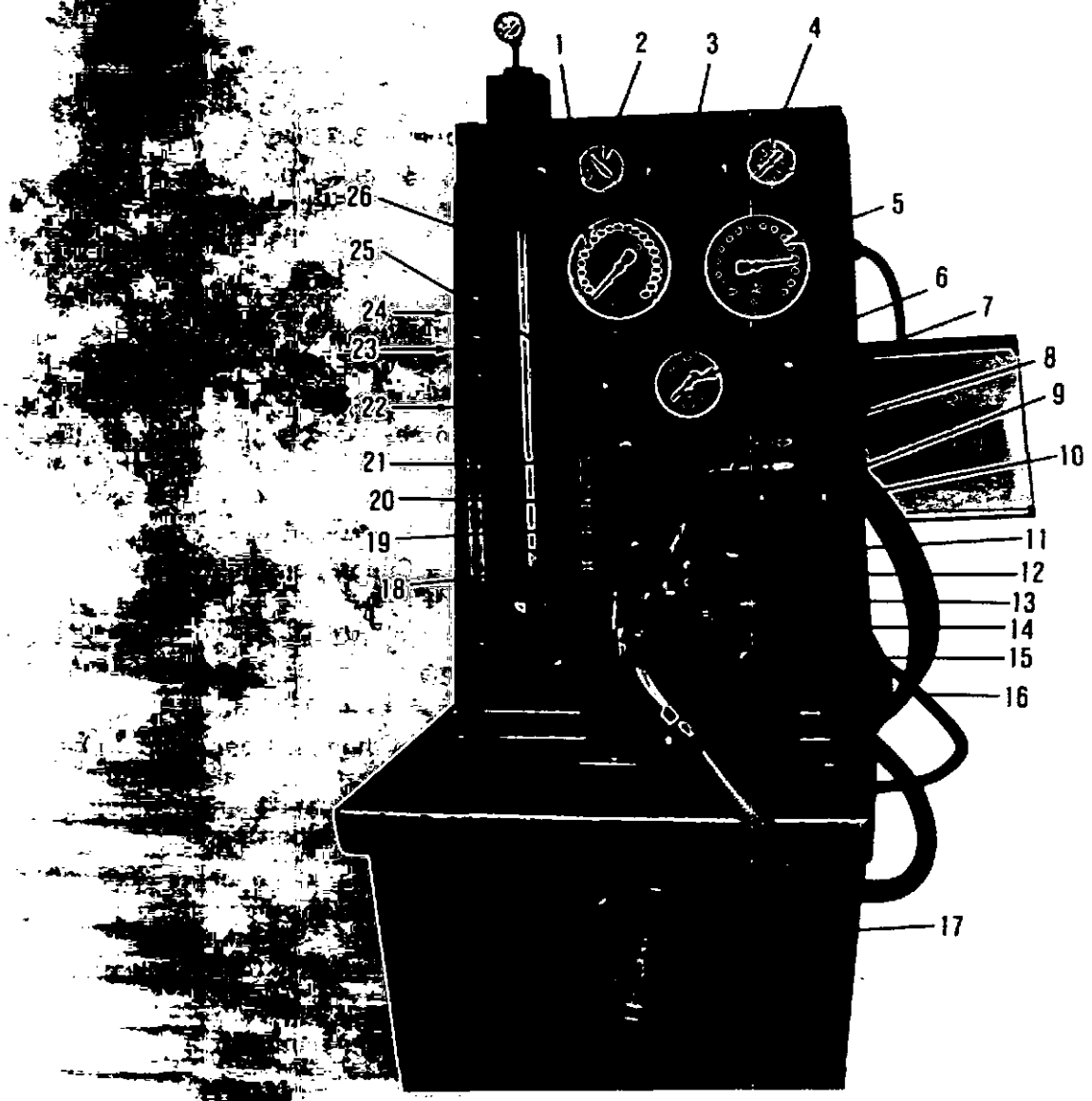
## No. 7 Problem
## The check point No. 2 is out of the specifications.

| | Cause | Change |
|---|---|---|
| Check 1: | The flow reading is not correct. | Adjust the flow meter valve. |
| Check 2: | The check point No. 2 pressure is too low. | If the weight assist protrusion is within the specifications, one or more shims can be added to the assembly. |
| Check 3: | The check point No. 2 pressure is too high. | Remove the weight assist shims to lower the pressure. If no shims can be removed, install a new weight assist assembly or a new front cover. |
| Check 4: | The gear pump delivery is low. | Check the gear pump delivery. |

## No. 8 Problem
## The throttle travel is below or above the limit.

| | Cause | Change |
|---|---|---|
| Check 1: | Throttle stop screws are out of adjustment. | Set the throttle leakage then set the throttle travel. |

# Calibration Test Equipment




1. Pump Fuel Pressure Gauge
2. Fuel Temperature Gauge
3. Rotation Switch
4. Gear Pump Pressure Gauge
5. Vacuum Gauge or Air Pressure Gauge
6. Air Pressure Gauge or Vacuum Gauge
7. Air Pressure Control Valve
8. Fuel Flow Control Valve
9. Idle Orifice Valve
10. Throttle Leakage Valve
11. Gear Pump Fuel Return
12. Gear Pump Pressure
13. Vacuum Connection
14. Fuel Outlet Pressure to Gauge
15. Fuel Outlet Pressure to Valve
16. Fuel Supply to Pump
17. Speed Control Handle
18. Pump Mounting Ring
19. Tachometer
20. AFC/Aneroid Air Connection
21. Leakage Flow Meter
22. Fuses
23. Start/Stop Buttons
24. Temperature Control Switch
25. Temperature Control Indicator
26. Main Flow Meter

Fig. 14-1, (F5393) Fuel Pump Test Stand No. 3375698

The correct calibration of the fuel pump is one of the most important procedures for a good engine operation. Correct calibration is possible only with accurate test equipment as described in the following paragraphs.

## Fuel Pump Test Stand, Tool No. 3375698

The 3375698 Cummins Fuel Pump Test stand has increased accuracy to meet the requirements of the fuel pump test area, Fig. 14-1.

The test stand is smaller than the Tool No. ST-848 Test Stand. This test stand is two feet [61 cm] wide.

The fuel pump is mounted to the test stand with the gear pump toward the operator. It is easier to adjust the AFC plunger on this test stand.

The gauges include a fuel manifold and an air pressure gauge calibrated accurately to within ±0.2%. The gear pump suction (vacuum) gauge, like the manifold and air pressure gauge, is calibrated at ±0.2% accuracy. The gear pump pressure and fuel temperature are also on large gauges.

The main flow meter is a dual scale, continuous indicating glass meter calibrated from 60 to 2200 lb./hr. The flow meter is 36-1/2 inch [927 mm] long and is accurate to ±1/2%. Throttle leakage is measured in another flow meter. This flow meter is 8-1/2 inches [216 mm] long and is calibrated 20 to 500 cc/minute. A third flow meter, calibrated 0-150 units, is used to check the ASA performance and the AFC leakage.

The digital tachometer is mounted just above the fuel pump mounting plate. The gauge indicates every 1/2 second and is accurate to ±1 rpm across the speed range.

The fuel storage is in a 6.25 U.S. gallon [5 Imperial gallon] tank. The fuel temperature is held at 95° ±2°F by the automatic 2 kW heater and the water coolant system. The temperature control can be adjusted.

The test stand is driven by a 5 HP electric motor. The motor rotates the pulley system. The pulleys expand mechanically. Speed is adjusted by rotating the hand wheel.

The electrical characteristics of these test stands are in Table 14-1.

**Table 14-1: Electrical Characteristics**

| Tool No. | Characteristics |
|---|---|
| 3375698 | 220V 3Ph 60Hz |
| 3375699 | 220V 3Ph 50Hz |
| 3375700 | 440V 3Ph 60Hz |
| 3375701 | 440V 3Ph 50Hz |

A converter is available to change the electrical supply from a single phase to a three phase. The service tool number is 3376045.

The test stand motor makes the fuel pump rotate under conditions that are like the engine during normal fuel pump operations. During the test stand operation, the fuel pump takes fluid from the test stand tank and returns it to the tank. The test stand instruments indicate the fuel pump delivery. This delivery is checked against the fuel pump code values.

The fuel pump to be tested is mounted onto the test stand. The test stand motor rotates the fuel pump drive through a speed drive that has a speed range of 450 to 4250 rpm.

Use the Cummins Calibration Fluid for test purposes. This fluid is available in 55 gallon (No. 3375364) and 30 gallon (No. 3375365) containers.

**Note:** The Cummins specified Calibration Fluid must be used for test purposes.

The serial number of the test stand is on a plate attached to the rear panel. The total serial number is the product code, test stand number, modification letter, and electrical supply code.

**Note:** If the end of the serial number is ./9 or ./9D the unit is a special unit for other voltage of dual frequencies. Information for these units is available from Service Tools Center, Cummins Engine Company.

**Note:** Give the total serial number in all orders for the test stand.

The manual, with the test stand, has all of the operation, maintenance and installation procedures.

## Fuel Pump Test Stand, Tool No. ST-848

The Cummins ST-848 Test Stand for the fuel pump has the following parts:

1. Large dial, accurate gauges. Good maintenance will keep the gauges accurate. The gauges must be checked at regular intervals.

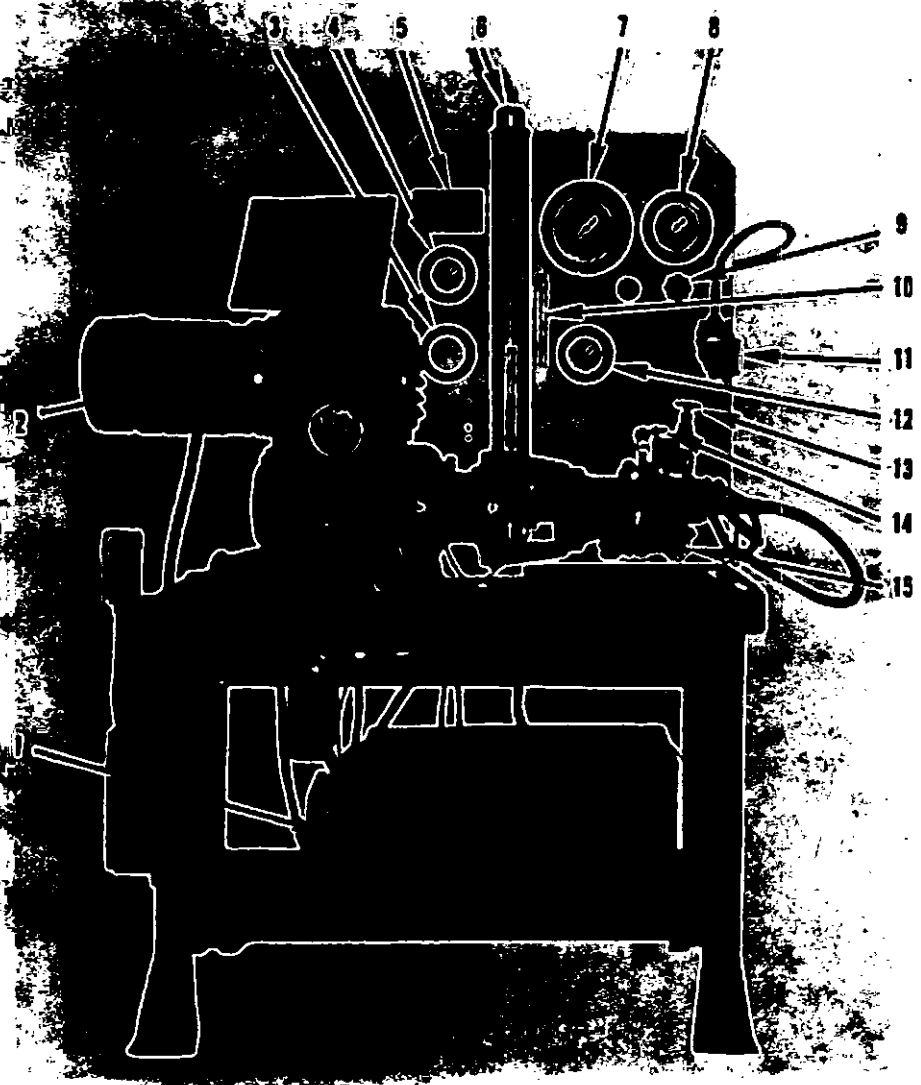
2. An accurate electric tachometer was on the ST-848. A digital tachometer is now in ST-848.
3. A flow meter permits the operator to adjust each fuel pump for total flow and check it against the pressure in the calibration. The fuel manifold pressure on the test stand will be the same as the fuel manifold pressure on the engine.
4. The support on the ST-848 Test Stands for the fuel pumps that are mounted with a bracket must be removed to hold the PT (type G) AFC fuel pump. Keep this bracket to test the older type of fuel pumps still in service.

## Test Stand

This section contains the instructions for the "Flow Meter" method of the PT (type G) Fuel Pump calibration only. For other methods of calibration and values, see Bulletin No. 983533. These are less accurate and were used before the establishment of the "Flow Meter" method.

## Test Oil

The test stands for the Cummins fuel pumps must be filled with clean Cummins Test Oil, Service Tool No. 3375364. All of the calibration data has been made using this test oil, Table 14-2.




1. Automatic Temperature Control
2. Speed Control
3. Test fuel Temperature
4. Gear Pump Pressure
5. Digital Tachometer
6. Flow Meter
7. Fuel Pressure Gauge
8. Aneroid Air Pressure Gauge
9. Aneroid Air Adjusting Valve
10. Throttle Leakage Flowmeter
11. Aneroid
12. Vacuum Gauge
13. Idle Orifice Valve
14. Flow Control Valve
15. Suction Valve

Fig. 14-2, (F5100) Cummins ST-848 Fuel Pump Test Stand

**Note:** Do not use hydraulic oil or any other fluid in Cummins test stands.

Making the same test as the factory test is the key to correct calibrations. This makes sure the results are the same every time the fuel pump is adjusted.

**Table 14-2: Calibration Fluid Chemical and Physical Specifications**

| | |
|---|---|
| Viscosity at 100°F [38°C] centi Stokes, ASTM D-4452 | 45-2.85 |
| Specific Gravity at 60°F, ASTM 1298 | 0.820-0.830 |
| Gravity, Degrees API, 60°F, ASTM 287 | 41-39 |
| Flash Point, ASTM D-56 | 167°F Min. |
| Color, ASTM D-1500 | 3 Max. |
| Color after Storage (6 Mos.), ASTM D-1500 | 4 Max. |
| Water and Sediment, ASTM D-2273 | 0.01% |
| Corrosion, ASTM D-130 | Must Pass Class 1 |
| Galvanic Corrosion, ASTM 5322.1 | Must Pass 10 Days |
| Sulphur % Weight, ASTM D-129 | 0.4 |
| Distallation 5% Volume Max., ASTM D-86 | 410°F Min. |
| Foaming Tendency, ASTM D-892 | 5 Min. (Blow) 50 mL |
| Foaming Stability, ASTM D-892 | 2 Min. (Settle) 0 |
| Gum | Anti-Gumming |
| Rust Protection Polished Panel, ASTM D-1748 | Pass 50 Hours |

Viscosity Oil Co SAE J967d meets the above requirements.

Cummins Service Tool Part No. 3375364

## Instruments

A fuel pump can not be calibrated with any greater precision than that of the instruments on the test stand. The pressure, speed and flow measurements must be very accurate. These measurements make the fuel pump characteristics.

The instruments on the test stand for the fuel pump and the engine have the accuracy required for the precision calibration and testing when new. This accuracy must be maintained and checked yearly.

## General

**Caution: Cummins Engine Company, Inc. is not responsible for damage if the fuel pump is calibrated to a different specification than for a specific engine model, CPL or a fuel pump code.**

### How to Find the SAE Brake Horsepower

The checking of engine performance during testing is from accurate horsepower readings. You must use the following rules with the test procedures. The basic rule to find brake horsepower is as follows:

$$\text{Brake Horsepower} = \frac{\text{Torque in (Ft. Lbs.)} \times \text{Engine rpm}}{5252}$$

Most engine dynamometer manufacturers have a number known as a "brake constant" for each dynamometer. The constant makes the process easy to find the horsepower since only the engine rpm and the scale reading (in pounds) need to be found by the test mechanic. The rule used with a known constant is:

$$\text{Brake Horsepower} = \frac{\text{Lbs. (On Dyno. Scale)} \times \text{Engine rpm}}{\text{Dynamometer Constant}}$$

Example: The dynamometer in operation has a brake constant of 500. The scales show a reading of 50 pounds and the tachometer shows engine rpm of 1600.

$$\text{Brake Horsepower} = \frac{50 \times 1600}{500} = 160$$

The above rules apply to engine dynamometers only. Where chassis dynamometers are in use, approximately 25% of engine horsepower will be lost because of the drive line, tires, transmission and other parasitic loads.

## Procedures for Changing the Horsepower

1. All horsepower ratings in the fuel pump data are Cummins test ratings. Cummins test horsepower ratings are made at 500 ft. [152 m] altitude.
   a. The horsepower of the turbocharged engines is the same from sea level to the altitude found in the engine shop manuals.
   b. All down rating of engines in power only, or in power and speed together, need not be changed for any difference between Cummins and Sea Level standards.
2. The data in Table 14-3 is to be used as a guide in the changing of horsepower from one system to that of another.

**Table 14-3: Test Standards for Conversions**

| | Altitude or Elevation | | Barometric Pressure | | Degrees Temperature and Humidity | | | Horsepower | |
|---|---|---|---|---|---|---|---|---|---|
| Measurement System | Feet | Meters | In.Hg. | mm Hg. | Fahrenheit | Centigrade | Relative Humidity | Mkg./ Sec. | Ft.Lb./ Sec. |
| Cummins | 500 | 152.4 | 29.38 | 746.25 | 85 deg. | 29.4 deg. | 30% | 76.04 | 550.0 |
| SAE | 500 | 152.4 | 29.38 | 746.25 | 85 deg. | 29.4 deg. | 50% | 76.04 | 550.0 |
| British | 500 | 152.4 | 29.38 | 746.25 | 85 deg. | 29.4 deg. | 50% | 76.04 | 550.0 |
| Din (Germany) | 984 | 300.0 | 28.88 | 733.55 | 68 deg. | 20.0 deg. | 60% | 75.00 | 542.5 |
| Metric | 984 | 300.0 | 28.88 | 733.55 | 68 deg. | 20.0 deg. | 60% | 75.00 | 542.5 |
| Sea Level | Sea Level | Sea Level | 29.92 | 759.97 | 60 deg. | 15.55 deg. | Dry Air | 76.04* | 550.0* |

*Horsepower for Metric or Din will be 75.00 Mkg./Second or 542.5 Ft.Lb./Sec.

**Note:** The Din (German) horsepower ratings includes the fan horsepower. The other systems do not include the horsepower required to rotate the engine fan or the battery charger generator. In general, approximately a 10% adjustment of the horsepower rating to rotate the fan and the generator is known. The exact adjustment in horsepower can be made.

3. The difference in altitude and temperature are in the standard test conditions. The additional change must also be made to the horsepower from the difference in ft.lbs./sec. The total change becomes:

   Cummins, SAE, or British hp =
   Metric or Din (German) hp × 0.9863

   Metric or Din (German) hp =
   Cummins, SAE, or British hp × 1.0139

**Note:** The above change does not use the small percent difference in relative humidity between Cummins and SAE or British systems.

4. The units of measurement, change from one system to another.

   a. Altitude or Elevation Change
   100 feet = 30.48 meters

   b. Barometric Pressure Change
   1 inch Hg = 25.4 millimeters Hg

   c. Temperature Change
   °F = 9/5 × °C + 32
   °C = °F − 32 × 5/9

   d. Horsepower Change
   Mkg./Sec. × 7.233 = Ft.Lb./Sec.
   Ft.Lbs./Sec. ÷ 0.13825 = Mkg./Sec.

## Fuel Pump and Injector Test Stand Audit Kit, Tool No. 3375187

The Audit Kit is used to check the performance of the ST-790 and ST-848 Test Stands, Fig. 14-3.

The kit includes one (1) ST-1210-132cc, one (1) ST-1262-185Acc and one (1) ST-1306-178Acc Master Injectors for the ST-790 Test Stand. The kit includes a master fuel pump for the ST-848 Test Stand. Also included are the spare parts which are most frequently replaced for both of the test stands. A master gauge used in checking the gauge calibration of the test stand is a part of the kit. This kit is available through the Cummins Service Tools Center.

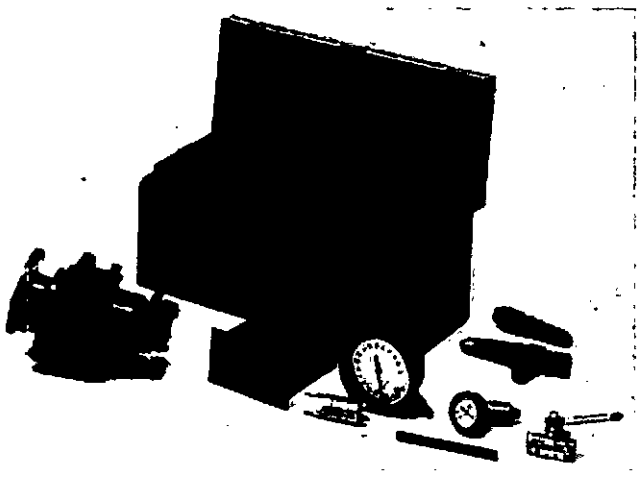


Fig. 14-3, Test Stand Audit Kit, Tool No. 3375187.

## Conversion Kits for the Test Stands

The test stands that are used to calibrate the fuel pumps in the list below must have or be converted to have a number 16 supply line, Fig. 14-4.

1. All of the test stands must be set at 7 inch [18 cm) Hg. vacuum when testing KTA-2300 and KTA-3067 fuel pumps.
2. All of the PT (type H) fuel pumps for the KTA-3607 engines.
3. The PT (type G) fuel pumps for the KT/KTA-2300 engines.
4. The V-1710 fuel pumps that use a 1/4 inch [6.35 mm] outlet fitting on the shutoff valve.

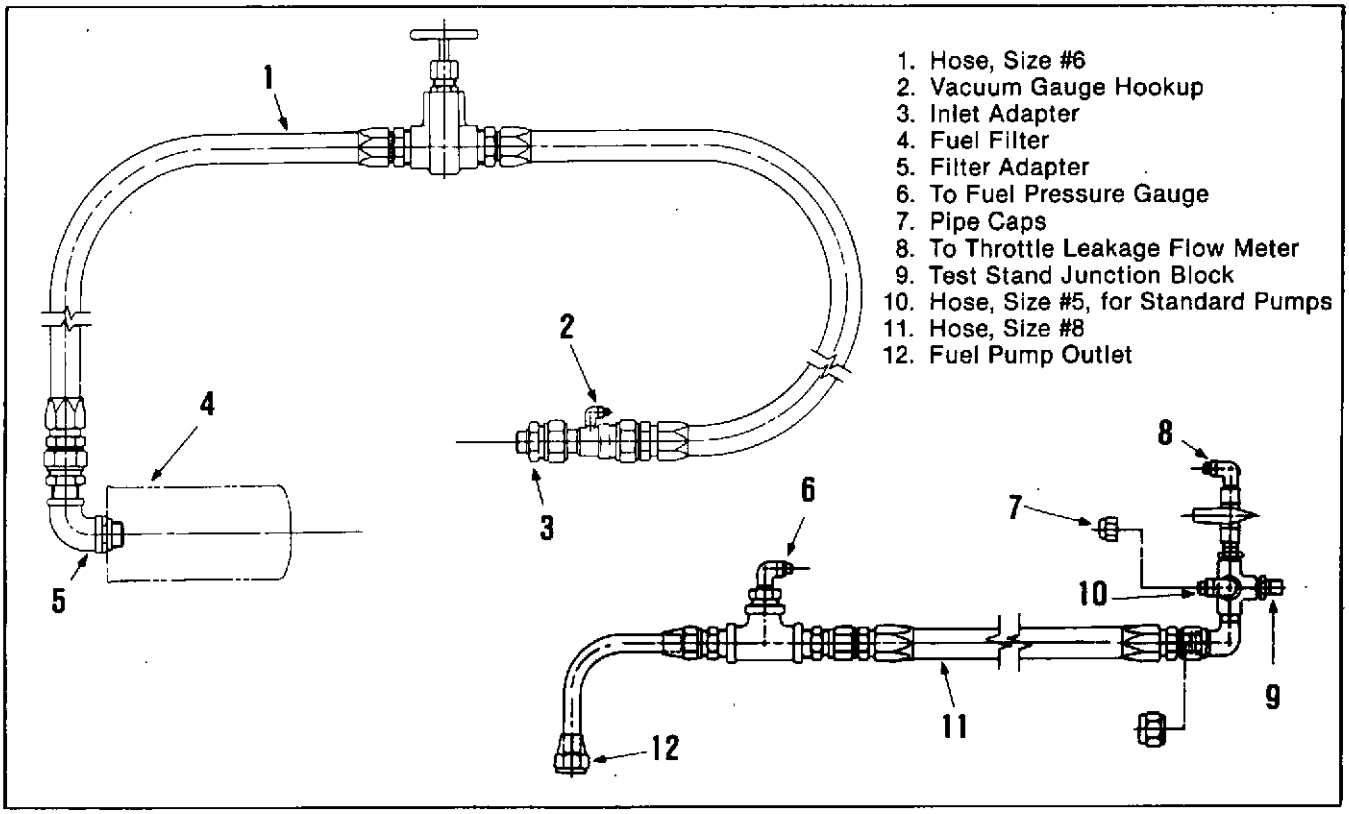



Fig. 14-4, The conversion kit for the ST-848 test stand is 3375793.

# Operating Procedures

You can better understand the PT fuel pumps if you know the basic functions of the fuel system parts. The operation of the injectors is described in Bulletin No. 3379071. The operation, cleaning and calibration of all Cummins PT injectors are in that manual.

In the Cummins PT Fuel System the volume of the liquid flow is proportionate to the fluid pressure, the time permitted to flow and the size of the passage the liquid flows through. The Cummins PT Fuel System has the following parts:

1. A fuel pump to pull the fuel from the supply tank and deliver it to the injectors for each cylinder. Fig. 15-1.
2. A way of controlling the pressure of the fuel delivery from the fuel pump to the injectors. Each cylinder will receive the correct amount of fuel for the power required by the engine.
3. Fuel passages of the correct size and material. The fuel distribution to all of the injectors has equal pressure under all speed and load conditions.
4. Injectors to receive low-pressure fuel from the fuel pump. The injectors will inject the fuel into each combustion chamber at the correct time, in equal quantity and the correct condition to burn.

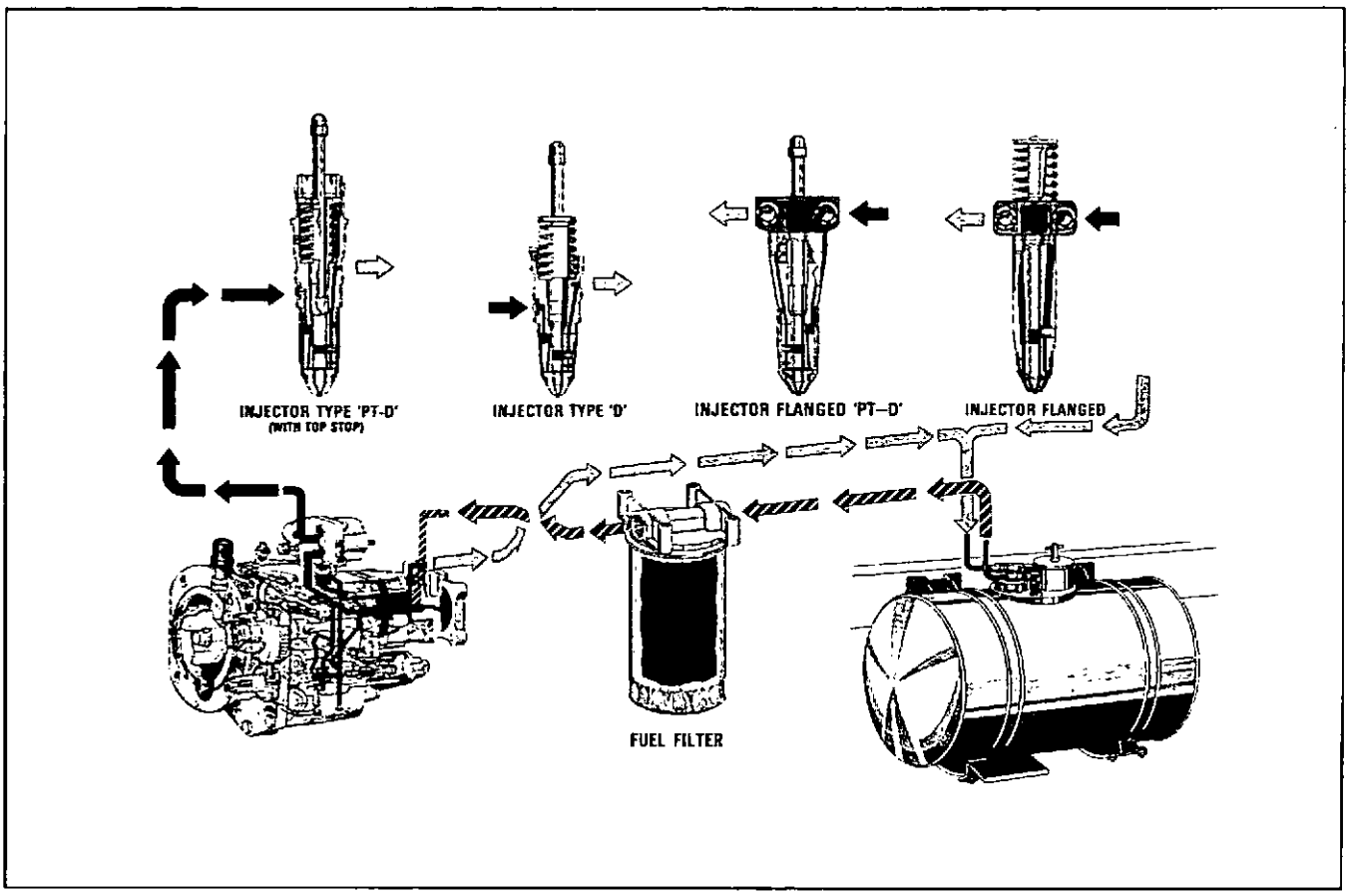
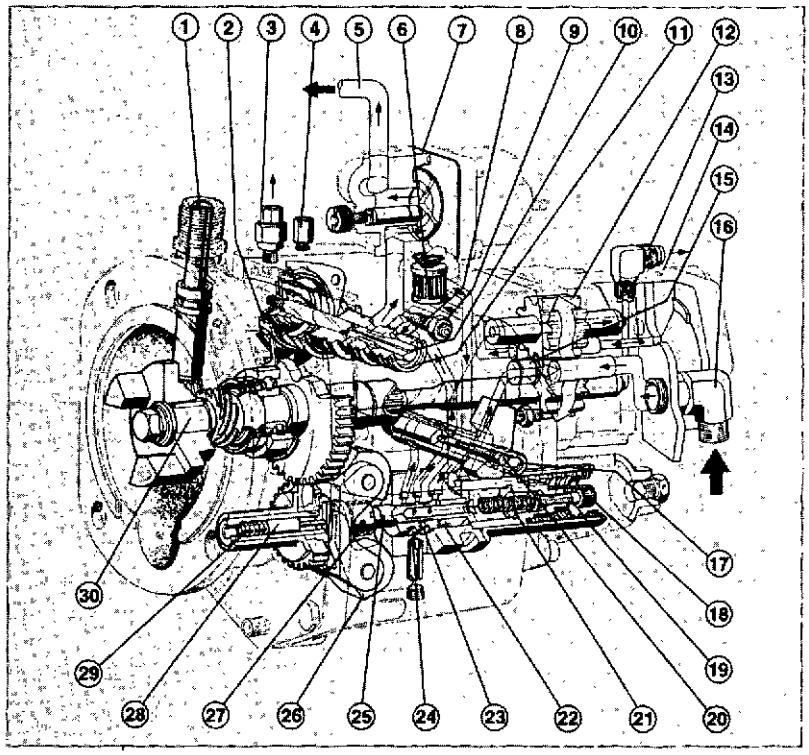



Fig. 15-1, (FWC-33). Fuel flow in the PT fuel system.



1. Tachometer Drive
2. AFC Piston
3. Hydraulic ASA
4. AFC Valve
5. Fuel to Injectors
6. Filter Screen
7. Shutoff Valve
8. AFC Fuel Barrel
9. AFC Needle Valve
10. AFC Plunger
11. AFC Barrel Spring
12. Gear Pump
13. Check Valve Elbow
14. Pulsation Damper
15. Pressure Regulator Valve
16. Fuel From Filter
17. Throttle Shaft
18. Idle Adjustment Screw
19. High Speed Spring
20. Fuel Adjustment Screw
21. Idle Spring
22. Gear Pump Pressure
23. Fuel Rail Pressure
24. Idle Pressure
25. Governor Plunger
26. Governor Weights
27. Torque Spring
28. Governor Assist Plunger
29. Governor Assist Spring
30. Main Shaft

Fig. 15-2, (FWC-37). PT (type G) fuel pump cross-section and fuel flow with the air fuel control.

## Fuel Pump

The fuel pump is connected to the compressor or fuel pump drive which is driven from the engine gear train. The fuel pump main shaft rotates at engine crankshaft speed on most of the engines. The main shaft rotates at 78% of the engine RPM in most the V-555 series engines. The main shaft makes the gear pump, governor assembly and tachometer shaft rotate.

## PT (type G) Fuel Pump

The PT (type G) fuel pump assembly is made up of three main units.

1. The gear pump which pulls the fuel from the supply tank and sends it through the pump filter screen to the governor.

**Note:** The fuel pump inlet on the V6-140, V8I-185, V-504 and V-555 series engines can be through a fitting in the top of the fuel pump. The fuel flows through the main housing to the gear pump.

2. The governor which regulates the pressure of the fuel from the gear pump, as well as controlling the maximum and idle engine speeds.
3. The throttle which is a manual control over the flow to the injectors under all of the conditions in the operation range. The location of the fuel pump parts is in Fig. 15-2.

### Gear Pump and Pulsation Damper

The gear pump and pulsation damper are located at the rear of the fuel pump.

The gear pump is driven by the pump main shaft. The gear pump contains one set of gears for the delivery of the fuel throughout the fuel system.

A damper is mounted to the gear pump. The damper contains a steel diaphragm which minimizes the fuel pressure pulses through the fuel system.

The PT (type G) gear pump can have a pressure valve.

**Note:** The PT (type H) and the special C.I.T.E. fuel gear pumps will have the assembly number on the side of the gear pump.

The PT (type H) gear pump is about 3/4 inch [19 mm] taller than the PT (type G). This gear pump

has a cooling drilling that comes out of the back of the gear pump.

From the gear pump, the fuel flows through the filter screen and to the governor assembly as shown in Fig. 15-2.

The PT (type G) gear pumps are now equipped with a coolant drain line to the engine injector return line. This line prevents high fuel temperatures within the fuel pump. This coolant drain line is necessary on trucks or other applications which will have down hill closed throttle motoring conditions. A special check valve or fitting is used in the gear pump to stop the reverse flow of fuel and hard starting.

**Pressure Regulator**

The pressure regulator is used only in the torque modification device of the PT (type G) fuel pump. The valve function is a by-pass valve to adjust the fuel pressure to the injectors. The by-pass fuel flows back to main housing.

**Pressure Valve**

The pressure valve is used in the PT (type G) AFC and the VS fuel pumps. These valves can be seen by looking in the fuel inlet connection. The PT (type G) and AFC valve is in the gear pump. The PT (type G) VS valve can be near the drive shaft of the gear pump in the housing. This valve causes a restriction in the flow of the return fuel coming from the governor barrel. This makes low fuel pressure in the housing.

**Throttle**

The throttle is a way for the operator to manually control the engine speed above idle.

In the PT (type G) fuel pump, the fuel flows through the governor to the throttle shaft. At idle speed, the fuel flows through the idle port in the governor barrel and around the throttle shaft. To operate above the idle speed, the fuel flows through the main governor barrel port to the throttle hole in the throttle shaft.

**Throttle Actuator Air Cylinders For KT/KTA-2300 and KTA-3067 Engines**

Air cylinders are used for the throttle control of some engines. The air cylinders can interfere with the air outlet connection of the air compressor.

Engines that have an air compressor with two cylinders, must have the air outlet connection on the side of the cylinder head of the air compressor. A new type of cylinder head for the air compressor is available, if required.

**Shutoff Valve**

Either a manual or an electric shutoff valve is used on the Cummins fuel pumps.

When a manual valve is used, the control lever must be fully clockwise or open to permit fuel flow through the valve.

When an electric valve is used, the manual control knob must be fully counterclockwise. This will permit the solenoid to open the valve when the "switch key" is turned on. For an emergency operation, during a electrical failure, turn the manual knob clockwise. This will permit the fuel to flow through the valve.

## High Pressure Fuel Shutoff Valve

Some applications and/or approved tests require that engine starts be made in rapid sequence. Starts are tried as soon as the flywheel stops. Rapid restarting puts an overload on the solenoid valve, since it must open against the high pressure from the first operation cycle. Fire engine applications are an example of this requirement.

The kit lets the valve operate against the higher fuel pressure plus the spring load.

The orifice disc with the center hole stops the fuel pressure load on the spring loaded disc. This lets the spring loaded disc operate like the standard disc without the high fuel pressure.

## Governors

**Idling and High-Speed Mechanical Governor**

The mechanical governor is sometimes called the "automotive or standard governor". This governor is actuated by a system of springs and weights and has two functions. First, the governor keeps enough fuel for idling with the throttle control in idle position; second, it cuts off the fuel to the injectors above the maximum rated rpm. The idle spring and screw, in the governor spring assembly, positions the governor plunger so the idle fuel port is opened enough to permit the passage of fuel to keep the engine idle speed.

During the operation between the idle and maximum speeds, the fuel flows through the governor to the injectors. The engine requirements are

controlled by the throttle position and the pressure regulation by the governor assembly. When the engine reaches the governed speed, the governor weights have moved the governor plunger to close the fuel passage to the throttle. In this manner the engine speed is controlled and limited by the governor regardless of the throttle position. Fuel going from the pump flows through the shutoff valve, supply lines and cylinder head passages into the injectors.

Most of the standard type of vehicles have the standard or maximum speed governor. The operator controls the throttle shaft which is attached to the foot throttle. The throttle shaft position can be used to control engine rpm between idle rpm and maximum no load engine speed so long as the load on the engine does not change. For conditions of constant speed control, such as in power takeoff driven equipment or in accessories for which close engine rpm control is required, an auxiliary governor which is called the VS (Variable Speed) governor, is used.

The standard type of governor can not constantly control the engine speed below the full load governed speed. When trying to control the engine RPM by changing the throttle position, a change in the load from the power takeoff driven equipment will cause a large change in engine speed. For all applications in which the engine is driving the power takeoff equipment but the operator is not controlling the engine rpm by constantly touching the throttle, use the VS governor. The VS governor fuel pump can be added to an existing engine or vehicle. The fuel pump must be calibrated to the correct VS type of fuel pump code.

In a limited number of applications, the engine rpm required for the power takeoff operation can be higher than the normal full-load governed rpm for that engine. This can occur when the engine speed is lowered for an over the road operation. To operate the engine at the higher rpm, the application must be approved by Cummins Engine Company, Inc. In this application, the VS governor low speed position will be for full load governed rpm. The maximum speed position will be set for the PTO operating speed. Also, the standard governor within the fuel pump must be set at the highest required operating speed.

**Torque Converter Governor**

Use a torque converter governor to control the tail shaft speed and not the engine speed. The auxiliary governor section is driven off of the engine torque converter rear drive shaft. The engine torque converter will control the fuel pump governor rpm which will limit the converter rear drive shaft speed. The engine governor and the converter (auxiliary) governor must be adjusted to work together.

The PT torque-converter governor has two mechanical variable-speed governors in series. One is driven by the engine and the other by the converter.

The engine governor changes the engine speed and also is an over-speed and idle-speed governor while the converter driven governor is controlling the engine. Each governor has its own control lever and speed adjustment screws.

The converter driven governor works the same way as the standard engine governor except it can not cut off the fuel to the idle port in the engine driven governor. This will make sure that if the converter rear drive shaft overspeeds, it will not stop the engine.

**PT (type G) Variable-Speed Governors**

There are four mechanical variable-speed governors used with the PT (type G) fuel pump. The "Mechanical Variable-Speed (MVS)" governor is mounted directly on top the fuel pump or remote mounted near the fuel pump, Fig. 15-5. The "Variable Speed (VS)" governor is above the housing and front cover of a standard pump, Fig. 15-3. The PT (type H) fuel pump is now in use on the KTA-3067 engines. This pump is a **high flow** VS type of fuel pump, Fig. 15-4.

**PT (type G) Variable Speed (VS) Governor**

The VS governor has replaced the PT (type G) MVS, PT (type G) SVS and PT (type R) MVS. Fig. 15-3. This pump has a lower speed droop than those it has replaced.

The VS governor assembly is in the upper portion of the fuel pump housing and front cover. The VS governor weights are in the upper front cover and are gear driven through an idler gear assembly from the fuel pump main drive shaft. PT (type G) standard governor is in the bottom of the housing as usual.

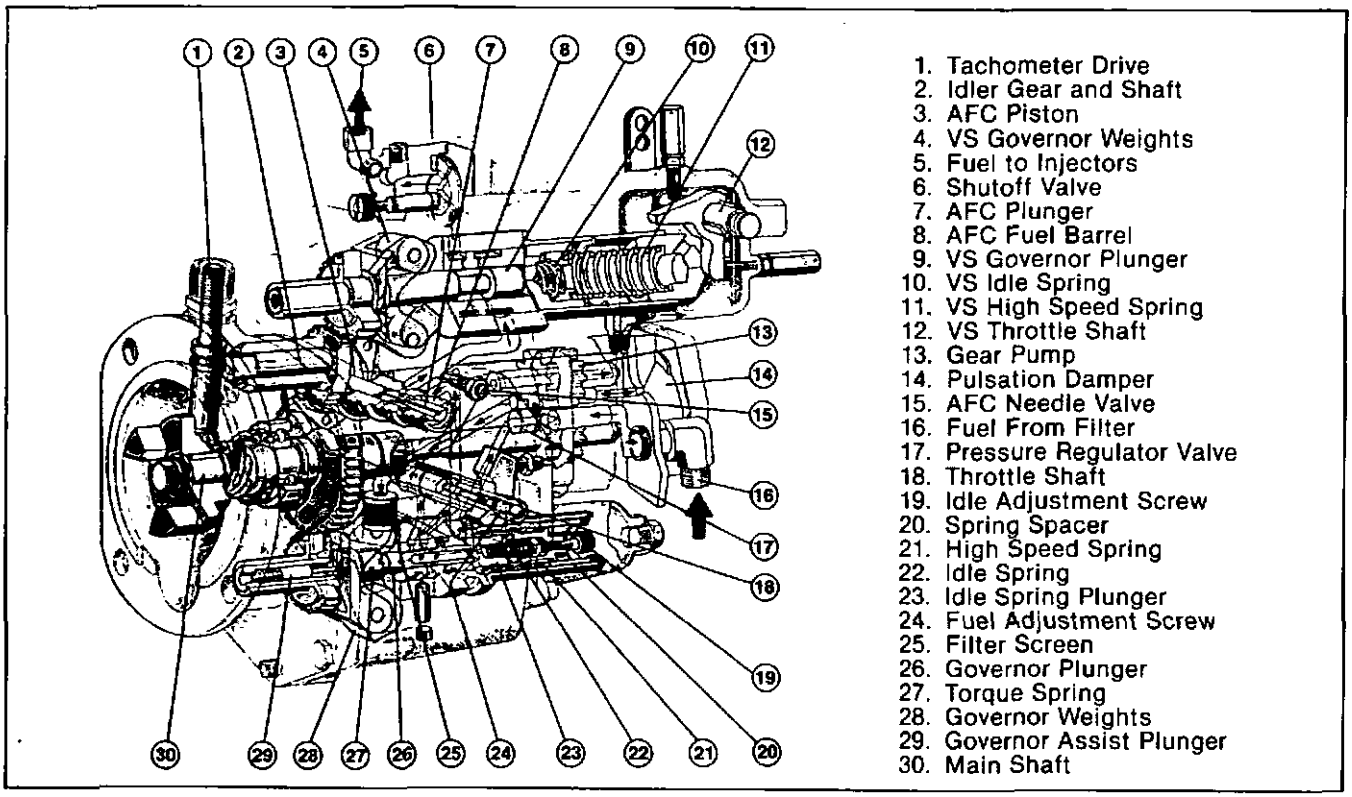



Fig. 15-3, (FWC-38). PT (type G) fuel pump with Variable Speed Governor and Air Fuel Control.

The housing of this pump has a pressure valve. The fuel pump will not have suction air leaks. The pressure valve is in the housing near the drive shaft or in the gear pump.

Because the VS governor is in the upper housing, the fuel screen has been removed. The screen is in the bottom of the housing under the shutoff valve. A snap ring is used to hold the screen and plug in the housing.

**PT (type H) Fuel Pump Governor**

The PT (type H) fuel pump is a high capacity VS type of fuel pump. This fuel pump was designed for the KTA-3067 engine, Fig. 15-4.

The gear pump of this fuel pump is larger. The capacity of this gear pump is 67% greater than the PT (type G). The gears of the gear pump are 1 1/4 inch [31.75 mm] in diameter. The PT (type G) gears are 1 inch [25.4 mm] in diameter.

The housing of the PT (type H) has two fuel passages from the fuel screen area. One passage goes to the governor barrel. The other fuel passage goes to the governor spring assembly.

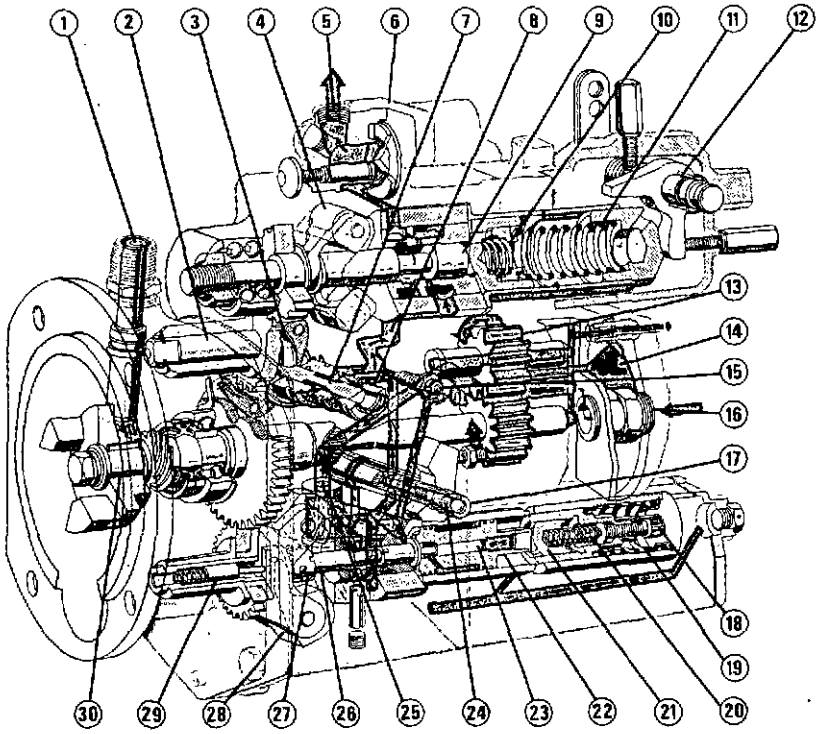
All of the fuel that goes through the governor barrel goes to the injectors. The fuel that does not go through the governor barrel goes through the fuel control plunger in the governor spring assembly.

The governor spring assembly has a fuel control plunger and a fuel control damper. The function of the fuel control plunger is the same as the idle spring plunger (button) in the PT (type G) fuel pump. The idle spring plunger guides the idle spring. It does not control the fuel flow. The fuel control damper controls the cycle oscillation of the fuel pressure. The governor spring assembly also has a standard type of governor spring assembly.

The filter screen is larger. It is in the normal VS location of the fuel pump housing. The screen is held in the housing by a screw in type of plug.

The pump has a high capacity shutoff valve. This valve can be used on other fuel pumps.

The front cover is made stronger to support the additional weight of the fuel pump. This front cover can be used on the PT (type G) VS fuel pump.



1. Tachometer Drive
2. Idler Gear and Shaft
3. AFC Piston
4. VS Governor Weights
5. Fuel to Injectors
6. Shutoff Valve
7. AFC Plunger
8. AFC Fuel Barrel
9. VS Governor Plunger
10. VS Idle Spring
11. VS High Speed Spring
12. VS Throttle Shaft
13. Gear Pump
14. Pulsation Damper
15. AFC Needle Valve
16. Fuel From Filter
17. Throttle Shaft
18. Idle Adjustment Screw
19. High Speed Spring
20. Idle Spring
21. Idle Spring Plunger
22. Fuel Control Plunger
23. Fuel Control Damper
24. Fuel Adjustment Screw
25. Filter Screen
26. Governor Plunger
27. Torque Spring
28. Governor Weights
29. Governor Assist Plunger
30. Main Drive Shaft

Fig. 15-4, (FWC-54). PT (type H) fuel pump cross-section.

The spring pack cover of the upper governor has dust seals and bushings on the VS throttle shaft. This cover can be used on the PT (type G) VS fuel pump.

**PT (type G) Mechanical Variable-Speed (MVS) Governors**

This governor helps the standard governor to meet the requirements of machinery on which the engine must operate at an even speed, but where a close control is not necessary.

The adjustment for the different rpm can be made by a lever control or an adjustment screw. At maximum speed, this governor has a speed droop between full-load and no-load of approximately ten to twelve percent. A cross-section of this governor is in Fig. 15-5.

As a variable-speed governor, this unit is adjustable to the changing speed requirements of cranes, shovels, etc., in which the same engine is used for moving the unit and rotating a pump or other fixed-speed machine.

As a fixed-speed governor, this unit will control pumps and other applications where close control (changes between no-load and full-load speeds) is not required.

The (MVS) governor assembly mounts on top of the fuel pump. The fuel solenoid is mounted to the governor housing, Fig. 15-5. The governor can also be remote mounted.

The fuel from the fuel pump body enters the variable-speed governor housing and flows to the governor barrel and plunger. Fuel flows around the plunger to the shutoff valve and on to the injector, according to the governor lever position, as selected by the operator.

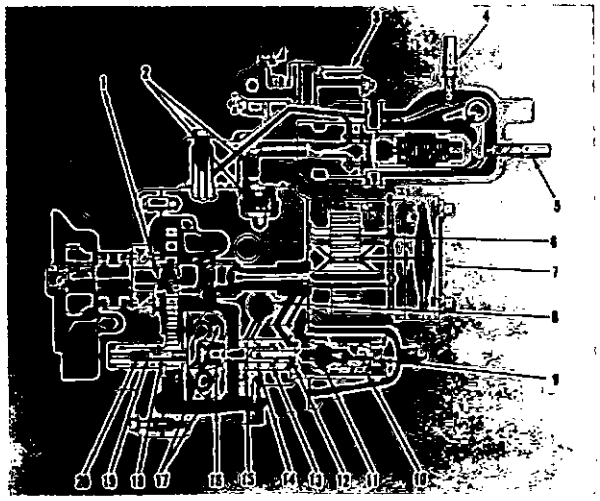
The variable-speed governor can not make engine speeds over that of the standard governor setting. The governor can make idle speeds below the standard pump idle speed setting. Do not adjust the idle speed below the idle speed setting of the standard governor.

**Special Variable-Speed (SVS) Governor**

Use an overspeed stop with the SVS governor when an operator is not near. If an overspeed stop is not in use, a positive shutoff valve in the fuel

line or a completely closed throttle arrangement must be installed, Fig. 15-6

Marine applications require the standard throttle of the fuel pump to be locked open during operation. The speed is controlled with the SVS governor lever.

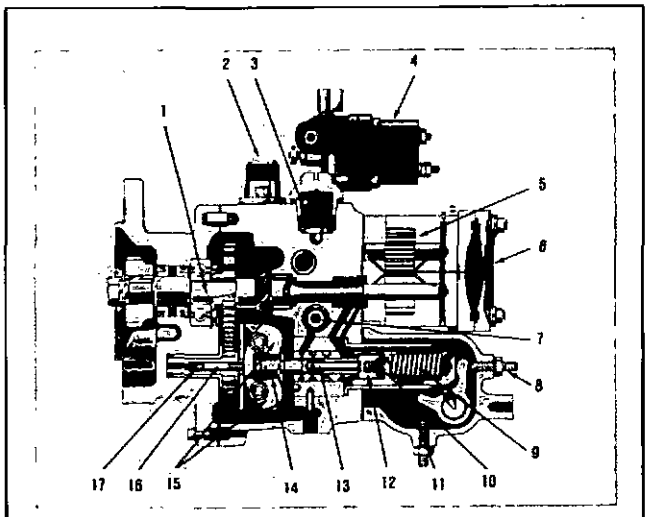


1. Main Shaft
2. Filter Screens
3. Shutoff Valve
4. Maximum Speed Screw
5. Idle Speed Screw
6. Gear Pump
7. Pulsation Damper
8. Throttle Shaft
9. Idle Adjustment Screw
10. Maximum Speed Spring
11. Idle Spring
12. Governor Plunger
13. Gear Pump Pressure
14. Fuel Rail Pressure
15. Idle Pressure
16. Torque Spring
17. Governor Weights
18. Governor Assist Plunger
19. Shims
20. Governor Assist Spring

Fig. 15-5 (FWC9A), PT (type G) with MVS Governor.

Power take off applications use the SVS governor lever to change the governed speed of the engine from full speed to an intermediate power take off speed. During the vehicle operation, the SVS governor is in the high speed position. See the engine operation instructions for further information.

The hydraulic governor applications that do not have the variable-speed governor settings, use the SVS governor to change the engine speed down from the maximum speed to near 1000 rpm for the engine warm up.



1. Main Shaft
2. Tachometer Connection
3. Filter Screen
4. Shutoff Valve
5. Gear Pump
6. Pulsation Damper
7. Throttle Shaft
8. Idle Speed Screw
9. Maximum Speed Spring
10. Idle Speed Spring
11. Maximum Speed Screw
12. Idle Plunger Button
13. Governor Plunger
14. Torque Spring
15. Governor Weights
16. Weight Assist Plunger
17. Weight Assist Spring

Fig. 15-6 (FWC-10), PT (type G) fuel pump with an SVS governor.

### Road Speed Governor on a PT (type G) VS Fuel Pump

The air cylinder assembly of the road speed governor replaces the normal VS spring assembly cover, Fig. 10-48.

1. The road speed governor is activated by applying air pressure against a piston in the air cylinder assembly.
2. When the air pressure is applied, the rpm setting of the road speed governor is higher than the lower governor setting.
3. Air pressure is in the air cylinder in all of the transmission gears except the high gear.
4. When the vehicle is in high gear, the air pressure is off of the air cylinder. The road speed governor then controls the maximum road speed.
5. The air pressure is controlled by a valve connected to the transmission.

## Air Signal Attenuator (ASA) Valve

1. The air signal attenuator (ASA) is a noise and smoke control valve. This valve is not in use on all of the engine models. Only the models requiring it for federal noise control will have the ASA valve.
2. Two types of the ASA valves are in use.
   a. The original ASA was in the air line to the Air Fuel Control (AFC) cover plate or in the flow valve in the cover plate.
      1) This valve makes a delay in the air pressure from the intake manifold to the AFC bellows.
      2) This valve is not adjustable. There is one valve for all of the engine models.
      3) A check valve is located in parallel with the valve restrictor inside the valve. The check valve will release the pressure in a reverse flow condition.
      4) A porous metal filter in the valve protects the AFC from dirt.
   b. The ASA now in use, is in the top of the fuel pump housing. This is a hydraulic ASA, Fig. 15-7.
      1) This valve controls the fuel flow from the AFC cavity. This retards the movement of the AFC plunger to the full open position during rapid acceleration.
      2) This valve has a 0.025 inch [0.64 mm] injector orifice plug.
      3) A check valve and an injector filter screen is in this valve.
      4) The fuel that goes through the valve is returned to the fuel tank.

## Flow Valve in the AFC Cover

1. A flow valve is in the top of the AFC cover. This valve will let air flow from the air intake manifold to the AFC bellows.
2. This valve will stop fuel from flowing from the fuel pump and into the air intake manifold. This can occur if the AFC bellows has a hole in it and the fuel drain hose is restricted or damped.

**CAUTION: Engine damage will occur if a large amount of fuel flows into the air intake manifold.**

## Fuel Pumps with Higher Torque

### Torque Modification Device (TMD)

A series of fuel pumps are available with higher torque peak set at a lower than normal rpm. These pumps, with a torque modification device (TMD), are called "High Torque Rise" pumps. The torque modification device is a pressure regulator like those inuse on the PT (type R) pumps. This device mounts on the pump between the housing and the shutoff valve. Fig. 15-8.

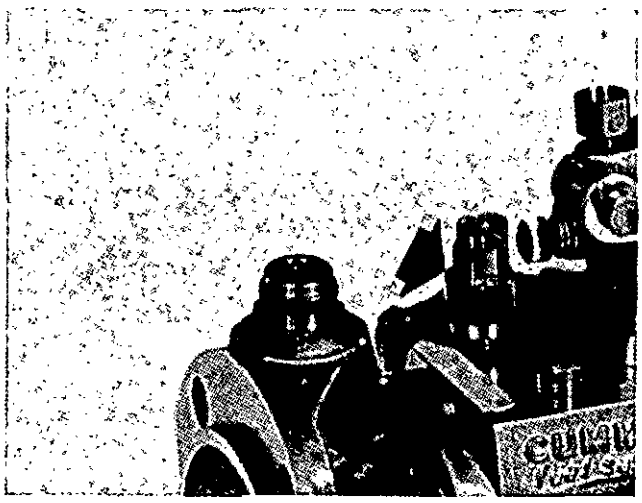


Fig. 15-7 (F5386). Hydraulic ASA installed on a fuel pump.

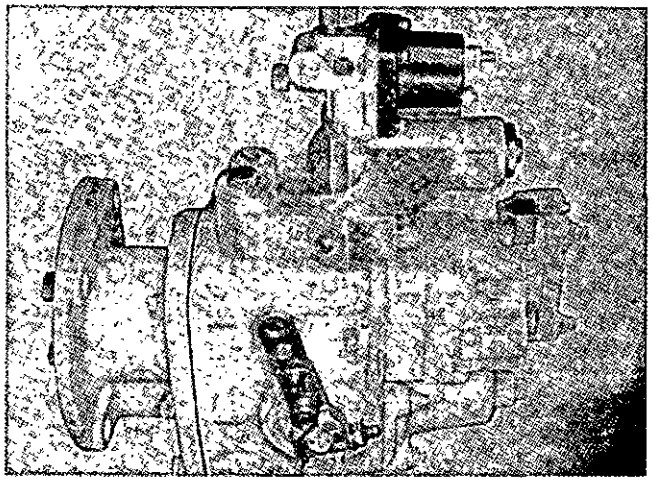


Fig. 15-8 (F5212). The high torque rise fuel pump with the torque modification device.

This pressure regulator is a bypass valve which controls the fuel pressure. When the fuel pressure exceeds the spring force, the valve action of the sleeve and plunger bypasses part of the fuel back to the top of the fuel pump housing.

The bypass valve setting must be made with ST-589. The location of the TMD is on top of the housing. It controls the fuel pressure, not the gear pump pressure like the PT (type R) regulator. The fuel adjustment plunger has all of the shims removed. It is always in a no fuel position. The device is in the pressure regulator cavity of the PT (type G)-VS pumps.

The PT (type G)-AFC-VS fuel pump, with the air fuel control, does not have any space inside the fuel pump housing for the TMD. The AFC assembly is in this area. This TMD is between the fuel pump housing and the shutoff valve. Fig. 15-9.

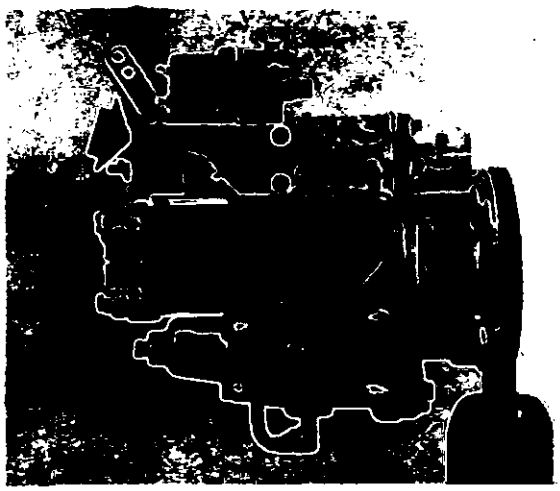


Fig. 15-9 (F5322). Torque modifying device installed on a PT (type G) AFC-VS pump.

## Torque Limiting Valve (TLV)

A torque limiting "dual power" valve is required to control the torque of the NTC-270-CT and other engines, with transmissions that have gear ratios of 17:1 or greater. The torque of these engines must be controlled on this type of engine/transmission when operating in high ratio gear only to protect the transmission and the drive components.

This valve is controlled by a pressure switch, which is deenergized. This valve reduces the fuel pressure to the engine when the transmission is in low gear only. The engine power output will not exceed the transmission rating. This valve permits normal fuel pressure when the switch is energized in all of the other operating gears. The valve will not operate during normal vehicle use. See Table 18-16.

The valve is between the TMD (Torque Modification Device) and the standard shutoff valve, Fig. 15-10.

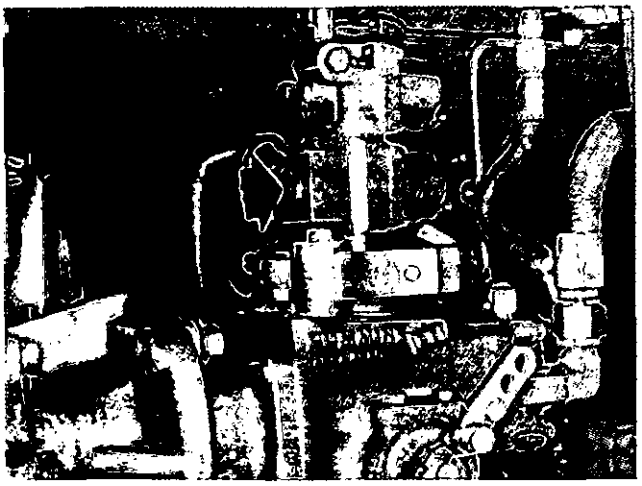


Fig. 15-10, (F5323). Torque limiting valve on a PT (type G) TMD fuel pump.

## Torque Limiting System (TLS)

The torque limiting system is a two way valve. It is not adjustable. It is in the air line between the intake manifold and the AFC, Fig. 15-11.

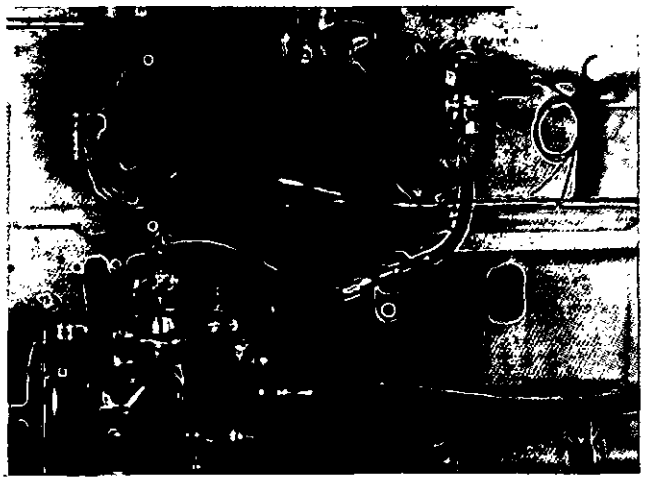


Fig. 15-11 (F5324). Torque limiting system valve and AFC pump.

This air valve Part No. 3003716, can be used on any Cummins turbocharged engine. It protects the vehicle drive components from high torque when operating in first or "creeper" gear.

An electric switch, actuated by the first gear shift mechanism, closes the two way valve solenoid. This prevents the intake manifold pressure from activating the AFC. This limits the engine to the "no air" fuel rate and horsepower. In all other gears, the AFC will operate normally.

## Multiple Unit Throttle Control

The multiple unit throttle control system was designed for use with the PT (type G) AFC fuel pump. The system is a replacement for mechanical linkages and/or hydraulic controls normally used on locomotives, railcars or other such applications with multiple engine power requirements. To use the system, the engine is to operate at distinct power settings (such as 35, 65, 80, or 100% of rated power) rather than variable throttle positions manually controlled by an operator.

The unit is a manifold-type block that has orifices which are opened or closed to fuel flow by electric solenoid valves as horsepower output requirements change. The valves open in various combinations, calibrated and timed to produce changes in the fuel pressure, hence horsepower output from the engine. The control unit can be either engine or remote mounted.

The fuel flows from the tank through the filter and to the fuel pump. After the governor (bottom of fuel pump), the fuel goes to the multiple unit throttle control. From the control unit it goes back to the fuel pump throttle shaft, through the AFC and the fuel pump shutoff valve to the injectors. As the fuel flow (horsepower) requirements change, orifices in the throttle control unit are opened by solenoid valves. This will let more or less fuel to the fuel pump as required. The unit has four throttle power valves. The shutoff control is by the standard fuel pump shutoff valve.

The multiple unit throttle control assembly valves are activated based on horsepower requirements, one example is as follows:

| Horsepower Requirement | Solenoid Opening |
|---|---|
| 25% | 1 |
| 50% | 1-2 |
| 70% | 1-3 |
| 80% | 1-2-3 |
| 94% | 1-4 |
| 97% | 1-2-4 |
| 100% | 1-2-3-4 |

The fuel flow value for each valve is set by selecting the orifices from the fuel pump code data to match the fuel pump calibration. Each installation requires a different fuel pump calibration; therefore, the pump code is different for each application.

### Mounting of Throttle Control Unit

The throttle control has four solenoids, and orifices. The closer to the pump it is mounted the better the results will be, Fig. 15-12. Throttle control solenoid valves are available at 24, 32 and 64-volts.

Fig. 15-12 (F5404). Fuel pump and throttle control on an NT-855 engine.

# Air/Fuel Ratio Controls

Beginning January 1, 1976 all Cummins on-highway engines were required to be certified by the Environmental Protection Agency. The Air Fuel Control (AFC) is used to meet the certification requirements.

## Air Fuel Control (AFC)

The PT (type G) AFC fuel pump was made to replace the PT (type G) fuel pump and the aneroid on the turbocharged engines. The aneroid is an on-off fuel by-pass device. The air fuel control (AFC) limits the fuel pressure and flow restriction. The AFC will give the correct air fuel delivery rate to the engine during acceleration.

Some fuel pumps do not require the air fuel control. These pumps will have a plug in the housing in place of the AFC barrel assembly.

### Operating Principles

The main operating difference between the PT (type G) and the PT (type G) AFC fuel pumps occurs between the fuel pump throttle shaft and the shutoff valve on the AFC pump. In a PT (type G) AFC, the fuel goes through the AFC unit after it leaves the throttle shaft and before it reaches the shutoff valve, Figs. 16-1 and 16-2.

The flow of fuel, when the AFC control plunger is in the "no-air" position, is in Fig. 16-1. This condition occurs during the engine start-up and when the engine (turbocharger) speed and air manifold pressure is too low to compress the AFC spring. Fuel from the throttle shaft flows through the no-air needle valve passage. The needle valve makes a restriction on the pressure and flow. The AFC plunger stops the fuel from going through the AFC barrel. After going through the needle valve, the fuel flows to the shutoff valve.

When the turbocharger speed and the pressure of the intake air manifold increases, the air pressure pushing on the AFC bellows and piston compresses the AFC spring. This causes the AFC plunger to move away from the AFC cover. When the plunger moves, the plunger groove begins to let the fuel flow through a passage in the AFC barrel. This allows the fuel to by-pass the no-air adjustment needle valve. The fuel flows across the AFC barrel to a second passage going to the shutoff valve. When the intake manifold air pressure increases, the AFC plunger moves until a minimum of fuel restriction is reached. The air pressure of the intake manifold holds the plunger in the full open position. This position is shown in Fig. 16-2.

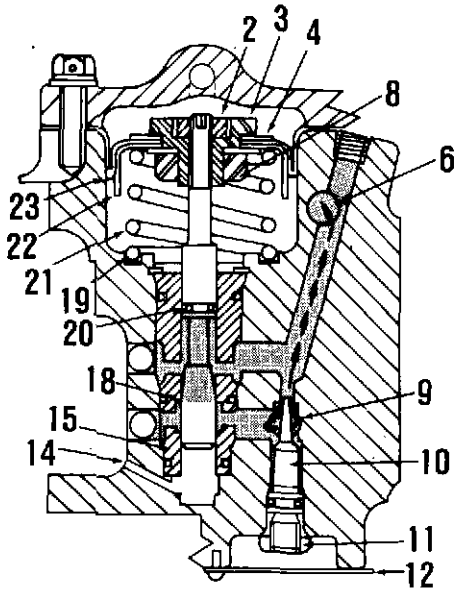
In the fuel pumps now being made, the fuel in the AFC cavity is drained away through a drain tube to the injector drain system. In the old type of fuel pumps, the fuel was sealed out of the AFC bellows and piston cavity by the plunger seal (glyd-ring and expander O-ring) in the plunger groove. Two steel balls are pressed into the two housing fuel passages that go to the two AFC barrel passages. These balls keep the fuel from leaking into the fuel pump housing cavity.

**Caution: The first field installation on an engine of a fuel pump with a tachometer drive in the front cover can require air compressor modifications. (When the tachometer drive was in the main housing of the fuel pump.) Oil must be permitted to spray from the air compressor housing into the front cover cavity. This will lubricate the tachometer drive gear. If an oil seal is used on the fuel pump side of the compressor drive shaft, the seal must be removed. A plug must be put in the oil drain holes before the fuel pump is installed. If the tachometer connection hits the air compressor outlet tube, change the air compressor head. Use air compressor head, Part No. 218793, with an offset air outlet port.**

When fuel pumps are in use on engines that do not require the air-fuel control, a plug will be in the housing instead of the AFC barrel assembly.

### AFC Adjustments

The AFC is set when the fuel pump is calibrated. See "Checking and Setting the AFC" in section 10 of this manual for the adjustment procedures.




1. Air Manifold Pressure
2. Plunger Jam Nut
3. Center Bolt
4. Sealing Washer
5. Flat Washer
6. Fuel to Shutoff Valve
7. Mounting Spacer
8. Piston Jam Nut
9. Fuel from Throttle Shaft
10. No Air Adjustment Valve
11. No Air Jam Nut
12. Throttle Cover Plate
13. Barrel Spring
14. Fuel Vent to Housing
15. Barrel
16. Barrel O-ring Seals
17. Fuel Drain Passages
18. Control Plunger
19. Washer
20. Plunger O-ring Seal
21. Spring
22. Piston
23. Diaphram or Bellows

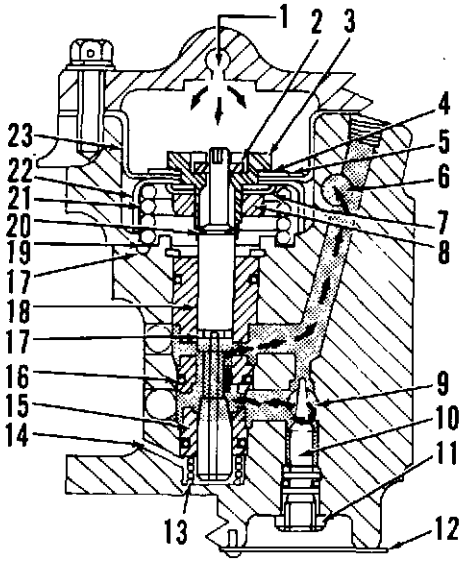



Fig. 16-1, (F5352). AFC top view-cross section with the control plunger in the "no air" position. Used when the ASA was in the AFC cover.

Fig. 16-2, (F5353). New design with the AFC control plunger in the "full air" position. Used when the ASA is in the fuel pump housing.

## Aneroids

Beginning January 1, 1970 all of the engine models sold by Cummins for on-highway applications had to meet the Federal Smoke Emission Certification. To meet the requirements for certifications, the aneroid was used as standard equipment.

Aneroids are required on the following engines built betwee January 1, 1970 and December 31, 1975, when used in on-highway applications.

| | | |
|---|---|---|
| NHCT-CT | NTC-350 | NTA-400 |
| NHCT-270 | NTA-350 | NTA-420 |
| NHCT-270-CT | NTF-365 | VT-1710-635 |
| NTC-290 | NTA-370 | VTA-1710-700 |
| NTC-335 | NT-380 | VTA-1710-800 |
| NT-350 | NTA-380 | |

Aneroids were standard on V-12-1710 engines (beginning with Engine Serial no. 715253) to stop the smoke at high altitudes. This occurs during acceleration at construction and mine areas.

The aneroids must not be removed, disconnected or changed on these engines. The settings must not be changed to exceed the specifications for the aneroid in Table 16-1.

This information replaces all of the older publications and must be used when setting the aneroid assemblies in Table 16-1.

**Note:** The AR-40000 series aneroid mounting can be moved. The fuel inlet is connected in the end of the starting check valve.

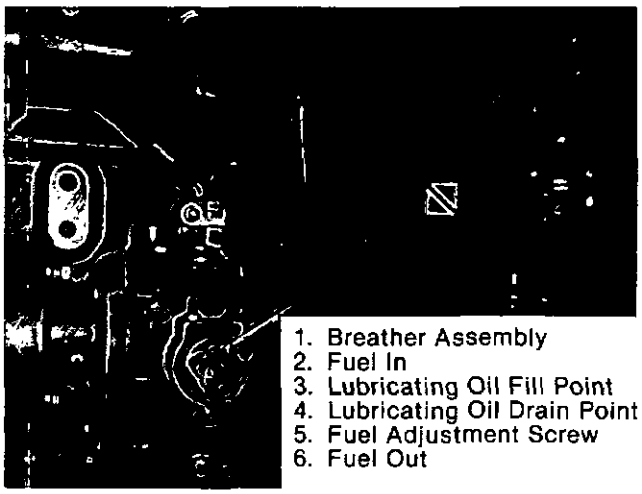
### Description

1. When the throttle is opened during acceleration or rapid engine load changes, the turbocharger speed (intake manifold pressure) change is normally behind the power or fuel requirement.
2. This delay is not in the fuel system. A high fuel to air ratio, normally with heavy smoke, occurs until the turbocharger "catches up".

3. The aneroid creates a delay in the fuel system. The fuel delay is equivalent to that of the turbocharger. This controls the engine smoke level.

Fuel Flow

1. The fuel from the outlet side of the fuel pump enters the aneroid. The fuel goes through the starting check valve area (5, Fig. 16-4). The aneroid AR-40600 series does not have a starting check valve but it must have a fuel check valve in the supply line.
2. The starting check valve (3) in the aneroid prevents the fuel bypass at the engine starting speeds. For speeds above the starting speed, the fuel pressure makes the check valve open. This lets the fuel flow to the valve port (4) of the shaft (9).
3. The shaft (9) and its bore form the bypass valve. This shaft and bore make a passage or a restriction of the fuel flow like the throttle shaft and sleeve in PT fuel pump.
4. The fuel that goes through the bypass valve is returned (2) to the suction side (inlet fitting) of the PT gear pump. This bypass fuel lowers the fuel pump pressure to the engine, Fig. 16-3.
5. Fuel goes through the aneroid shaft and sleeve when the arm (10) of the lever is against the adjustment screw (1). The amount of the fuel bypass is adjusted by this screw. This screw is in the bottom of the aneroid.
6. The lever arm, attached to the piston (8) by the actuator shaft (6), rotates the shaft. This closes the valve port. The lever is rotated by the action of the air manifold pressure (11) against the piston and the diaphragm (7). This moves the actuator shaft down against the compression spring force, Fig. 16-4.
7. When the air pressure to the aneroid is above the bellows air actuating set pressure, no fuel is bypassed.
8. The fuel goes through the aneroid when the air pressure in the intake manifold is below the set value. This will occur when:
   a. The engine slows down during a stop and go operation.
   b. You are changing gears.
   c. Going down a grade with the throttle closed.



1. Breather Assembly
2. Fuel In
3. Lubricating Oil Fill Point
4. Lubricating Oil Drain Point
5. Fuel Adjustment Screw
6. Fuel Out

Fig. 16-3 (N11026). Aneroid mounted on an engine.

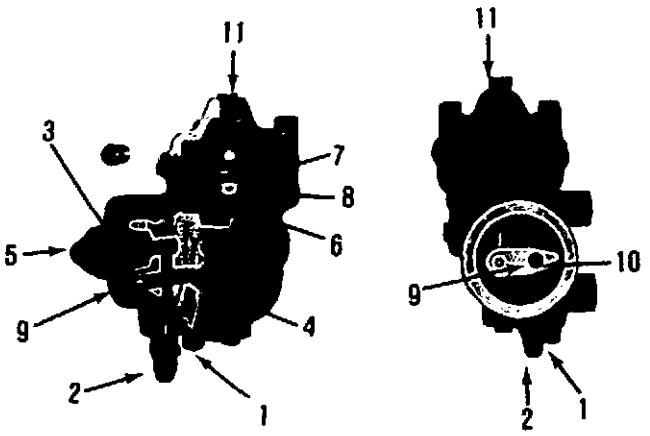



Fig. 16-4 (F5244). Aneroid cutaway.

9. The fuel will not go through the aneroid under full throttle lug down conditions. When the speed is low enough to lower the air pressure in the intake manifold to the aneroid operating range, fuel wil bypass. This speed is normally below the engine stall out speed.

**Install the Aneroid on the Fuel Pump Test Stand**

The precision setting and/or checking of the aneroids can be done on a fuel pump test stand.

1. Install Service Tool 3375934 or ST-1256 on the St-848 test stand.
2. The air pressure hose from the regulator must go to the top of the aneroid to actuate the bellows.

3. Install a tee off of the regulator air line (outlet) into a manometer or the pressure gauge.

## Test the Aneroid

### Adjust the Fuel Screw

1. Mount a fuel pump on the fuel pump test stand. This pump must be calibrated to the same code as that on, or will be used, on the engine. If an aneroid is used with a fuel pump calibrated to code No. 2049, use a pump set at the same code (2049) to set the aneroid.
2. Connect the aneroid to the fuel pump, Figs. 16-7 and 16-8.
3. Start the fuel pump test stand and remove all of the air from the system.
4. Adjust the air regulator to get 30 inch [76.2 cm] Hg. pressure on the aneroid bellows.
5. Set the fuel pump at the maximum speed calibration point (Manifold psi @ rpm and Flow Reading) for the pump code.

**Caution: The flow control valve setting must not be changed during the following checks. Changing the flow will cause wrong adjustments.**

6. Lower the test stand speed to that shown in Table 16-1 under bhp @ speed.
7. Set the air regulator to "O" inches of mercury. Adjust the screw in bottom of the aneroid housing. Set it to the specification under "Fuel Manifold Pressure" for the pump and aneroid code shown in Table 16-1, Fig. 16-5.

**Note:** See the section "Engine Altitude Derate and Aneroid Settings". The engine can require a fuel pressure setting lower than the specification in Table 16-1 because of the altitude.

8. Return the air pressure to 30 inches [76.2 cm] Hg. Lower the air pressure slowly. Look at the fuel pressure gauge. When the aneroid bypass has just opened, the fuel pressure will be lower. Compare the air pressure to that in Table 16-1. This check must always be made when the air pressure is being reduced. The inside friction in the aneroid bellows, spring and linkage causes the air pressure requirements to change when the air pressure is going up or going down.

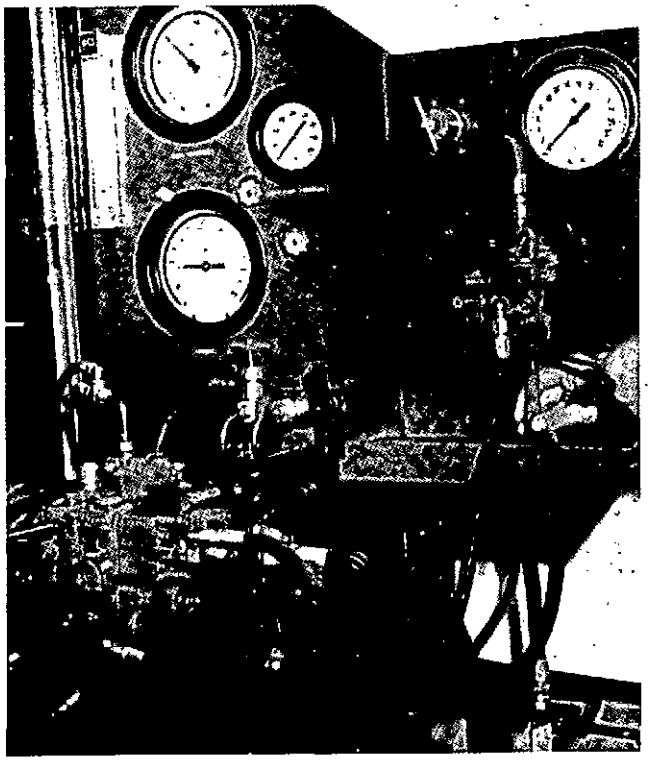


Fig. 16-5 (F5287). Adjusting aneroid fuel screw.

   a. If the air pressure is too high, turn the two-piece shaft 1/4 turn. Remove the aneroid shims, Part No. 144921, or add a washer, Part No. 67684, as shown in the assembly drawing. If the air pressure is too low, add shims or make the shaft longer. If the capscrew that holds the shaft to the bellows is removed, tighten to 20 to 25 in. lbs. [2.3 to 2.8 N•m].
   b. The correct aneroid spring must be used, Table 18-10.

### Check the Starting Check Valve

1. To check the action of the aneroid starting check valve, stop the fuel pump test stand and set the air regulator to 0 inches of mercury. Disconnect the aneoid fuel return line at the fuel pump. Put a plug in the opening of the inlet suction fitting of the in gear pump.
2. Move the aneroid supply line from the bottom of the housing to the side of the shut-off valve. Put a plug in the hole of the bottom of housing.

**Note:** The check valve, Part N. 216737, is not interchangeable with the older type of check valves.

3. Open the rail flow valve on the test stand completely. Open the rail flow "snubber" valve. Hold the pump throttle wide open.
4. Start the test stand at the lowest possible speed setting. The rail pressure must be less than 10 psi [69 kPa].
5. Check the fuel drain from the aneroid hose. There must be only a little fuel leakage. If the valve is stuck open, a free flow of fuel will occur.
6. To check the valve opening pressure, gradually close the rail flow valve to increase the rail pressure.
7. Check the rail pressure gauge and fuel drain from the aneroid line. When the starting check valve opens, a large flow increase will occur, Fig. 16-6.
8. Check to see if the aneroid starting valve is loose by opening and closing of the rail flow valve. See Table 19-11 for the spring opening pressures of the starting check valve.

### Aneroid Assembly Number and Code

1. The 40000 series AR numbers have reference to the aneroid air setting.
2. The last two numbers of the AR is the aneroid air setting.
3. The factory aneroid calibration procedures can be made in the field, if the engine is on an engine dynamometer.
   a. The air actuation pressure is set by a monometer or a gauge on a fuel pump test stand to the value under "Bellows Air Actuation Pressure" in the table.
   b. The bottom screw (fuel pressure) setting is made at engine test so that the engine has the power under setting "BHP @ Speed" in Table 16-1. Remove the air line from the air intake manifold.

**Note:** The above procedure must be used in the field, if engine is on an engine dynamometer.

4. All aneroids sent out as service parts will be set and ready for engine installation.

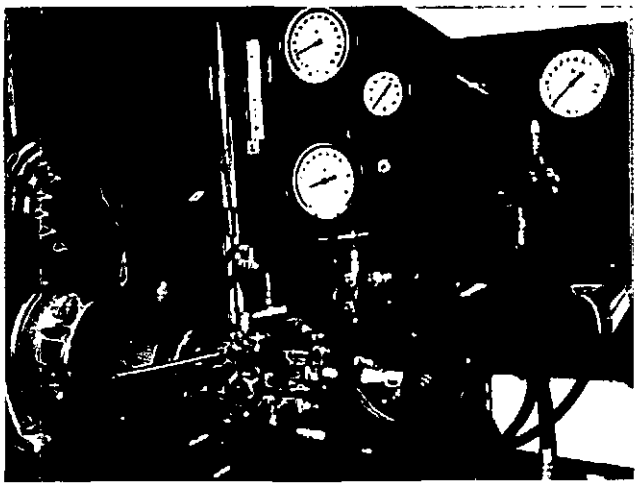


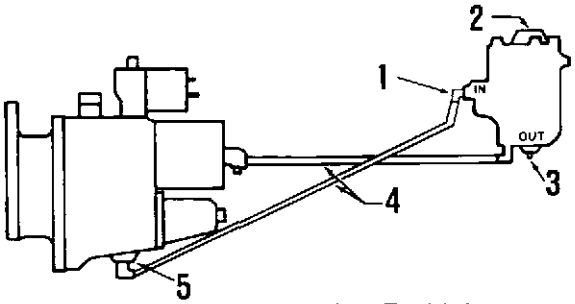
Fig. 16-6, (F5288). Check the starting check valve.

### Aneroid Fuel Lines

The fuel hose size is a No. 5 on all of the engine models.

The fuel line connection points are:

1. Standard automotive PT (type G) and VS, Fig. 16-7.
2. PT (type G) pumps that have a MVS governor, Fig. 16-8.
3. Connect the hose to the aneroid from the pressure regulator cavity. This will lower the MVS surge as the aneroid bypass opens and closes.




1. New Fuel Inlet
2. Air from Regulator on Test Stand
3. Fuel Adjustment Screw
4. No. 5 Hose
5. Outboard Pipe Plug

Fig. 16-7, (F5245). Aneroid fuel lines for a PT (type G) fuel pump.

**Table 16-1: Engine and/or Fuel Pump Aneroid Setting — No Air On Diaphragm**

| New Aneroid | Old Code | CPL | Engine Model | Reference Pump Code | No Air Setting BHP@RPM | Fuel Mfld. Pressure PSI See Note (1) | Altitude Limit Ft. | Bellows Spring | Color Code | Bellows Air Actuation Press. In. Hg. |
|---|---|---|---|---|---|---|---|---|---|---|
| AR-40303 | FC | 16 | NHCT-CT | 2046 | 205@2000 | 155 | 8,000 | 124033 | Green | 3.0-3.5 |
| | | 113 | NTC-270-CT | S-221 | 228@1600 | | 12,000 | | | |
| AR-40304 | AC | 9 | NT-855-380 | 2579 | 250@2000 | | 5,000 | 124033 | Green | 4.0-4.5 |
| | | 10 | NTA-855-380 | 2483 | 275@1900 | 155 | 8,000 | | | |
| | | 69 | NT-855-310 | S-210 | 265@2000 | 130 | 12,000 | | | |
| | FE | 14 | NHCT-270 | 1500 | 260@2000 | 195 | 12,000 | | | |
| | | 101 | NTC-290 | 2433 | 218@1600 | 86 | 8,500 | | | |
| | | 101 | NTF-295 | 2613 | 255@2000 | 102 | 5,000 | | | |
| | | 113 | PT-270 | 2490 | 232@2000 | 102 | 12,000 | | | |
| | | 127 | KT-1150 | 2829 | 270@2000 | | 12,000 | | | |
| | | 128 | Super 250/270 | 2639 | 200@2000 | 102 | | | | |
| | | 144 | NTA-380 | | 240@1600 | 99 | 8,000 | | | |
| AR-40305 | F | 79 | JT-6-BI | 1290 | 133@2100 | 93 | 10,000 | 124033 | Green | 5.0-5.5 |
| | | 136 | VT-350 | 2805 | 262@1900 | 95 | 5,000 | | | |
| | | 110 | JT-6-BI | 2446 | 128@2100 | 75 | 10,000 | | | |
| AR-40306 | AB | 146 | NTA-855-380 | 2786 | 221@1600 | | 8,000 | 115084 | Black | 6.0-6.5 |
| AR-40307 | AM | 88 | NHHRTO-6 | 1611 | 252@2000 | 190 | 8,000 | 115084 | Black | 7.0-7.5 |
| AR-40309 | FA | 1 | (2)NT-855(series) | 2253 | 275@2000 | 137 | 12,000 | 115086 | Blue | 9.0-9.5 |
| | | 5 | NTF-365 | 2408 | 285@2000 | 125 | 5,000 | | | |
| | | 21 | NTC-350 | 2612 | 285@2000 | 116 | 12,000 | | | |
| | | 21 | NTC-350 | 2665 | 270@1850 | 105 | 12,000 | | | |
| | | 21 | PT-330-D | 2780 | 285@2000 | 116 | 12,000 | | | |
| | | 25 | NTF-365 | 2174 | 285@2200 | 130 | 5,000 | | | |
| | | 61 | VT-1710-525 | | 450@2000 | 85 | | | | |
| | | 61 | VT-1710-635 | | 550@2000 | 117 | 11,000 | | | |
| | | 62 | VT12-700 | | 550@2000 | 117 | 7,000 | | | |
| | | 63 | VT12-700 | | 550@2000 | 117 | 7,000 | | | |
| | | 69 | NTC-335 | 2312 | 275@2000 | 137 | 12,000 | | | |
| | | 69 | NTC-335 | 2809 | 258@1850 | 121 | 12,000 | | | |
| | | 69 | NTC-335 | 2809 | 253@1800 | 117 | 12,000 | | | |
| | | 69 | NT-855-310 | 8039 | 265@1900 | 128 | 12,000 | | | |
| | | 69 | NT-855-310 | 2444 | 240@1700 | 107 | 12,000 | | | |
| | | 69 | PT-300-D | 2778 | 275@2000 | 125 | 12,000 | | | |
| | | 70 | NTC-335 | 2002 | 275@2000 | 137 | 12,000 | | | |
| | | 132 | NTC-335 | S-255 | 230@1600 | 96 | 12,000 | | | |
| | | 132 | NTC-335 | 2900 | 230@1600 | 96 | 12,000 | | | |

**Table 16-1: Engine and/or Fuel Pump Aneroid Setting — No Air On Diaphragm (Continued)**

| New Aneroid | Old Code | CPL | Engine Model | Reference Pump Code | No Air Setting BHP@RPM | Fuel Mfld. Pressure PSI See Note (1) | Altitude Limit Ft. | Bellows Spring | Color Code | Bellows Air Actuation Press. In. Hg. |
|---|---|---|---|---|---|---|---|---|---|---|
| AR-40309 | FA | 137 | VT12-635 | 2811 | 465@1600 | 85 | 11,000 | | | |
| | | 138 | VT12-635 | 2772 | 550@2000 | 117 | 11,000 | | | |
| | | 138 | VT12-525 | 2776 | 450@2000 | 117 | 11,000 | | | |
| | | 139 | VT12-700 | 2925 | 550@2000 | 117 | 7,000 | | | |
| | | 145 | VT12-700 | 2784 | 550@2000 | 117 | 7,000 | 115086 | Blue | 9.0-9.5 |
| | | 145 | VT12-635 | 2806 | 550@2000 | 117 | 11,000 | | | |
| | | 147 | NTC-350 | 2681 | 285@2000 | 116 | 12,000 | | | |
| | | 152 | NTA-380 | 2831 | 244@1600 | | 8,000 | | | |
| | | 158 | VT12-525 | 2868 | 450@2000 | 85 | 11,000 | | | |
| AR-40311 | AL | 9 | NT-380 | 2372 | 250@2200 | 120 | 5,000 | 115086 | Blue | 11.0-11.5 |
| | | 10 | NTA-380 | 2376 | 275@2000 | 114 | 8,000 | | | |
| | | 10 | NT-380 | 2389 | 275@2000 | 114 | 8,000 | | | |
| | | 10 | NTA-855-L | 2370 | 225@2000 | 114 | 12,000 | | | |
| | | 10 | NTA-380 | 2370 | 215@1900 | 105 | 8,000 | | | |
| | | 11 | NT-380 | 2055 | 250@2200 | 120 | 5,000 | | | |
| | | 12 | NTA-380 | 0203 | 250@2200 | 120 | 8,000 | | | |
| | | 146 | NTA-380 | | 221@1600 | | 8,000 | | | |
| AR-40313 | AK | 61 | VT12-600 | 2295 | 500@2000 | | | 115086 | Blue | 13.0-13.5 |
| | | 63 | VT12-635 | 2195 | 500@1950 | | 11,000 | | | |
| | | 149 | VT12-635 | 2840 | 500@2000 | | 11,000 | | | |
| AR-40314 | AH | 15 | VT8-430 | 0682 | 300@2400 | 121 | 5,000 | 115086 | Blue | 14.0-14.5 |
| | | 15 | VT8-430 | 1173 | 300@2400 | 121 | 5,000 | | | |
| | | 127 | KT-1150 | | 305@2000 | 93 | 12,000 | | | |
| | | 127 | KT-1150 | | 260@1900 | 75 | 12,000 | | | |
| AR-40315 | FB | 23 | NTA-420 | 2320 | 300@2000 | 135 | 7,000 | 115086 | Blue | 15.0-15.5 |
| AR-40316 | FD,AF | 61 | VT12-635 | 2379 | 315@2000 | 58 | 11,00 | 115086 | Blue | 16.0-16.5 |
| | | 61 | VT12-525 | 2720 | 315@2000 | 58 | | | | |
| | | 62 | VT12-700 | 8083 | 470@2000 | 100 | 7,000 | | | |
| | | 63 | VT12-700 | 2396 | 470@2000 | 100 | 7,000 | | | |
| | | 63 | VT12-600 | 2395 | 470@1950 | | | | | |
| | | 64 | VT12-800 | 2412 | 600@2000 | 100 | 7,000 | | | |
| | | 64 | VTA-1710-800 | 2412 | 575@1900 | 92 | 7,000 | | | |
| | | 64 | VTA-1710-800 | 2412 | 500@1600 | 72 | 7,000 | | | |
| | | 140 | VT-1710-700 | 2773 | 379@1600 | | 7,000 | | | |
| | | 141 | VT12-800 | 8059 | 503@1600 | 72 | 7,000 | | | |
| | | 157 | VT12-800 | 8206 | 503@1600 | 99 | | | | |

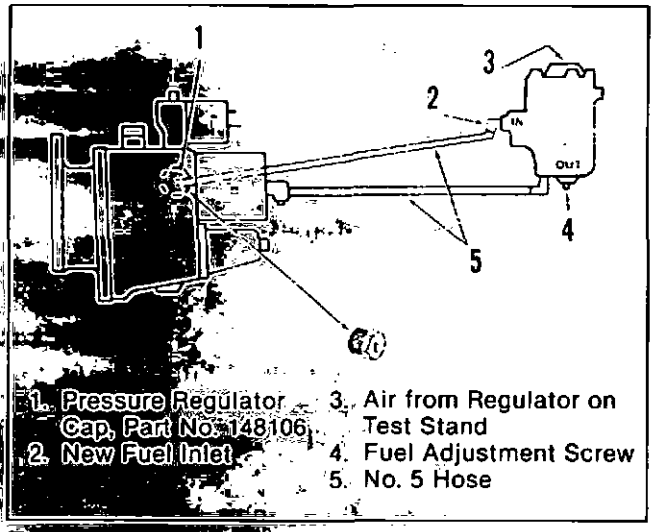
**Table 16-1: Engine and/or Fuel Pump Aneroid Setting — No Air On Diaphragm (Continued)**

| New Aneroid | Old Code | CPL | Engine Model | Reference Pump Code | No Air Setting BHP@RPM | Fuel Mfld. Pressure PSI See Note (1) | Altitude Limit Ft. | Bellows Spring | Color Code | Bellows Air Actuation Press. In. Hg. |
|---|---|---|---|---|---|---|---|---|---|---|
| AR-40316 | FD,AF | 179 | KTA-2300 | 8230 | 470@1600 | | | | | |
| AR40404 | | 101 | NTF-295 | 8107 | 218@1600 | 86 | | 124033 | Green | 4.0-4.5 |
| AR-40407 | | 181 | PT-270 | 2953 | 210@1600 | 88 | | 115084 | Black | 7.0-7.5 |
| AR-40409 | | 5 | NTF-365 | 2427 | 234@1600 | 99 | | 115086 | Blue | 9.0-9.5 |
| AR-40413 | AK | 154 | NTC-350 | | 214@1600 | | 12,000 | 115086 | Blue | 13.0-13.5 |
| | | 155 | NTF-365 | 2937 | 204@1600 | | 5,000 | | | |
| | | 174 | NTC-335 | | 220@1600 | | | | | |
| AR-40414 | AH | 153 | KT-1150 | 2856 | 224@1600 | | 12,000 | 115086 | Blue | 14.0-14.5 |
| | | 127 | KT-1150 | 8123 | 255@1600 | | 12,000 | | | |
| AR-40415 | FB | 22 | NTA-370/380 | 2240 | 290@2000 | 115 | 12,000 | 115086 | Blue | 15.0-15.5 |
| | | 107 | NTA-420 | 2383 | 290@2000 | 115 | 7,000 | | | |
| | | 135 | NTA-420 | 2819 | 300@2000 | 135 | 7,000 | | | |
| | | 135 | NTA-400 | 2818 | 300@2000 | 135 | 9,000 | | | |
| | | 154 | NTC-350 | | 204@1600 | | 12,000 | | | |
| | | 160 | NTC-350 | 2921 | 204@1600 | 65 | | | | |
| AR-40515 | | 171 | KT-1150 | E0001 | 228@1600 | 57 | | 115085 | Orange | 15.0-15.5 |
| AR-40615 | | 163 | NTA-370 | 2968 | 238@2000 | 90 | | 115085 | Orange | 15.0-15.5 |
| AR-40619 | | 162 | NTA-400 | 2951 | 206@2100 | 78 | | 115086 | Blue | 19.0-19.5 |

**Approximate Bellows Spring Shim Requirement of Old Style**

| Aneroid Code | FA | FB | FD | AC | FC | FD |
|---|---|---|---|---|---|---|
| No. of 114921 Shims | 7 | 9 | 6 | 6 | 6 | — |
| Bellows Shaft | 115033 | 119345 | 119345 | 115033 | 115033 | 115033 |
| Starting Valve Spring | 114745 | 114745 | 120073 | 114745 | 114745 | 114745 |

**Notes:** 1. The fuel manifold pressure is ±5 psi on engine or ±0 psi on the test stand.
2. This aneroid is not standard, it is sent only upon a special request.




1. Pressure Regulator Cap, Part No. 148106
2. New Fuel Inlet
3. Air from Regulator on Test Stand
4. Fuel Adjustment Screw
5. No. 5 Hose

Fig. 16-8 (F5246) Aneroid fuel lines for a PT (type G) fuel pump with a MVS governor and a PT (type G)-VS fuel pump with an aneroid housing, Part No. 218081

4. The PT (type G) VS fuel pumps with aneroid housing, Part No. 218081, must be connected per Fig. 16-8. The high torque rise fuel pump housings, Part No. 201790 or 201791, must also be connected like paragraph No. 3. This fuel pump must not contain the high torque rise (TMD) presure regulator.
5. The aneroid AR 40600 series has the starting check valve omitted. A fuel check valve must be installed into the fuel supply line of this aneroid.

## Engine Altitude Lower Ratings and the Aneroid Settings

### Fuel Pump Lower Rating

The engine model rating and turbocharger limit the maximum altitude at which the engine can be used. The engine horsepower must be lowered. This will make sure the exhaust temperatures and the turbocharger speed are not too high. The amount of the rate is 4% of the sea level bhp per 1000 feet [305 m] above the altitude limit specifications.

**Example:** Engine Model NTC-335 rated at 335 hp.

The altitude limit is 12,000 feet [3657 m].

The altitude at which the engine must operate is 17,000 feet, [6181 m], or 5,000 feet [1524 m] above the limit.

The amount of the lower rate is 4% × 5 = 20% or 0.20 × 335 = 67 bhp. To find the amount of fuel pressure, take the rate at sea level bhp × 0.20.

This is an example of an NTC-335. The fuel pump code 2312-A fuel pressure is 183 psi [1262 kPa]. The engine fuel pressure at 17,000 feet [6181 m] should be 183 − (183 × 0.20) = 146 psi [1007 kPa].

### Aneroid Lower Rating

When the fuel pump pressure on an engine is lowered, the aneroid "fuel pressure" setting is automatically lowered at the same rate.

### "Fuel Pressure Setting"

**Note:** The aneroid fuel pressure setting is always adjusted and checked with the air line to the aneroid disconnected.

1. The acceleration smoke level of an engine with an aneroid increases with the increase in altitude. Adjust the "aneroid fuel pressure" or the bottom screw for the engine operating altitude to have an acceptable smoke level.
2. Some engines operate permanently at a high altitude. Some locations through which the vehicle operates are at high altitudes and have smoke level laws. Adjust the aneroid on these engines to that altitude.
3. The engines operating at a high altitude construction or mine area must have the "aneroid fuel pressure" or bottom screw adjusted. This adjustment is made at the "In Service Inspection" if required. An adjustment can be necessary if the equipment is moved to another location that has a different altitude.
4. An approximate rule to find the lower amount of "aneroid fuel pressure" for a set altitude is as follows. Lower the fuel pressure setting 3% per 1000 ft. [305 m] above 500 ft. [152 m]. On an NTC-335 which will operate at 6000 ft. [1829 m], the "aneroid" fuel manifold pressure in Table 16-1 must be lowered 125 × 5.5 × 0.03 = 20.6 psi [142 kPa].
5. Set to this specification in the shop and adjust in the field as necessary.

## Air Actuation Pressure Setting of Turbocharged Engines

The intake manifold pressure of the turbocharged engines does not change with the increase in altitude. The "air actuation" pressure setting

requires no adjustment with the changes in altitude. This setting must never be changed.

## Custom Ratings

1. Except for the special applications, both the bellows air setting and fuel screw no air setting will not change. They will be the same for all of the power ratings of the Control Parts List (CPL). The lower horsepower rating will not change the setting specifications.
2. When a special horsepower rating change is made, the aneroid fuel pressue, bottom screw, changes at the same rate. The air actuation pressure of the bellows will not change.
3. All of the NTC-335 aneroids are the same except for the fuel pressure setting.
4. With the exception of the 280 hp rating, all of the NTC-335 ratings are set the same. These engines are set on engine test to give 275 bhp @ 2000 rpm with no air on the aneroid.
5. Use Table 16-2 to select the correct NTC-335 fuel pump when setting the aneroid on the fuel pump test stand.
6. On low horsepower, low rated engines, the fuel pressure screw can be turned in all the way. This can stop the fuel flow through the aneroid. The aneroid must remain on the engine because of the federal smoke certifications requirements.

**Table 16-2: NTC-335 Custom Rate Aneroid Settings**

| Power Rating | Engine Pump Code | Aneroid Code | No-Air Engine Power at 2000 rpm | Pump Code for Aneroid Bench Test |
|---|---|---|---|---|
| 335 @ 2100 | 2312-A* | FA | 275 bhp | 2312-A |
| | 1791-E** | FA | 275 bhp | 2312-A |
| 320 @ 2100 | 2313-A* | FA | 275 bhp | 2313-A |
| | 1790-Z** | FA | 275 bhp | 2313-A |
| 300 @ 2100 | 2314-A* | FA | 275 bhp | 2314-A |
| | 1789-C** | FA | 275 bhp | 2314-A |
| 280 @ 2100 | 2315-A* | FA | 260 bhp*** | 2315-A |
| | 1787-B** | FA | 260 bhp*** | 2315-A |
| | 2362-A* | FA | 255 bhp**** | 2362-A |

*VT-50 Turbocharger
**T-50 Turbocharger
***"Fuel pressure" setting is 120 psi.
****"Fuel pressure" setting is 115 psi.

## Aneroid Assembly, Disassembly and Repair

No special tools are required for disassembly and assembly. Fig. 16-9.

### Bellows Replacement

This can be done without changing the aneroid settings. Make sure the same bellows spring and shims or the two-piece shaft length is the same when it is installed.

1. Use a grinder or a file to remove the rivet seal, Part No. 125111, or cut the seal wire.
2. Remove the cover, Part No. 114947, nut, Part No. 108074 and washer, Part No. 114754.
3. Remove the piston and bellows assembly.
4. Put a coating of lubricating oil on the new bellows. Assemble the aneroid like Fig. 16-9. Make sure the capscrew holes in bellows align with the holes in the aneroid body. Tighten the piston shaft nut or capscrew 20 to 25 inch lbs. [2.3 to 2.8 N•m]. Tighten the cover capscrews 30 to 35 in. lb. [3.4 to 4.0 N•m].

**Caution: If the bellows is "wrinkled" during assembly or if the cover capscrews are to tight, the bellows will fail very soon.**

### Replace the Shaft Valve O-Ring, Part No. 114791

This can be done without changing the aneroid settings if the bottom screw position is not changed. The same bellows spring and shims or the two-piece shaft length must be the same when it is installed.

1. Drain the oil and remove the side cover, Part No. 114773 (this is pressed into the aneroid body).
2. Install a rod through the air inlet opening. Push down on the piston. Remove the shaft, Part No. 140358.
3. Replace the O-ring. Lubricate it with oil. Install the shaft in the aneroid.
4. Clean the bore of the side cover in the housing. Use a new side cover, Part No. 114773.

5. Apply a thin coating of a good liquid gasket around the cover outside diameter. To install the cover, put a piece of wood flat on the cover. Hit the wood to install the cover in the housing. The cover flange must touch the housing.

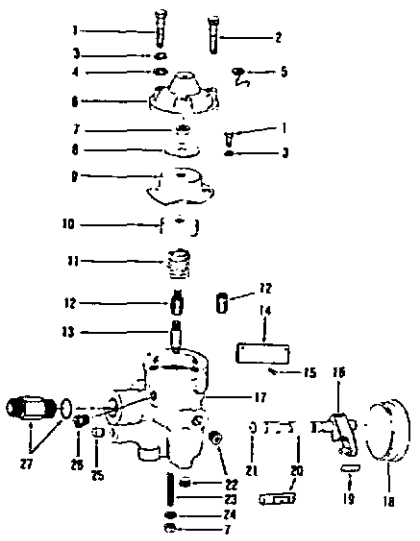
**Note:** Do not hit or press against the inside part of the cover. Distortion will stop the shaft from turning.

6. Fill with oil after the aneroid is mounted on the engine.

## Maintenance and Repair

### Maintenance

1. Make sure that the housing is filled with oil. Use the same grade that is in the engine.



1. Capscrew
2. Capscrew, Seal Type
3. Lockwasher
4. Washer
5. Lead Seal
6. Bellows Cover
7. Nut
8. Bellows Washer
9. Bellows
10. Piston
11. Bellows Spring
12. Upper Shaft
13. Lower Shaft
14. Dataplate
15. Drive Screw
16. Lever
17. Housing
18. Side Cover
19. Lever, Pin
20. Shaft Valve
21. O-Ring
22. Pipe Plugs
23. Adjustment Screw
24. Screw Seal
25. Plug
26. Air Filter
27. Check Valve

Fig. 16-9, (F5249). Aneroid exploded view.

2. Check the oil level. Change the oil every second or third engine oil change period.
   a. If rust is in the oil, remove the aneroid from the engine.
   b. Remove the side cover. Wash the cavity with solvent.
   c. Install the side cover. Fill with oil.
3. Check for oil leakage at the bottom adjustment screw or side cover.
4. Replace the aneroid bellows at 125,000 to 150,000 miles [200 000 to 240 000 km].
5. Every 30,000 to 50,000 miles [48 000 to 80 000 km], replace the breather. Tighten to 10 to 13 ft. lbs. [14 to 18 N•m].

## Troubleshooting the Aneroid

### The Engine Will Not Start

The starting check valve can be open and does not move.

1. Remove the air line from the aneroid. Install a rod through the hole and hold the piston down. Try to start the engine.
2. If the engine starts, the aneroid check valve is open and does not move. Remove, clean and polish the check valve with crocus cloth. Check for free movement in the bore. Replace with a new type of valve.
3. If the engine does not start when the aneroid piston is down, the aneroid is not at fault.

### Too Much Acceleration Smoke

1. The engine fuel rate will be too high if the pump calibration is above the specifications.
2. The aneroid check valve is closed and will not move.
   a. Disconnect the fuel outlet line at the aneroid. Put a plug into the end of the hose. Attach a hose at the aneroid outlet connection. Put the other end of the hose into a container. Start the engine. Watch for fuel coming from the hose as the engine no load speed is increased. Fuel must come out of the hose at or a little above the idle rpm. See Table 18-11 for the starting check valve opening pressure.

b. If fuel does not come from the hose, replace the valve or remove, clean and polish the starting check valve. Check for free movement in the bore.

c. Disconnect the air line at the top of the aneroid. Use a rod through the hole to check if the piston is down and will not come up. If the piston is down and does not come up, disassemble and repair the aneroid.

d. If the fuel comes from the hose, the check valve is not at fault.

3. Fuel does not flow through the aneroid hoses or fittings.

   Check for a plug in the aneroid hoses or fittings.

4. The aneroid fuel pressure setting is too high.

5. The aneroid air actuation pressure is too low.

   a. The wrong spring is in use (too light).

   b. The aneroid spring is shimmed too lightly or the two-piece shaft is too long.

6. The altitude is too high for the engine setting.

   The aneroid fuel pressure setting must be reduced.

**Low Power**

If the exhaust smoke density is high, at full power, the aneroid is not at fault.

1. The aneroid "fuel pressure" setting is too low.

   Check for a wrong adjustment.

2. The aneroid air actuation pressure is too high.

   Check for a wrong adjustment. Check for air leaks between the aneroid cover and the bellows.

3. The aneroid bellows is damaged.

   Remove the breather and apply 20 psi [138 kPa] maximum air pressure at the aneroid air inlet. If a continuous air leakage is at the breather hole, bellows is damaged.

4. The breather is plugged.

   Clean or replace the breather.

5. The aneroid piston and linkage mechanism is in the up position and will not go down.

   Put a rod through the aneroid air inlet opening, check for piston, aneroid shaft or linkage free movement. A damaged side cover will touch the valve lever.

**Air in the Fuel System**

1. The shaft O-ring, Part No. 114791, is leaking.

   a. *Disconnect the aneroid air inlet line and* put a restriction on the gear pump suction. Attach a manometer at the breather opening to find if a vacuum is being pulled in the aneroid oil reservoir.

**Note:** The aneroid oil level will be low if the leakage is occurring at the O-ring.

   b. A quick check to find if the aneroid is or is not the problem is to disconnect the aneroid fuel outlet line at the aneroid. Put a plug in the end of the hose and the opening in the aneroid. If the air going into the fuel system continues, the aneroid is not at fault. If the air stops, the aneroid is at fault.

# Adjustment On The Engine

The accuracy of the "on engine" adjustments changes with condition of the engine, engine loads and accuracy of the instruments in use. Adjustments can not be made on a cold engine. The engine must be run before making the adjustments. The oil temperature must be at least 165°F [74°C]. The valves and injectors must be set correctly.

## Service Tools

The following service tools are used to check a fuel pump on an engine.

**Service Tools (Or Equivalent) Required**

| Tool Number | Tool Name |
|---|---|
| ST-435 | Fuel Pressure Gauge |
| ST-1190 | Fuel Rate Checking Tool |
| 3375981 | Idle Adjustment Tool |
| 3376150 | Fuel Pump Tester |

**Desirable (Or Equivalent) Service Tools**

| | |
|---|---|
| ST-774 | Hand Tachometer |
| ST-998 | Fuel Flow Sight Glass |
| ST-1111 | Seal Leakage Tester |
| ST-1224 | Overspeed Stop Adjustment Tool |
| 3375362 | Fuel Flow Sight Glass |
| 3375515 | AFC Air Pressure Pump |
| 3375764 | Fuel Pump Removing Wrench |

## Pump Hook-Up

If the fuel pump has been removed from the engine for calibration, the correct hook-up is necessary.

1. Install the fuel pump to the accessory drive or to the air compressor with a new gasket. Install the correct rubber spider, nylon spider or a spline coupling and tighten securely.

**Note:** Use a black rubber spider for engine rating at or below 2300 rpm. Use the white nylon above 2300 rpm. Use the white nylon spider on all K engines.

2. Put some clean oil into the inlet hole of the gear pump. This will help the gear pump start the fuel through the pump housing.
3. Connect the fuel line from the pump shutoff valve to the engine fuel supply line.
4. The throttle lever linkage must not be connected to the throttle lever. The throttle lever must be free for the pump adjustment.
5. Install an accurate tachometer to the drive shaft connection of the fuel pump tachometer. You can use Tool No. ST-774 Hand Tachometer.
6. Connect the shutoff valve electrical connections correctly. The manual control button must be turned out which will be in the closed position.
7. Connect the pump cooling line to the check valve elbow on the gear pump.
8. Connect the AFC air line from the intake manifold to the AFC cover plate, if required.
9. Connect the ASA valve, on top of the fuel pump housing, to the gear pump drain line, if required.

## Checking and Adjusting the Fuel Pump on the Engine

Before making the fuel system checks or adjustments on the engine, make sure of the following:

1. The engine must be at the operating temperature. The fuel temperature is not above 110°F [43°C].
2. The engine parts are the same as those in the Control Parts List and in good condition. The timing, valves and injectors are correctly adjusted.
3. The instruments (gauges and tachometers) must have high accuracy.

**Caution: Do not change the fuel pump settings to be the same as engine tachometers that are not acurate.**

4. The control linkage of the vehicle throttle is adjusted for full throttle travel. When released, the throttle is stopped by the throttle adjustment screw (throttle leakage adjustment screw).

**Note:** The control linkage of the vehicle throttle must have a maximum throttle stop. When the fuel pump is in the full throttle position there must not be any pressure on the throttle shaft.

5. When the fuel pump is correctly calibrated, very little adjustment is required after the installation on the engine. A small adjustment of the idle setting and the fuel rail pressure is acceptable.

## Governor Settings

### Idle Speed

1. After the fuel pump installation, the engine must be run to get all of the air out of the fuel system. The engine must be up to the operating tempeature (165°F [74°C] oil temperature or higher).

**Note:** The idle speed adjustment must never be made on a cold engine.

2. Remove the pipe plug from the spring pack cover.

3. The idle adjustment screw is held in position by a spring clip. Turn the screw in to increase or out to decrease the speed. Use Tool No. ST-984 o 3375981 to adjust the idle speed while the engine is running. This tool will not let the spring pack cover leak when the idle is adjusted.

4. Replace the pipe plug when the idle speed is correct.

**Note:** Beginning in 1978, the engine speed is on the engine dataplate. It is under the exhaust emission control information on the dataplate. The idle of some engine models will exceed the values in Table 17-1.

5. On the VS, SVS and MVS and the PT (type H) the maximum and idle adjustment screws are on the governor cover.

**Table 17-1: Factory Approved Engine Idle Speeds**

| Engine Series | Idle Speed RPM |
|---|---|
| J and C | 625 ± 20 |
| H, NH and NT | 600 ± 20 |
| V-12-1710 | 550 ± 20-30 |
| V6-200, V8-265 and V-903 | 650 ± 25 |
| V8-350 and VT8-430 | 550 ± 20-30 |
| V6-140, V8-185 and V-555 | 625 ± 25 |
| KT-1150 | 600 ± 20 |
| KT-2300 | 600 ± 20 |

   a. To adjust the idle, loosen the rear idle adjustment screw locknut.

   b. Turn the adjustment screw in or out to get the speed requirement. Do not set the SVS governor idle in a power takeoff application, at less than 1100 rpm.

   c. Tighten the adjustment screw locknut immediately after the adjustment to stop the air from getting in the fuel pump.

6. The MVS governor fuel pumps with a stub shaft are set as follows. Adjust the idle on the *automotive governor. The MVS governor idle* screw will be adjusted 10 to 12 psi [69 to 83 kPa] above the specifications.

   a. If a surge occurs at idle, it is acceptable to turn the standard idle screw all the way in. Set the VS or MVS governor idle screw to specifications.

   b. If the surge does not stop on the MVS, replace the Part No. 153240 Idle Spring with Part No. 201116. Use a Part No. 154461 Series Plunger.

   c. If the surge occurs on a VS pump, change the VS plunger. If the upper governor plunger is Part No. 213610, replace it with a plunger Part No. 212350. This plunger has a 10 degree chamfer.

7. Some problems with high engine vibrations have occurred at engine idle speeds in vehicles that also have power takeoffs. This is found in cement mixture applications. Adjust the idle for a smooth engine operation, Table 17-1.

8. The idle speeds in Table 17-1 are to be used as a reference point. Small changes can be made from these speeds. Large changes in the idle

speed can cause other engine or application problems.

9. Problems like difficult gear changes will be found with high idle speeds. Moving a load from a stop can be a problem if the idle speeds are adjusted too low.

10. High weight assist settings have been found to be the cause of idle surge on J and C series engines. These engines have a Part No. 168630 Governor Plunger (or oversizes).

    a. The governor plunger can be correct and not cause the idle surge. Check the weight assist protrusion against the specifications.

11. The idle surge on NH/NT Big Cam engines can be controlled.

    a. Remove the idle spring Part No. 144195 and install Part No. 3018767.

    b. Change the weight assist spring to the next higher tension spring. Increase the protrusion of the weight assist plunger about 0.040 inch [1.02 mm].

    c. Set the throttle leakage to the correct code specification.

    d. Increase the idle speed 50 rpm.

    e. Check the fuel pump calibration at the 1000 rpm check point.

**High Speed**

1. The tachometer and fuel pressure gauge must be of high accuracy. The engine fuel system must have all of the air removed. The engine must be at the operation temperature.

2. The correct method of checking the governor setting is to "load" the engine on an engine or chassis dynamometer.

3. The maximum engine speed is adjusted by adding or removing the shims under the high speed governor spring. Normally, this adjustment is made on the fuel pump test stand as the fuel pump is calibrated. It usually does not need to be changed on the engine.

**Cut Off Setting**

1. At full throttle, increase the load until the speed is pulled down to at least 100 rpm below the engine rated speed. Decrease the load gradually while looking at the fuel pressure gauge. (The fuel manifold pressure will increase with the decreasing load until the governor begins the restriction of fuel. The pressure will then begin decreasing with the decreasing load.

2. Continue decreasing the load until the fuel manifold pressure reaches its peak and decreases 1 to 2 psi. This is the so called "governor goes dead", "governor break" or "governor cut off" point. This speed is between 20 to 50 rpm higher than the engine rated speed. This will make sure the governor restriction does not occur before the rated speed. For example: On a 2100 rpm engine this speed must be about 2100 to 2160 rpm.

3. The governor cut off point can be higher or lower than the specifictions. Remove or add shims behind the governor high speed spring.

4. Recheck the governor cut off point adjustment.

**Checking and Adjusting the Fuel Rail Pressure**

Below are the three methods of checking the fuel rail pressure. The engine must be at operation temperature and the fuel system purged of all air. When a fuel check valve is used the pressure connection must be between the valve and engine.

1. The correct method of checking the engine rail pressure is to install the engine on a chassis or engine dynamometer.

**Note:** If a fuel supply line check valve is present the pressure must be taken between the check valve and the cylinder head.

   a. Check the governor cut off.

   b. Run the engine at full throttle. Increase the load until the engine is down to the rated speed (an accurate tachometer must be used). Read the fuel pressure. If the fuel pressure is below the minimum or above the maximum specifications, make the following adjustments.

*To Raise the Pressure*

1. Turn the stop screw out to get the maximum throttle travel. This will use the throttle restriction that is there.

**Caution: Do not turn the screw out beyond the maximum throttle travel. The fuel hole in the throttle shaft will begin to close.**

2. Remove the throttle shaft and add the fuel adjustment shims as required or adjust the AFC fuel pump fuel adjustment screw in the throttle shaft. Install the steel ball into the end of the shaft with Tool No. 3375204 after the adjustment.

*To Decrease the Pressure*

1. Remove the throttle shaft. Remove the shims or turn the fuel screw as required.

**Caution: Never adjust the fuel rail pressure above the maximum specifications. This will void the engine warranty and violate EPA requirements.**

2. It will not be necessary to adjust the fuel pressure on a new or calibrated pump more than ±2 psi [0.14 kg/sq cm]. If adjustments greater than this are required, check the fuel pump test, injector test stand or engine problems.
3. The next best method of checking the maximum engine fuel manifold pressure is as follows. Watch the maximum pressure while accelerating at full throttle when going up through the transmission ratios. This method can be reliable, if a heavy load is being pulled and the engine acceleration in the higher gears is slow.

### No-Air Rail Pressure at 1600 RPM (On Chassis Dynamometer)

1. The following procedure applies to the no-air adjustment on the chassis dynamometer:
   a. Install the 3375932 Rail Pressure Gauge or ST-435 Pressure Gauge. The drain valve on the 3375932 Gauge must be in the open position.
   b. Install an accurate tachometer.
   c. Remove the AFC air manifold line and put a plug in the manifold.
   d. Run the engine in the highest possible gear at 1600 rpm with the maximum load.
   e. Take the rail pressure at 1600 rpm. This must be within the recheck limits of the no-air pressure setting on the fuel pump test stand. The original setting is the value in the Calibration Manual, Bulletin No. 3379068-04 or 3379182-00 on line 40 (or in Bulletin 3379068-02, Column 20).
   f. The no-air setting can be made on the engine at 1600 rpm under load. Use the no-air pressure in the above bulletins.

### Check the Air Signal Attenuator (ASA) and the Air Fuel Control (AFC)

The ASA in the AFC cover can be checked on the engine. This test will tell if the ASA or the AFC bellows is defective. If the ASA is defective, it can be replaced without removing the fuel pump from the engine. If the AFC bellows is defective, the fuel pump must be removed, bellows replaced and calibrated.

1. Remove the ASA from the fuel pump to check the air flow through the valve.
2. Use Service Tool No. 3375934 ASA-AFC Test Stand for this check.
3. The 3375934 has two different flow meters. Some flow meters are marked 0-15, others are marked 0-150. Leave off the last number on the 0-150 scale. Use the checking values shown below.
4. Attach the ASA to the service tool. Check the position of the two way valve on 3375934.
5. Adjust the air pressure to 8 psi [55 kPa].
6. The ASA must have a flow value between 8.0 and 10.4 units. Replace the valve if it is out of this range.
7. A low valve flow can cause slow acceleration. A high flow can cause rapid acceleration and high smoke.
8. Check the AFC air leakage.
9. Install the ASA in the AFC cover, if used. Tighten to 5 ft. lb. [7 N•m].
10. Attach the top hose of 3375934 to the ASA or the AFC cover plate.
11. Check the position of the two way valve of 3375934. Adjust the air pressure to 24.5 psi [169 kPa].
12. The flow must not exceed 1 unit of leakage on a 0-15 flow meter or 10 units of leakage on a 0-150 flow meter.

13. If the leakage exceeds the this value, check for ASA bellows, bellows flange or thread leakage.
14. If there is no ASA valve or no thread leakage and the 1 unit limit is exceeded, the AFC bellows is defective.
15. Remove the fuel pump from the engine and repair the AFC bellows.
16. The most common faults are a defective bellows, AFC plunger thread leakage and leakage around the bellows flange.

### Checking and Adjusting the Aneroid Fuel Pressure Setting

Fig. 17-1, (F5178). Check the fuel manifold pressure.

1. Install the Tool No. 3375932 or the ST-435 Pressure Gauge into the pipe plug hole in the shut-off valve, Fig. 17-1.
2. Run the engine until all of the systems are up to temperature.
3. Disconnect the air line between aneroid bellows and the intake manifold.
4. Run the engine at full throttle at the setting bhp speed in Table 16-1. Adjust the screw in the bottom of the aneroid until the fuel pressure is lowered to the correct setting.
5. Tighten the locknut on the adjustment screw. Connect the air line between the aneroid and the intake manifold.

### Check and Adjust the Engine Fuel Rate

The engine fuel rate (fuel used) in lbs. per hr. is measured with Tool No. ST-1190 Flow Rater, Fig. 17-2.

1. The fuel rate in the tables for the fuel pump codes is at full throttle and maximum speed.
2. An engine dynamometer or a chassis dynamometer must be used. Accurate fuel manifold pressure and speed readings must also be taken.

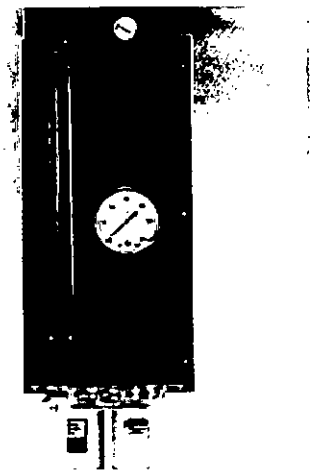


Fig. 17-2, (F5247). Check the fuel rate with ST-1190.

3. Check the engine fuel rate as follows:
   a. Apply a load to the engine at full throttle until the engine speed is pulled down to and kept at the maximum speed.
   b. Check the governor cut off speed while a load is on the engine.
   c. Check the fuel manifold pressure at the maximum speed.
   d. Hold the engine speed and the load at the maximum speed long enough for the flow meter to stabilize.
   e. Take the fuel rate measurement.

### Throttle Leakage

1. The purpose of the throttle leakage is to keep the fuel lines and injector drillings full of fuel. This occurs during a closed throttle engine operation.

2. The correct throttle leakage will help the engine acceleration when the throttle is opened after going down a grade. Throttle leakage will also prevent an engine stall when it slows down to the idle speed. Too much leakage will cause slow deceleration of the engine.

**Note:** If the throttle leakage is adjusted correctly on the fuel pump test stand, the fuel pump will not need to be adjusted on the engine.

3. If the throttle leakage adjustment on the engine is required, it must be done by the following method.

4. The engine must be run long enough to remove all of the air from the fuel system and at the operating temperature.

**Caution: Never check the engine deceleration time or adjust the throttle leakage on a cold engine. The engine will decelerate faster when it is cold because of more friction.**

5. The vehicle throttle linkage must be adjusted so the pump throttle just touches the front throttle stop screw (on non AFC pumps). The linkage must be adjusted when the throttle is closed. This is the rear screw on the AFC fuel pumps.

6. A fuel rail pressure gauge must not be in use.

7. A stop watch or other suitable timer and a tachometer must be used to do the following check.

8. Put the transmission in neutral or disengage the clutch. Open the throttle fully and let the engine run at hi-idle (maximum no low speed).

   a. Release or move the throttle to the closed position quickly and start the stop watch at the same time.

   b. Stop the stop watch when the engine reaches 1000 rpm and check the deceleration time. Repeat this check several times.

   c. Increase the leakage if the engine begins to stall. The idle governor does not idle the engine after decelerating from hi-idle. Remove the fuel pump and check the leakage on the fuel pump test stand.

9. If the engine decelerates too slowly, it can be necessary to decrease the throttle leakage. Before decreasing the throttle leakage, make sure it is required.

   a. Check the deceleration time when the shutoff valve is closed while running at hi-idle.

   b. If the deceleration time is not faster by this method, the throttle leakage is not the problem.

   c. If the deceleration time is faster by this method, the throttle leakage must be reduced.

**Note:** If an MVS governor is used, and there is too much MVS governor barrel to plunger leakage, this can be the problem of high throttle leakage and not the throttle shaft. This can be checked by adjusting the MVS governor so the engine will idle on the MVS (with automotive throttle fully open). Hold the automotive throttle fully open. Accelerate and decelerate the engine with the MVS governor. There is too much MVS governor barrel to plunger leakage if the engine deceleration time is faster by this method. Check the deceleration by holding the MVS lever in the maximum speed position. Accelerate and decelerate the engine by the automotive throttle.

### Adjust the Torque Modifying Device (TMD)

1. Do not change the throttle shaft shimming. Do not adjust the rear throttle screw if the fuel rate or the manifold pressure requires adjusting at the rated speed.

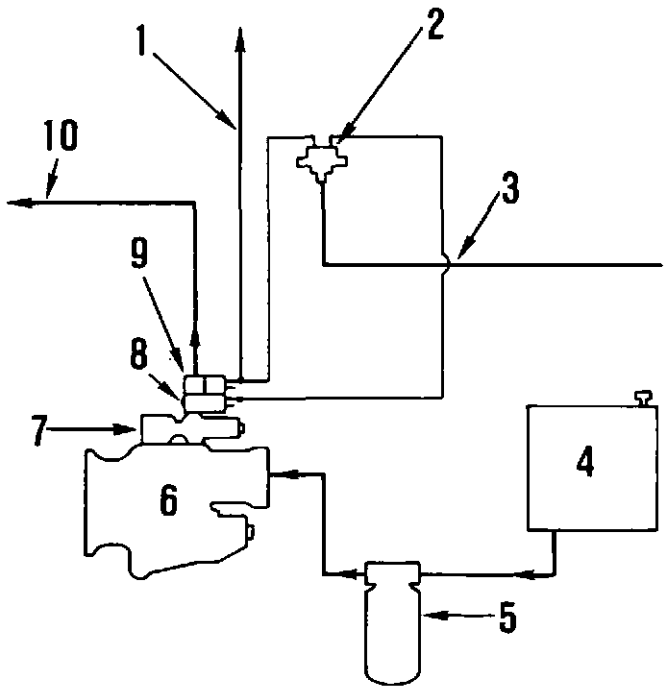
2. The shims in the TMD can be changed 0.005 inch [0.13 mm] at a time to get the correct specifications. If the torque rise can not be adjusted or other calibration problems are found, calibrate the fuel pump again.

### Adjust the Dual Power Torque Limiting Valve (TLV)

This valve must be adjusted when the engine is on a dynamometer, Fig. 17-3.

1. When the fuel pump is calibrated, the valve solenoid can be energized. The valve adjustment sleeve can be turned all of the way down. This will let the fuel flow through the valve.

2. Normal engine testing can be completed with the valve locked open.




1. Wire to Ignition Switch
2. Hobbs (M-4008-18) Pressure Switch
3. Air Signal from Transmission
4. Fuel Tank
5. Fuel Filter
6. Fuel Pump
7. Torque Modifier
8. Dual Power Limiting Valve
9. Shutoff Valve
10. Fuel to Engine 0-150 psi.

**Operation Mode:**

**Air Signal 0 psi**
Dual power limiting valve de-energized, fuel pressure restricted to limit engine torque to 500 ft. lb. maximum.

**Air Signal 18-150 psi**
Dual power limiting valve energized, pump operates normally.

Fig. 17-3, (F5275). Schematic of the dual power torque limiter valve installation.

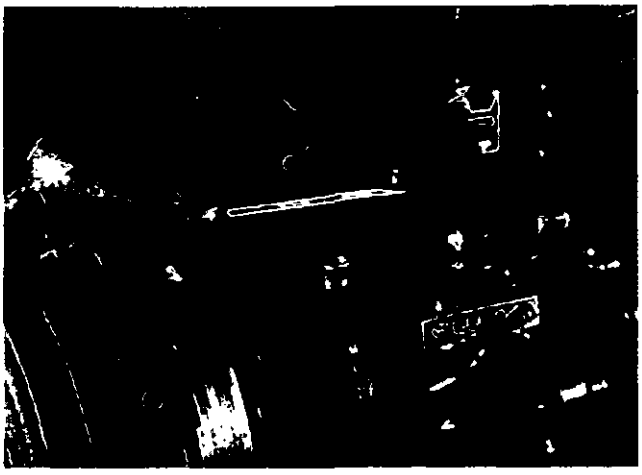


Fig. 17-4, (F5354). Adjust the dual power torque limiting valve.

3. To adjust the valve, remove the aneroid fuel lines and install a plug in the holes. Remove the solenoid wire of the limiting valve. Remove the plug from the front of the valve body.
4. Deenergize the solenoid. Start the engine and increase the speed to high idle.

**Table 17-2: Torque Limiting Valve Dynamometer Setting 500 Ft.Lbs. @ Maximum Torque Peak**

| Fuel Pump Code | CPL | Load | Rail | Flow | RPM |
|---|---|---|---|---|---|
| 2433 | 101 | 381 | 54 | 297 | 1600 |
| 2921 | 160 | 381 | 46 | 287 | 1600 |
| 2953 | 181 | 381 | 48 | 225 | 1400 |
| 2553 | 124 | 381 | 57 | 207 | 1600 |
| 2684 | 26 | 381 | 72 | 204 | 1600 |
| E005 | 183 | 381 | 106 | 375 | 1600 |

5. Apply a load on the dynamometer until the correct rpm is reached. This is normally 1400 to 1600 rpm. Adjust the valve sleeve until your application specification is correct. Most applications require 500 ft. lbs. at the maximum torque peak, Fig. 17-4.
6. Install the valve plug and record the value.
7. Connect the solenoid wires to the limiting valve. Remove the aneroid plugs and install the aneroid hoses.
8. Check the engine power at the rated speed again.

**Torque Limiting System Valve**

This valve is in the air line between the air intake manifold and the AFC.

This valve is not adjustable. It has a solenoid which is closed by an electric switch. The switch is actuated by the first gear shift mechanism.

## Engine Power

1. Engine power can not be set accurately in any way except on an engine dynamometer. Any other method of setting the engine power is not accurate.
2. Fuel pump adjustments must not be made on an engine when the engine power comes from an estimate. Before an adjustment on the fuel pump is made, the following engine performance data must be checked.
   a. Fuel rail pressure.
   b. Fuel rate.
   c. Speed setting .
   d. Smoke
   e. Coolant temperature.
   f. Combustion smoothness.
   g. Exhaust restriction.
   h. Fuel quality.
   i. Air intake restriction.
   j. Engine oil level.
   k. Engine power derate factors.

**Note:** Do not exceed the fuel pump specificaitons. When checking the fuel system and engine performance, accurate instruments must be used.

3. The rate of engine power (maximum power at engine rated speed) can be checked. Check it in the same way as "checking and adjusting the fuel manifold pressure" as described before.
4. Check the governor cut off setting to make sure this is not changing the rate of the engine power.

## Torque Converter Governor on VS Fuel Pump

A torque converter can be used to connect the engine with its driven unit. An auxiliary governor can be driven off the torque converter out put shaft to control the engine governor. This auxiliary governor will limit the converter output shaft speed. The engine governor and the converter governor must be adjusted to work together.

The PT (type G)-VS governor with the torque converter governor is two separate mechanical variable-speed governors. One governor is driven by the engine and the other by the converter.

The engine governor gives a variable engine speed and is an overspeed and idle speed governor. At the same time, the torque converter driven governor is controlling the engine. Each governor has a control lever (1, engine lever and 2, converter governor lever) and speed adjustment screws.

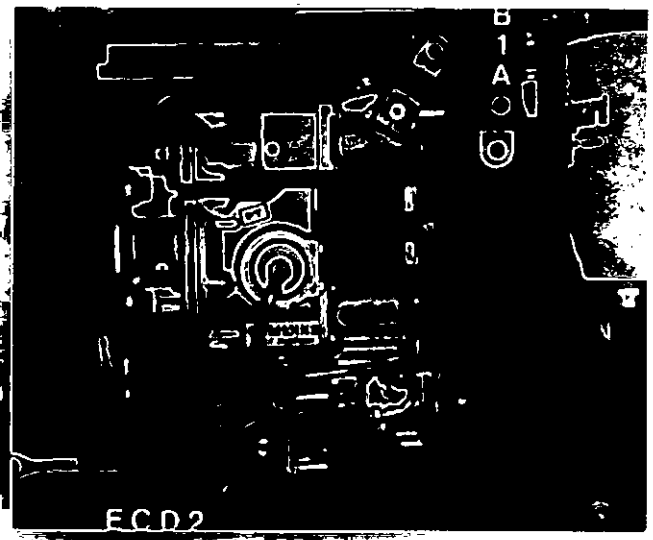
The converter driven governor works the same way as the standard engine governor. It can not cut off the idle fuel in engine driven governor. If the converter tailshaft overspeeds, it will not stop the engine.

The fuel flows out of the bottom of the main housing, through the converter governor and back into the main housing through the end of the throttle shaft.

The cable for the torque converter governor, between the engine torque converter and the fuel pump, requires regular maintenance. Every 500 hours of operation, remove the flexible shaft and apply a coating of multi-purpose grease.

**Initial Adjustment**

1. Disconnect the flexible drive cable of the torque converter governor or put the converter in neutral. The engine governor must have complete control of the engine. Disconnect the drive cable at converter to prevent the cable from rotating.
2. Hold the converter governor lever in the clockwise position and turn in the converter governor idle screw "C", Fig. 17-5, until the spring is compressed. Turn the adjusting screw out, then turn it in slowly to check the adjustment.
3. Start the engine and rotate the engine governor lever in a counterclockwise direction. Set the engine idle speed by adjusting the idle screw "A" to get 515 to 700 rpm.
4. Set the approximate engine maximum no-load speed. Adjust the maximum speed screw "B"




A. Standard Governor Idle Adjustment
B. Standard Governor Maximum Adjustment
C. T.C. Governor Idle Adjustment
D. T.C. Governor Maximum Adjustment
E. T.C. Governor Fuel Cut Off Leakage Adjustment
1. Standard Governor Throttle Lever
2. T.C. Governor Throttle Lever

Fig. 17-5. (F5292) PT (type G) VS fuel pump with a torque converter governor.

4. while holding the engine governor lever against the stop. Turn the lever in a clockwise direction.

5. Stop the engine and engage the torque converter clutch or connect the flexible drive cable to the torque converter governor. Make sure the torque converter drives the fuel pump governor. The flexible cable must have 10 inch [254 mm] radius bends, or larger, for a good service life.

6. Start the engine and increase the speed to 1000 rpm with the engine governor lever.

7. Increase the speed of the engine until it reaches the speed of converter tailshaft.

8. Decrease the speed at the torque converter governor. Adjust the screw "C" out until the converter speed can be controlled by the converter governor lever. Turn the lever in a counterclockwise direction.

9. Increase the engine governor to the rated speed position.

10. If the unit has a single speed setting:

    a. Adjust the screw "C" to get the maximum no-load tailshaft speed of the converter.

    b. Adjust the screw "D" until the converter governor lever will not move.

11. If the unit has a two speed setting:

    a. Adjust the screw "C" to get the minimum required no-load tailshaft speed of the converter.

    b. Adjust the screw "D" until reaching the correct maximum converter speed.

### Adjustments for Minimum Fuel

1. Run the engine at full speed, no-load with the tailshaft governor in operation.

2. Loosen the screw "C" and turn it out approximately 3/4 inch [19.05 mm], Fig. 17-5.

3. Move the throttle lever of the converter governor counterclockwise. This will lower the engine speed to 400 rpm. Hold this position.

4. Loosen the screw "E" and turn it clockwise approximately 1/16 inch [1.59 mm]. Increase the engine speed to 450 rpm.

5. Tighten the screw "E" in position. Adjust the screw "C" as described before.

### Stall Speed Settings

Check the converter output shaft stall speed. The stall speed is different for each installation. The stall speed procedure can be different for each equipment manufacturer. If the stall speed or the procedure is not known, see your Cummins Distributor.

1. Put the converter in a stall. Check the engine speed.

2. If necessary, adjust the converter governor speed adjustment screws. This is described in Steps 10 or 11 of the governor adjustment. This will get the maximum speed from the unit.

3. If the engine speed is low, adjust the engine governor maximum speed adjustment screw "B". If the governor adjustment does not change the unit, check the fuel delivery on a pump test stand.

**Caution: Do not hold the converter in a stall for more than 30 seconds. You can overheat and damage the converter.**

### Change the Speed Droop of the Converter Governor

Because of the many applications, converter ratios and the different operators characteristics, the converter governor spring in the fuel pump can not give the correct speed droop. Speed droop is controlled by changing springs, Table 18-3.

### Adjustment for "Unstable" or Constantly Changing Speeds

1. Begin the check with the minimum output shaft speed setting. Loosen the VS pump throttle screws and adjust the throttle shaft. Turn the screw in a clockwise direction to increase the engine speed 10 to 15 rpm. Continue the throttle screw adjustment one-half turn of the screws. This is approximately 10 to 20 rpm more. Tighten the locknut.

**Note:** Make this check with a hot engine only.

   a. If the throttle leakage is too high, the engine will begin to overspeed after the load is released.

   b. If the throttle leakage is too low, engine speed will surge or be "unstable" at half- or no-load.

2. If necessary, adjust the converter governor speed adjustment screws to get the maximum speed from the unit.

## Fuel Filter Restriction

1. The fuel filter restriction can be checked using ST-434 Vacuum Gauge, Fig. 17-6.

2. Connect the gauge using the special adapter in ST-434.

3. Run the engine at full speed and load. If the restriction is at 8 inch vacuum, the filter must be changed. Also correct any other type of restriction. The sight glass gauge, Tool No. ST-998, will show air bubbles when air is in the fuel tubing. The gauge will also show possible gasket or other air leaks.

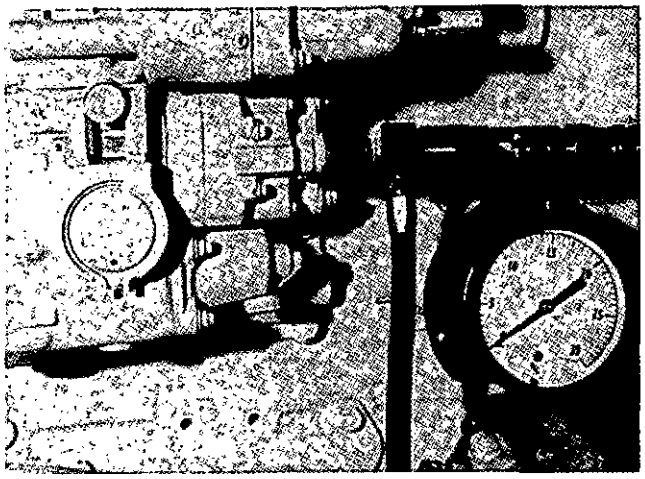


Fig. 17-6, (F5180). Check the fuel restriction.

4. If the air bubbles continue and the engine is over 400 brake horsepower, check the float valve assembly in the float tank (if so equipped). The gear pump can be pulling more fuel than the float valve will let into the float tank. A new interchangeable float valve is available with a large capacity to meet this requirement.

## Seal the Fuel Pump

1. To prevent operator adjustments to the fuel pump after the final adjustments are made, seal the spring pack cover lower capscrews and the rear throttle screw or the throttle cover and the spring pack cover plug, Fig. 17-7.

2. Sealing the Spring Pack cover.

   a. Install the capscrew with a hole through the head in one of the holes in the bottom of the cover. Install the plug with a hole into the spring pack cover.

   b. Insert the wire through the capscrew and the plug.

   c. Twist the wire ends together until the wire is tight.

   d. Bend the twisted wire into the seal and press on the top half of the seal.

3. Sealing the Front Drive Cover.

   a. Use a longer wire to reach a lower capscrew on the drive cover.

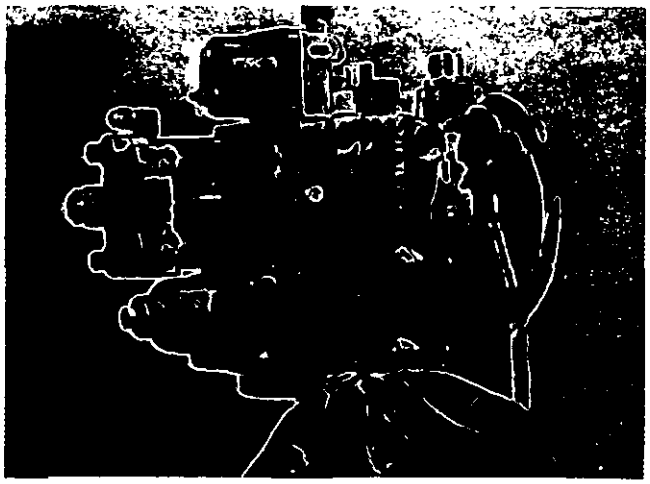


Fig. 17-7, (F5181). Seal the fuel pump.

Fig. 17-8, (F5241). Drill the spring pack cover with ST-1175.

b. Put the wire through the capscrew in the spring pack cover. Put the wire through one of the bottom capscrew holes in the drive cover.

c. Twist the wire and seal as in Step 2.

4. Sealing the throttle adjustment setscrew.

a. Install the acorn nuts on the setscrew.

b. Insert the wire through the hole in the acorn nuts.

c. Twist the wire down to the throttle shaft.

d. Put the wire behind the throttle lever and around both sides of the throttle shaft.

e. Twist the wire and insert it through the bottom hole in the throttle shaft cover.

f. Bend the twisted wire into the seal and press on the top half of the seal.

5. An optional spring pack cover, without the idle adjustment access hole, is available.

a. After the pump is calibrated, remove the cover with the access hole and install the plain cover.

b. Install the lockwire through the capscrew hole and install the seal as before.

6. To further protect the fuel pumps, install a twist-off countersink capscrew.

a. Remove one or more of the capscrews, lockwashers and flatwashers from the front cover and/or the spring pack cover.

b. Use Tool No. ST-1175 Countersink Drill to make a counterbore in the covers. The twist-off capscrew must be even with the surface, Fig. 17-8.

c. Apply Loctite to the capscrew counterbore surface. Install the capscrews, Part No. 204925, and countersink lockwashers, Part No. 204926, in the covers.

d. Tighten the other cover capscrews to 90 to 95 inch lbs. [10.2 to 10.7 N•m]. The twist-off capscrews will twist off at about 105 inch lbs. [11.9 N•m].

e. To remove the twist-off capscrew, use an electric arc to weld a nut to the top of the capscrew.

**Caution: Weld the nut in the thread area. Do not get the aluminum covers too hot.**

f. The heat from the weld will make the retaining compound weak. Disassemble immediately while it is hot.

g. Because of the hardness of the twist-off capscrews; do not try to drill them out.

7. The spring pack guard is made to protect the spring assembly from being changed. The spring pack guard mounts on the rear of the spring pack housing, Fig. 17-9. The "tetra-seal" is to be installed over the "shoulder" at the small end of the guard. Install as follows:

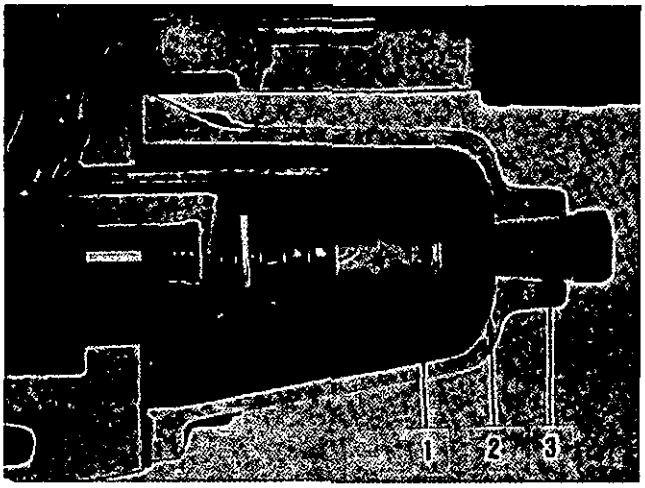
**Note:** This guard can not be used on the MVS governor on the TMD fuel pumps.

a. Remove the spring pack cover and discard the gasket. Install the spring pack guard and the "tetraseal".

b. Install the spring pack cover with a new gasket.

**Note:** When a spring pack cover that has a plug is used, cut the plug off even with the cover.

8. Remove standard retaining ring that holds the throttle shaft cover. Replace it with a retaining ring, Part No. 214761, Fig. 17-10.




1. Spring pack housing guard
2. Tetraseal
3. Spring pack housing plug

Fig. 17-9, (F5290). Spring pack housing guard and tetraseal installed.

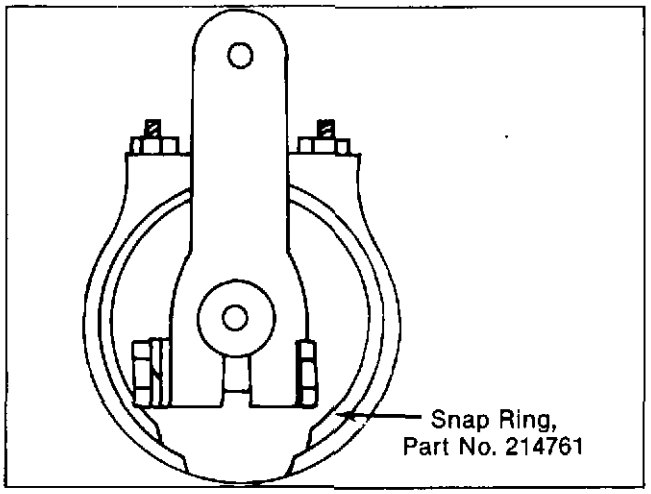



Fig. 17-10, (F5291). Throttle shaft retaining ring installed.

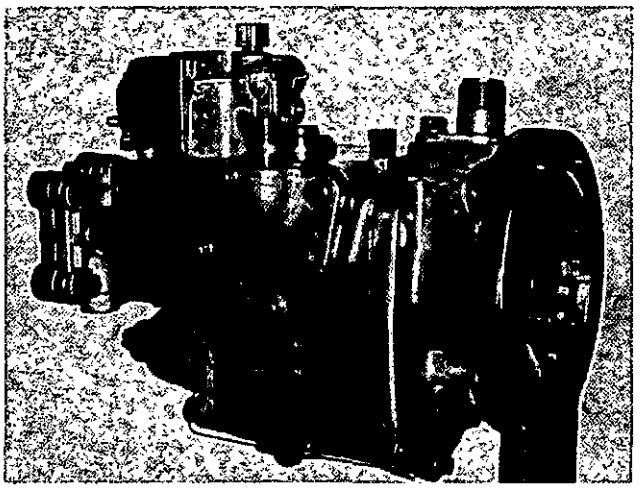


Fig. 17-11, (F5355). Seal the AFC fuel pump.

9. To seal the AFC cover plate, front cover and spring pack cover, install a seal wire and a seal, Fig. 17-11.

## Throttle Cover Plate Installation

After the fuel pump settings are completed on the AFC pumps, install the throttle cover plate.

1. The cover plate can be removed by pulling the drive screws or grinding off the heads.
   a. To install a new cover plate, drill two new holes on opposite sides of the plate and into the pump housing.
   b. Use a No. 44 (0.086 inch [2.18 mm]) bit.
   c. Drill the holes 0.235 [5.97 mm] deep.
2. Use an etching kit tool or steel "stamp" to mark the cover. Put the distributor or dealer code number and the date on the back side of the throttle cover plate. This is for future reference.
3. Secure the cover plate with two Part No. S-2286 Drive Screws.

## Fuel Pump Seals

All of the fuel pumps for highway engines and most of the fuel pumps for other applications will have a seal installed at the factory. The lead seal marking is a manufacturing control system. All warranty claims sent to the factory must have the seal attached. After completing any fuel pump repair, the pump must be sealed again using your code on the new seal.

# Fuel Pump Torque Specifications

| | New Minimum | New Maximum |
|---|---|---|
| **Air Fuel Control** | | |
| Check valve in the AFC cover (ft.lb. [N•m]) | 8 [11] | 11 [15] |
| Cover capscrews (in.lb. [N•m]) | 30 [3.4] | 35 [4] |
| Needle valve jam nut (in.lb. [N•m]) | 30 [3.4] | 45 [5] |
| Needle valve plug (in.lb. [N•m]) | 30 [3.4] | 45 [5] |
| Plunger jam nut (in.lb. [N•m]) | 25 [2.8] | 35 [4] |
| Piston jam nut (in.lb. [N•m]) | 30 [3.4] | 40 [4.5] |
| ASA hydraulic valve assembly (ft.lb. [N•m]) | 5 [7] | 10 [14] |
| **Front Cover** | | |
| Drive coupling capscrew (ft.lb. [N•m]) | 5 [7] | |
| Mounting capscrew (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| Mounting allen screws (ft.lb. [N•m]) | 4 [5] | 5 [7] |
| Tachometer Drive Housing (ft.lb. [N•m]) | 35 [47] | 45 [61] |
| **Fuel Pump Housing** | | |
| Filter screen cap (ft.lb. [N•m]) | 8 [11] | 12 [16] |
| Throttle stop locknuts (in.lb. [N•m]) | 70 [8] | 90 [10] |
| Throttle shaft plunger | | |
| - pipe plug (old style) (in.lb. [N•m]) | 40 [4.5] | 55 [6.2] |
| Torque modification device (ft.lb. [N•m]) | 17 [23] | 20 [27] |
| VS governor barrel setscrew (in.lb. [N•m]) | 70 [8] | 90 [10] |
| Pressure regulator cap (ft.lb. [N•m]) | 20 [27] | 25 [34] |
| **Governor Spring Assembly** | | |
| Cover capscrews (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| PT (type H) lower housing capscrews (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| PT (type H) lower housing cover (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| **Gear Pump** | | |
| Cover to body capscrew (ft.lb. [N•m]) | 11 [15] | 13 [18] |
| Gear pump to fuel pump housing (ft.lb. [N•m]) | 11 [15] | 13 [18] |
| Fuel damper to gear pump (ft.lb. [N•m]) | 11 [15] | 13 [18] |
| Fuel damper assembly capscrews (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| Check valve in the gear pump (ft.lb. [N•m]) | 5 [7] | 14 [19] |
| **Shutoff Valve** | | |
| Coil capscrews (in.lb. [N•m]) | 25 [2.8] | 30 [3.4] |
| Mounting capscrews (ft.lb. [N•m]) | 9 [12] | 11 [15] |
| **Pipe Plugs** | | |
| 1/4 inch (ft.lb. [N•m]) | 25 [34] | 30 [41] |
| 1/8 inch in bottom of housing (ft.lb. [N•m]) | 5 [7] | 8 [11] |

# Fuel Pump Parts Specifications — Inch [mm]

| | Usable Limit | New Minimum | New Maximum |
|---|---|---|---|
| **Front Cover** | | | |
| **PT (type G)** | | | |
| Cast Weight Carrier | | | |
| Oil Seals to Front Cover Surface | | .000 | – .015 [ – .38] |
| Press Fit Between the Shaft and the Cast Carrier | | .005 [.013] | |
| Shaft to the Face of the Carrier | | .000 | – .005 [ – .13] |
| Gear Backlash — Drive Gear to Weight Gear | | .005 [.13] | .009 [.23] |
| Gear Backlash — VS Idler Gear to Weight Gear | | .005 [.13] | .009 [.23] |
| Shaft Bushing Inside Diameter of the Governor Weight Carrier | | | .504 [12.80] |
| VS Idler Shaft Gear and Bushing End Clearance | | .002 [.05] | .007 [.18] |
| VS Idler Shaft Inside Diameter | | | .507 [12.88] |
| Tachometer Drive Shaft and Bushing Clearance | .005 [.13] | .008 [.020] | .003 [.08] |
| Tachometer Shaft in the Front Cover | | .3950 [10.033] | .3955 [10.046] |
| Tachometer Shaft Bushing in the Front Cover | | .3963 [10.066] | .3970 [10.084] |
| Tachometer Shaft in the F.P. Housing | | .3100 [7.874] | .3105 [7.887] |
| Tachometer Shaft Bushing in the F.P. Housing | | .3120 [7.925] | .3130 [7.950] |
| Replacement Clearance Between the Shaft and the Bushing | .005 [.13] | | |
| **Gear Pump** | | | |
| **PT (type G)** | | | |
| Shaft Outside Diameter | | .4998 [12.695] | .5001 [12.703] |
| Shaft Bore Inside Diameter | | .5013 [12.773] | .5016 [12.740] |
| Distance from the Gears to the Body End of the Shaft | | .680 [17.27] | .690 [17.53] |
| Protrusion of the Drive Shaft from the Body | | 2.370 [60.2] | 2.412 [61.3] |
| Gear Pump Backlash | | .006 [.152] | .010 [.254] |
| Shaft End Clearance | | .0015 [.038] | .0009 [.023] |
| Gaskets between Cover and Body | | .0015 [.038] | .0020 [.051] |
| Gear Size 7/16 [11.11] | | | |
| Gear Width | | .4360 [11.074] | .4363 [11.082] |
| Gear Hole Depth | | .4353 [11.056] | .4356 [11.064] |
| Gear Size 3/4 [19.05] | | | |
| Gear Width | | .7483 [19.006] | .7486 [19.014] |
| Gear Hole Depth | | .7478 [18.994] | .7481 [19.002] |
| Gear Size 1 [25.40] | | | |
| Gear Width | | .9980 [25.349] | .9983 [25.356] |
| Gear Hole Depth | | .9980 [25.349] | .9983 [25.356] |
| Gear Size 1-1/4 [31.75] | | | |
| Gear Width | | 1.2483 [31.706] | 1.2486 [31.714] |
| Gear Hole Depth | | 1.2482 [31.704] | 1.2485 [31.712] |

| | Usable Limit | New Minimum | New Maximum |
|---|---|---|---|
| **PT (type H)** | | | |
| Gear Pump Gear Pitch Diameter | | | 1.25 [31.75] |
| Gear Pump Shaft Bore | | .6891 [17.503] | .6894 [17.511] |
| Gear Pump Driven Shaft — from Gear to Cover End of Shaft | | .865 [21.97] | .875 [22.22] |
| Gear Pump Drive Shaft — from Gear to Spline End of Shaft | | 3.425 [86.99] | 3.435 [87.25] |
| Shaft End Clearance | | .0020 [.051] | .0012 [.030] |
| Gear Size 5/8 [15.87] | | | |
| Gear Width | | .6244 [15.859] | .6247 [15.867] |
| Gear Hole Depth | | .6239 [15.847] | .6242 [15.855] |
| Gear Size 13/16 [20.64] | | | |
| Gear Width | | .7999 [20.317] | .8002 [20.325] |
| Gear Hole Depth | | .7994 [20.305] | .7997 [20.312] |
| Gear Size 1 [25.4] | | | |
| Gear Width | | .9999 [25.397] | 1.0002 [25.405] |
| Gear Hole Depth | | .9994 [25.385] | .9997 [25.392] |
| **Fuel Pump Housing** | | | |
| Throttle Shaft Sleeve | | | |
| Outside Diameter Oversize Available | | .010 [.25] | .020 [.51] |
| Governor Barrel Outside Diameter | | 1.5020 [38.15] | 1.5025 [38.16] |
| Governor Barrel Outside Diameter PT (type G) and VS Oversizes Available | | .010 [.25] | .020 [.51] |
| Governor Barrel Press Fit | | .002 [.05] | |
| Main Drive Shaft Bushing Inside Diameter | .7495 [19.04] | .7505 [19.06] | .7525 [19.11] |
| Governor Plunger Clearance between Driver and Thrust Washer | | .002 [.05] | .005 [.13] |
| PT (type G) VS Pressure Valve Protrusion | | .030 [.76] | .090 [2.29] |
| **Governor Spring Assemblies** | | | |
| Maximum Speed Shims Available | .005 [.13] | .010 [.25] | .020 [.51] |
| MVS, SVS and VS Throttle Shaft Bushing Inside Diameter | | .560 [14.22] | .563 [14.30] |
| MVS Plunger to Barrel Clearance | | .0001 [.002] | .0005 [0.013] |
| MVS Clearance between the Adapter Plate and the Barrel Face | | .003 [.076] | .006 [.152] |
| **Shutoff Valve** | | | |
| Valve Seat Width | | .015 [.38] | |
| Housing Surface to the Shaft Tip | | .118 [2.997] | |
| Pressure Check | | 300 psi [2068 kPa] | |
| **Torque Converter Governor** | | | |
| Converter Drive Bushing | | | .569 [14.45] |
| Fuel Cutoff Leakage Adjustment | | .635 [16.13] | .640 [16.26] |
| Clearance Between the Bushing and the Thrust Bearing | | .003 [.076] | .005 [.127] |
| **Air Signal Attenuator** | | | |
| Flow Check Air ASA | | 8 units | 10 units |
| Flow Check Hydraulic ASA on Test Stand | | 400 cc/minute | 500 cc/minute |
| **Miscellaneous** | | | |
| V555 fuel pumps rotate at 78% of the engine RPM. | | | |
| Distance Between the Fuel Pump Drive Coupling and the Test Stand Drive Coupling | | 1/16 [1.587] | |

**Table 18-1: Governor Springs and Specifications — High Speed**

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 70711-G | Orange/White | | .054 [1.37] | 5.5 | 1.82/2.07 [.83/.94] | @ | 1.19 [30] | |
| 70711-H | Lt. Blue/Orange | | .054 [1.37] | 6.5 | 1.50/1.71 [.68/.78] | @ | 1.19 [30] | |
| 70711-J | Lt. Green/White | | .051 [1.30] | 6.2 | 1.21/1.39 [.55/.63] | @ | 1.19 [30] | |
| 70711-K | Orange/Lt. Green | | .047 [1.19] | 7.2 | 0.78/0.89 [.35/.40] | @ | 1.19 [30] | |
| *143247 | Yellow | | .092 [2.34] | 7.4 | 17.72/16.36 [8.04/7.42] | @ | 1.00 [25] | 1.487 [37.8] |
| 143248 | Yellow/Green | 70711 | .092 [2.34] | 7.9 | 16.20/14.96 [7.35/6.79] | @ | 1.00 [25] | 1.487 [37.8] |
| 143249 | Yellow/White | | .086 [2.18] | 7.1 | 14.68/13.56 [6.66/6.15] | @ | 1.00 [25] | 1.487 [37.8] |
| 143250 | Red/White | 70711A | .086 [2.18] | 7.7 | 13.17/12.15 [5.97/5.47] | @ | 1.00 [25] | 1.487 [37.8] |
| *143251 | Blue/Purple | 70711B | .086 [2.18] | 8.4 | 11.65/10.75 [5.28/4.89] | @ | 1.00 [25] | 1.487 [37.8] |
| 143252 | Red | | .080 [2.03] | 7.6 | 10.13/9.35 [4.59/4.24] | @ | 1.00 [25] | 1.487 [37.8] |
| 143253 | Red/Yellow | 70711C | .080 [2.03] | 8.6 | 8.61/7.95 [3.91/3.60] | @ | 1.00 [25] | 1.487 [37.8] |
| 143254 | Red/Purple | 135158 | .072 [1.83] | 7.5 | 7.09/6.55 [3.22/2.97] | @ | 1.00 [25] | 1.487 [37.8] |
| 143255 | Red/Green | *70711D | .067 [1.70] | 7.8 | 5.21/4.81 [2.37/2.18] | @ | 1.00 [25] | 1.487 [37.8] |
| 143256 | White/Blue | 70711E-F | .062 [1.57] | 7.5 | 4.05/3.74 [1.84/1.70] | @ | 1.00 [25] | 1.487 [37.8] |
| *144478 | White | | .086 [2.18] | 7.7 | 19.92/18.40 [9.04/8.35] | @ | 1.00 [25] | 1.737 [44.1] |
| *144479 | Green | | .086 [2.18] | 8.4 | 17.63/16.27 [8.00/7.38] | @ | 1.00 [25] | 1.737 [44.1] |
| *144490 | Orange | | .080 [2.03] | 7.6 | 4.93/4.55 [2.23/2.06] | @ | 1.00 [25] | 1.237 [31.4] |
| *144491 | Light Blue | | .080 [2.03] | 8.6 | 4.19/3.87 [1.90/1.75] | @ | 1.00 [25] | 1.237 [31.4] |
| *147292 | Purple | | .092 [2.34] | 7.0 | 16.02/14.78 [7.27/6.70] | @ | 1.00 [25] | 1.405 [35.7] |
| 147293 | Orange/Yellow | | .092 [2.34] | 6.6 | 13.72/12.68 [6.22/5.75] | @ | 1.00 [25] | 1.322 [33.6] |
| 147294 | White/Purple | | .092 [2.34] | 6.3 | 11.21/10.35 [5.08/4.69] | @ | 1.00 [25] | 1.245 [31.6] |
| 147295 | Orange/Red | | .092 [2.34] | 6.0 | 11.58/10.69 [5.25/4.85] | @ | 1.00 [25] | 1.237 [31.4] |
| 147296 | Purple/Green | | .092 [2.34] | 5.8 | 12.31/11.37 [5.58/5.16] | @ | 1.00 [25] | 1.237 [31.4] |
| 153232 | Blue | | .086 [2.18] | 7.1 | 6.60/7.14 [3.00/3.24] | @ | 1.00 [25] | 1.237 [31.4] |
| 153235 | Green/Orange | | .080 [2.03] | 8.6 | 6.40/5.90 [2.90/2.68] | @ | 1.00 [25] | 1.362 [34.6] |
| 153236 | Green/Blue | | .086 [2.18] | 7.7 | 9.78/9.04 [4.44/4.10] | @ | 1.00 [25] | 1.362 [34.6] |
| 153237 | Blue/Yellow | 125498 | .086 [2.18] | 8.4 | 8.66/7.99 [3.93/3.62] | @ | 1.00 [25] | 1.362 [34.6] |
| 153238 | Blue/Red | | .080 [2.03] | 7.6 | 7.25/6.95 [3.29/3.15] | @ | 1.00 [25] | 1.362 [34.6] |
| 157059 | Blue/Orange | | .092 [2.34] | 6.3 | 20.75/22.03 [9.41/9.99] | @ | 1.00 [25] | 1.487 [37.8] |
| 177629 | Purple/Orange | | .102 [2.59] | 6.1 | 19.3/21.3 [8.75/9.66] | @ | .945 [24] | 1.270 [32.2] |
| 3000932 | Purple/Lt. Blue | | .080 [2.03] | 7.64 | 15.33/14.15 [6.96/6.42] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000933 | Purple/Orange | | .080 [2.03] | 8.64 | 13.03/12.03 [5.91/5.46] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000934 | Blue/Lt. Blue | | .072 [1.83] | 7.46 | 10.73/9.91 [4.87/4.50] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000935 | Green/Lt. Blue | | .072 [1.83] | 9.00 | 8.43/7.79 [3.83/3.54] | @ | 1.00 [25] | 1.737 [44.1] |
| 3000936 | Yellow/Lt. Blue | | .092 [2.34] | 6.65 | 10.10/9.32 [4.59/4.23] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000937 | White/Lt. Blue | | .092 [2.34] | 7.00 | 9.36/8.64 [4.25/3.92] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000938 | Red/Lt. Blue | | .092 [2.34] | 7.44 | 8.62/7.96 [3.91/3.61] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000939 | White/Orange | | .092 [2.34] | 7.94 | 7.88/7.28 [3.58/3.31] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000940 | Orange/Lt. Blue | | .086 [2.18] | 7.69 | 6.41/5.91 [2.91/2.68] | @ | 1.00 [25] | 1.237 [31.4] |
| 3000941 | Green/White | | .086 [2.18] | 8.43 | 5.67/5.23 [2.57/2.37] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001146 | Yellow/Purple | | .072 [1.83] | 9.00 | 6.87/6.34 [3.12/2.88] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001147 | Brown | | .076 [1.93] | 8.70 | 8.74/8.06 [3.97/3.66] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001148 | Brown/Green | | .080 [2.03] | 8.70 | 10.61/9.79 [4.82/4.44] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001149 | Brown/White | | .080 [2.03] | 7.70 | 12.49/11.51 [5.67/5.22] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001150 | Brown/Yellow | | .086 [2.18] | 8.50 | 14.35/13.25 [6.51/6.02] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001151 | Brown/Red | | .086 [2.18] | 7.70 | 16.22/14.95 [7.36/6.79] | @ | 1.00 [25] | 1.600 [40.6] |

*Formerly color coded — 143247 Yellow/Black, 143251 Red/Black and Blue/Brown, 144478 Black/White, 144479 Black/Green, 144490 Black/Orange, 144491 Black/Blue and 147292 Black/Brown and Brown.

## Table 18-2: Governor Springs and Specifications — High Speed

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 3001152 | Brown/Blue | | .086 [2.18] | 7.10 | 18.10/16.70 [8.22/7.58] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001153 | Grey | | .092 [2.34] | 8.00 | 19.95/18.45 [9.06/8.38] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001154 | Brown/Orange | | .092 [2.34] | 7.40 | 21.85/20.15 [9.92/9.15] | @ | 1.00 [25] | 1.600 [40.6] |
| 3001155 | Brown/Lt. Blue | | .086 [2.18] | 7.10 | 10.92/10.08 [4.96/4.58] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001156 | Brown/Purple | | .092 [2.34] | 7.94 | 12.03/11.12 [5.46/5.05] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001157 | Grey/Yellow | | .092 [2.34] | 7.44 | 13.18/12.18 [5.98/5.53] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001158 | Grey/Green | | .092 [2.34] | 7.00 | 14.31/13.21 [6.50/6.00] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001159 | Grey/White | | .092 [2.34] | 6.65 | 15.42/14.23 [7.00/6.46] | @ | 1.00 [25] | 1.362 [34.6] |
| 3001160 | Grey/Red | | .092 [2.34] | 5.70 | 13.06/12.06 [5.93/5.48] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001161 | Grey/Blue | | .092 [2.34] | 5.40 | 13.81/12.75 [6.27/5.79] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001162 | Grey/Brown | | .092 [2.34] | 5.30 | 14.53/13.43 [6.60/6.10] | @ | 1.00 [25] | 1.237 [31.4] |
| 3001163 | Grey/Orange | | .092 [2.34] | 5.10 | 15.28/14.11 [6.94/6.41] | @ | 1.00 [25] | 1.237 [31.4] |
| 3004750 | Grey/Purple | | .072 [1.83] | 6.45 | 6.08/5.61 [2.92/2.54] | @ | 1.00 [25] | 1.48 [37.8] |
| 3004751 | Grey/Lt. Blue | | .067 [1.70] | 9.40 | 4.99/4.61 [2.26/2.09] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004752 | Pink | | .072 [1.83] | 9.70 | 6.24/5.76 [2.83/2.61] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004753 | Pink/Yellow | | .072 [1.83] | 8.45 | 7.49/6.91 [3.39/3.13] | @ | 1.00 [25] | 1.600 [40.6] |
| 3004754 | Pink/Green | | .067 [1.70] | 9.40 | 6.13/5.66 [2.78/2.57] | @ | 1.00 [25] | 1.737 [44.1] |
| 3004755 | Pink/White | | .072 [1.83] | 9.70 | 7.66/7.08 [3.47/3.21] | @ | 1.00 [25] | 1.737 [44.1] |
| 3004756 | Pink/Blue | | .072 [1.83] | 8.45 | 9.20/8.47 [4.17/3.84] | @ | 1.00 [25] | 1.737 [44.1] |

## Table 18-3: MVS, SVS and TC Governor Springs and Specifications

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 70821 | Red | | .072 [1.83] | 10 | 8.91/7.29 [4.04/3.31] | @ | 1.12 [28] | 1.395 [35.4] |
| 70822 | Green | | .080 [2.03] | 9.5 | 12.65/10.25 [5.74/4.65] | @ | 1.12 [28] | 1.358 [34.5] |
| 101002 | White | | .063 [1.60] | 11 | 6.43/5.47 [2.92/2.48] | @ | 1.12 [28] | 1.514 [38.4] |
| 105422 | Black | | .054 [1.37] | 11 | 3.35/2.85 [1.52/1.29] | @ | 1.12 [28] | 1.508 [38.3] |
| 107787 | Yellow/Blue | | .072 [1.83] | 12 | 8.75/7.45 [3.97/3.38] | @ | 1.12 [28] | 1.482 [37.6] |
| 109686 | Blue | | .072 [1.83] | 8.5 | 8.03/6.57 [3.64/2.98] | @ | 1.12 [28] | 1.318 [33.5] |
| 109687 | Yellow | | .080 [2.03] | 10 | 11.2/9.2 [5.08/4.17] | @ | 1.12 [28] | 1.347 [34.2] |
| 109688 | Green/White | | .080 [2.03] | 9 | 14.1/11.5 [6.39/5.22] | @ | 1.12 [28] | 1.370 [34.8] |
| 109689 | Gray | | .080 [2.03] | 8.5 | 16.3/13.3 [7.39/6.03] | @ | 1.12 [28] | 1.384 [35.1] |
| 109690 | Pink | | .080 [2.03] | 8 | 18.5/15.1 [8.39/6.85] | @ | 1.12 [28] | 1.396 [35.4] |
| 110460 | Orange | | .063 [1.60] | 14 | 4.97/4.23 [2.25/1.92] | @ | 1.12 [28] | 1.538 [39.1] |
| 110461 | Purple | | .063 [1.60] | 12 | 5.72/4.88 [2.68/2.21] | @ | 1.12 [28] | 1.528 [38.8] |
| 116508 | None (Idle) | | .029 [.736] | 10.5 | .350 [0.16] | @ | .40 [10] | 0.440 [10.3] |
| 116128 | Black/White | | .054 [1.37] | 14 | 2.42/2.84 [1.10/1.29] | @ | 1.12 [28] | 1.558 [39.6] |
| 118934 | Blue/White | | .072 [1.83] | 11 | 8.96/7.64 [4.06/3.46] | @ | 1.12 [28] | 1.439 [36.5] |
| 118935 | Orange/White | | .063 [1.60] | 9 | 7.64/6.50 [3.46/2.95] | @ | 1.12 [28] | 1.498 [37.0] |
| 143849 | Yellow (Idle) SVS | | .025 [.635] | 9 | 2.38/2.62 [1.08/1.19] | @ | .325 [8.2] | .650 [16.5] |
| 153240 | None (Idle) MVS & VS | | .044 [1.12] | 5.5 | 3.70/4.10 [1.68/1.85] | @ | .295 [7.5] | .430 [10.9] |
| 153232 | Blue | | .086 [2.18] | 7.1 | 6.60/7.14 [2.99/3.24] | @ | 1.00 [25] | 1.237 [31.4] |
| 201116 | Green (Idle) | | .032 [.813] | 7.4 | 1.49/1.64 [.67/.73] | @ | .285 [7.2] | .625 [15.9] |

**Table 18-4: Idle Springs and Specifications**

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 70778 | None VS | | .032 [.813] | 6.5 | 0.28/0.36 [0.13/0.16] | @ | .265 [6.7] | 0.335 [8.50] |
| 138810 | None | | .032 [.813] | 7 | 0.39/0.49 [.18/.22] | @ | .418 [11] | 0.525 [13.3] |
| 138811 | None | | .032 [.813] | 12 | 0.58/0.92 [.26/.42] | @ | .850 [21] | 0.918 [23.3] |
| 144195 | None Std. Auto | | .032 [.813] | 14 | 0.69/0.85 [.31/.38] | @ | .955 [24] | 1.025 [26.0] |
| 218957 | None V555 | | .044 [1.12] | 14 | 6.05/7.45 [2.7/3.4] | @ | .900 [22.9] | 1.05 [26.7] |
| 3018767 | Yellow | | .039 [.991] | 11.5 | Preload 3.5, Subtract .250, Load 11.75-12.75 | | | 0.900 [22.9] |

**Note:** 138810 and 138811 used only in fuel pumps without weight assist.

**Table 18-5: Weight Assist Springs and Specifications**

| Part Number | Color Code | Replaces | Wire Dia. Inch [mm] | Number Coils | Pounds Load [kg] | @ | Inches Length [mm] | Free Length Inch [mm] |
|---|---|---|---|---|---|---|---|---|
| 143847 | Blue | | .028 [.711] | 9.7 | 3.30/3.70 [1.50/1.68] | @ | .325 [8.2] | .584 [14.8] |
| 143848 | White | | .030 [.762] | 9 | 4.17/4.83 [1.89/2.19] | @ | .325 [8.2] | .529 [13.4] |
| 143849 | Yellow | | .025 [.635] | 11 | 2.38/2.62 [1.09/1.19] | @ | .325 [8.2] | .650 [16.5] |
| 143855 | White/Yellow | | .022 [.559] | 10 | 0.90/1.10 [.41/.50] | @ | .325 [8.2] | .475 [12.1] |
| 650662 | Green | | .022 [.559] | 7.5 | 1.92/2.08 [.870/.943] | @ | .325 [8.2] | .710 [18.0] |
| 416920 | White/Red | | .032 [.81] | 10 | 9.02/9.46 [4:1/4.3] | @ | .319 [8.1] | .670 [17.0] |

**Table 18-6: Torque Springs and Specifications**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Pounds Load [kg] | Inches [mm] @ Length | Free Length Inches [mm] |
|---|---|---|---|---|---|---|
| 138768 | Red | .044 [1.12] | 6.5 | 3.00/3.20 [1.4/1.5] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138769 | Blue | .044 [1.12] | 5.7 | 3.60/3.84 [1.6/1.7] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138780 | Green | .044 [1.12] | 5.2 | 4.20/4.48 [1.9/2.0] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138781 | Yellow | .047 [1.19] | 5.6 | 4.80/5.12 [2.2/2.4] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138782 | Red/Blue | .047 [1.19] | 5.2 | 5.40/5.76 [2.5/2.6] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138783 | Red/Green | .051 [1.30] | 5.9 | 6.00/6.40 [2.7/2.9] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138784 | Red/Yellow | .051 [1.30] | 5.5 | 6.60/7.04 [3.0/3.2] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 138785 | Red | .044 [1.12] | 6.5 | 2.50/2.70 [1.1/1.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138786 | Blue | .044 [1.12] | 5.7 | 3.00/3.24 [1.4/1.5] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138787 | Green | .044 [1.12] | 5.2 | 3.50/3.78 [1.6/1.7] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138788 | Yellow | .047 [1.19] | 5.6 | 4.00/4.32 [1.8/1.9] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138789 | Red/Blue | .047 [1.19] | 5.2 | 4.50/4.86 [2.0/2.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138790 | Red/Green | .051 [1.30] | 5.9 | 5.00/5.40 [2.3/2.4] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138791 | Red/Yellow | .051 [1.30] | 5.5 | 5.50/5.94 [2.3/2.7] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138792 | Blue/Green | .051 [1.30] | 5.2 | 6.00/6.48 [2.7/2.9] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 138793 | Red | .044 [1.12] | 6.5 | 2.00/2.20 [0.9/1.0] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138794 | Blue | .044 [1.12] | 5.7 | 2.40/2.64 [1.1/1.2] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138795 | Green | .044 [1.12] | 5.2 | 2.80/3.08 [1.3/1.4] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138796 | Yellow | .047 [1.19] | 5.6 | 3.20/3.52 [1.4/1.6] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138797 | Red/Blue | .047 [1.19] | 5.2 | 3.60/3.96 [1.6/1.8] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138798 | Red/Green | .051 [1.30] | 5.9 | 4.00/4.40 [1.8/2.0] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138799 | Red/Yellow | .051 [1.30] | 5.5 | 4.40/4.84 [2.0/2.2] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138800 | Blue/Green | .051 [1.30] | 5.2 | 4.80/5.28 [2.2/2.4] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138801 | Blue/Yellow | .051 [1.30] | 4.7 | 5.20/5.72 [2.4/2.6] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138802 | Green/Yellow | .054 [1.37] | 5.4 | 5.60/6.16 [2.5/2.8] | @ .340 [8.64] | .540/.560 [13.72/14.22] |
| 138803 | Red | .044 [1.12] | 6.5 | 1.50/1.70 [.67/.77] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138804 | Blue | .044 [1.12] | 5.7 | 1.80/2.04 [.81/.91] | @ .340 [8.64] | .490/.510 [12.45/12.95] |

Table 18-6. Torque Springs and Specifications (Continued)

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Pounds Load [kg] | Inches [mm] @ Length | Free Length Inches [mm] |
|---|---|---|---|---|---|---|
| 138805 | Green | .044 [1.12] | 5.2 | 2.10/2.38 [.94/1.1] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138993 | Yellow | .047 [1.19] | 5.6 | 2.40/2.72 [1.1/1.2] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138994 | Red/Blue | .047 [1.19] | 5.2 | 2.70/3.06 [1.2/1.4] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138995 | Red/Green | .051 [1.30] | 5.9 | 3.00/3.40 [1.4/1.5] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138996 | Red/Yellow | .051 [1.30] | 5.5 | 3.30/3.74 [1.5/1.7] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138997 | Blue/Green | .051 [1.30] | 5.2 | 3.60/4.08 [1.6/1.8] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138998 | Blue/Yellow | .051 [1.30] | 4.7 | 3.90/4.42 [1.8/2.0] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 138999 | Green/Yellow | .054 [1.37] | 5.4 | 4.20/4.76 [1.9/2.1] | @ .340 [8.64] | .490/.510 [12.45/12.95] |
| 139584 | Blue/Green | .051 [1.30] | 5.2 | 7.20/7.68 [3.3/3.5] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 139585 | Blue/Yellow | .051 [1.30] | 4.7 | 7.80/8.33 [3.5/3.8] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 139586 | Green/Yellow | .054 [1.37] | 5.4 | 8.40/8.96 [3.8/4.0] | @ .340 [8.64] | .640/.660 [16.26/16.76] |
| 139587 | Blue/Yellow | .051 [1.30] | 4.7 | 6.50/7.02 [2.9/3.2] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 139588 | Green/Yellow | .054 [1.37] | 5.4 | 7.00/7.56 [3.2/3.4] | @ .340 [8.64] | .590/.610 [14.99/15.49] |
| 142696 | White/Blue | .041 [1.04] | 6.3 | 2.32/2.48 [1.0/1.1] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142697 | White/Yellow | .041 [1.04] | 7.7 | 1.74/1.86 [.77/.84] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142698 | White/Green | .035 [0.89] | 6.7 | 1.16/1.24 [.49/.54] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 142699 | White/Blue | .041 [1.04] | 6.3 | 1.92/2.08 [.86/.94] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142700 | White/Yellow | .041 [1.04] | 7.7 | 1.44/1.56 [.63/.70] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142701 | White/Green | .035 [0.89] | 6.7 | 0.96/1.04 [.41/.45] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 142702 | White/Blue | .041 [1.04] | 6.3 | 1.52/1.68 [.67/.75] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142703 | White/Yellow | .041 [1.04] | 7.7 | 1.14/1.26 [.49/.54] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142704 | White/Green | .035 [0.89] | 6.7 | 0.76/0.84 [.34/.38] | @ .350 [8.89] | .540/.560 [13.72/14.22] |
| 142705 | White/Blue | .041 [1.04] | 6.3 | 1.12/1.28 [.49/.54] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142706 | White/Yellow | .041 [1.04] | 7.7 | 0.84/0.96 [.38/.41] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142707 | White/Green | .035 [0.89] | 6.7 | 0.56/0.64 [.25/.29] | @ .350 [8.89] | .490/.510 [12.45/12.95] |
| 142843 | White/Blue | .041 [1.04] | 6.3 | 3.92/4.08 [1.7/1.8] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142844 | Red | .044 [1.12] | 6.5 | 4.90/4.10 [2.2/2.3] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142845 | Blue | .047 [1.19] | 6.8 | 5.88/6.12 [2.7/2.8] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142846 | Green | .047 [1.19] | 6.1 | 6.86/7.14 [3.1/3.2] | @ .350 [8.89] | .840/.860 [21.34/21.84] |
| 142850 | White/Blue | .041 [1.04] | 6.3 | 3.52/3.68 [1.6/1.7] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142851 | Red | .044 [1.12] | 6.5 | 4.40/4.60 [2.0/2.1] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142852 | Blue | .047 [1.19] | 6.8 | 5.28/5.52 [2.4/2.5] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142853 | Green | .047 [1.19] | 6.1 | 6.16/6.44 [2.8/2.9] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142854 | Yellow | .047 [1.19] | 5.6 | 7.04/7.36 [3.2/3.3] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142855 | Red/Blue | .051 [1.30] | 6.3 | 7.92/8.28 [3.6/3.7] | @ .350 [8.89] | .790/.810 [20.07/20.57] |
| 142857 | White/Blue | .041 [1.04] | 6.3 | 3.12/3.28 [1.4/1.5] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142858 | Red | .044 [1.12] | 6.5 | 3.90/4.10 [1.7/1.8] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142859 | Blue | .047 [1.19] | 6.8 | 4.68/4.92 [2.1/2.2] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142860 | Green | .027 [1.19] | 6.1 | 5.46/5.74 [2.5/2.6] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142861 | Yellow | .047 [1.19] | 5.6 | 6.24/6.56 [2.8/2.9] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142862 | Red/Blue | .051 [1.30] | 6.3 | 7.02/7.38 [3.2/3.3] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142863 | Red/Green | .051 [1.30] | 5.9 | 7.80/8.20 [3.5/3.7] | @ .350 [8.89] | .740/.760 [18.80/19.30] |
| 142864 | White/Blue | .041 [1.04] | 6.3 | 2.72/2.88 [1.2/1.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142865 | Red | .044 [1.12] | 5.5 | 3.40/3.60 [1.5/1.6] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142866 | Blue | .047 [1.19] | 6.8 | 4.08/4.32 [1.8/1.9] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142867 | Green | .047 [1.19] | 6.1 | 4.76/5.04 [2.1/2.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142868 | Yellow | .047 [1.19] | 5.6 | 5.44/5.76 [2.4/2.6] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142869 | Red/Blue | .051 [1.30] | 6.3 | 6.12/6.48 [2.8/2.9] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 142870 | Red/Green | .051 [1.30] | 5.9 | 6.80/7.20 [3.1/3.3] | @ .350 [8.89] | .690/.710 [17.53/18.03] |
| 3002047 | White | .054 [1.37] | 5.2 | 8.74/9.27 [3.97/4.21] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002048 | White/Red | .054 [1.37] | 5.0 | 9.31/9.89 [4.23/4.49] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002049 | Brown | .054 [1.37] | 4.8 | 10.08/10.71 [4.58/4.86] | @ .350 [8.89] | .640/.660 [16.26/16.76] |

**Table 18-6: Torque Springs and Specifications (Continued)**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Pounds Load [kg] | Inches [mm] @ Length | Free Length Inches [mm] |
|---|---|---|---|---|---|---|
| 3002050 | Brown/Red | .059 [1.50] | 5.6 | 10.48/11.12 [4.76/5.05] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002051 | Brown/Blue | .059 [1.50] | 5.5 | 11.06/11.73 [5.03/5.33] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002052 | Brown/Green | .059 [1.50] | 5.3 | 11.63/12.36 [5.28/5.61] | @ .350 [8.89] | .640/.660 [16.26/16.76] |
| 3002053 | White | .054 [1.37] | 5.2 | 7.28/7.72 [3.31/3.50] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002054 | White/Red | .054 [1.37] | 5.0 | 7.76/8.24 [3.52/3.74] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002055 | Brown | .054 [1.37] | 4.8 | 8.24/8.76 [3.74/3.98] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002056 | Brown/Red | .054 [1.37] | 4.6 | 8.73/9.27 [3.96/4.21] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002057 | Brown/Blue | .059 [1.50] | 5.5 | 9.22/9.78 [4.19/4.44] | @ .350 [8.89] | .590/.610 [14.99/15.49] |
| 3002058 | Brown/Green | .059 [1.50] | 5.3 | 9.70/10.30 [4.40/4.68] | @ .350 [8.89] | .590/.610 [14.99/15.49] |

**Table 18-7: AFC Springs and Specifications (see text for checking procedure)**

| Part Number | Color Code | Wire Dia. Inches [mm] | Number Coils | Preload A Pounds [kg] | Load B Pounds [kg] |
|---|---|---|---|---|---|
| 179804 | White | .105 [2.67] | 5.2 | 2.00 [ 0.91] | 7.5- 8.5 [ 3.40- 3.86] |
| 179806 | Orange | .105 [2.67] | 4.1 | 3.00 [ 1.36] | 11.3- 12.7 [ 5.13- 5.77] |
| 179808 | Purple | .120 [3.04] | 4.6 | 4.00 [ 1.82] | 15.0- 17.0 [ 6.81- 7.72] |
| 179816 | Blue-White | .120 [3.04] | 4.1 | 5.00 [ 2.27] | 18.8- 21.2 [ 8.54- 9.62] |
| 179818 | Blue-Orange | .135 [3.43] | 4.7 | 6.00 [ 2.72] | 22.5- 25.5 [10.21-11.58] |
| 179820 | Blue-Purple | .135 [3.43] | 4.3 | 7.00 [ 3.18] | 26.3- 29.7 [11.94-13.48] |
| 179822 | White-Green | .135 [3.43] | 4.1 | 8.00 [ 3.63] | 30.1- 33.9 [13.66-15.39] |
| 179824 | White-Red | .135 [3.43] | 3.9 | 9.00 [ 4.09] | 33.8- 38.2 [15.35-17.34] |
| 179826 | White-Yellow | .148 [3.76] | 4.4 | 10.00 [ 4.54] | 37.6- 42.4 [17.07-19.25] |
| 179828 | Green-Red | .148 [3.76] | 4.2 | 11.00 [ 4.99] | 41.3- 46.7 [18.75-21.20] |
| 179830 | Green-Yellow | .148 [3.76] | 4.0 | 12.00 [ 5.45] | 45.1- 50.9 [20.47-23.11] |
| 179832 | Orange-Purple | .148 [3.76] | 3.8 | 13.00 [ 5.90] | 48.9- 55.1 [22.20-25.02] |
| 179834 | Red-Purple | .148 [3.76] | 3.7 | 14.00 [ 6.36] | 52.6- 59.4 [23.88-26.97] |
| 179836 | Purple-Yellow | .156 [3.96] | 4.0 | 15.00 [ 6.81] | 56.4- 63.6 [25.60-28.87] |
| 3000592 | Light Green | .156 [3.96] | 3.9 | 16.00 [ 7.26] | 60.1- 67.9 [27.29-30.83] |
| 3007692 | Lt. Blue-Green | .162 [4.11] | 3.8 | 18.00 [ 8.17] | 67.7- 76.3 [30.74-34.64] |
| 3007694 | Lt. Blue-Red | .177 [4.50] | 3.7 | 20.00 [ 9.08] | 75.2- 84.8 [34.14-38.32] |
| 3007696 | Lt. Blue-Yellow | .177 [4.50] | 3.7 | 22.00 [ 9.99] | 82.7- 93.3 [37.55-42.36] |
| 3007698 | Lt. Green-White | .177 [4.50] | 3.6 | 24.00 [10.90] | 90.2-101.8 [40.95-46.22] |

**Table 18-8: Idle Spring Plunger Data (Button)**

| Code No. | Part No. | Counterbore Diameter Inch | [mm] |
|---|---|---|---|
| 5 | 141623 | .2085-.2115 | [5.30-5.36] |
| 7 | 141624 | .2135-.2165 | [5.42-5.50] |
| 10 | 141625 | .2185-.2215 | [5.54-5.62] |
| 12 | 141626 | .2235-.2265 | [5.67-5.75] |
| 15 | 139894 | .2285-.2315 | [5.80-5.88] |
| 17 | 140417 | .2335-.2365 | [5.93-6.00] |
| 20 | 141629 | .2385-.2415 | [6.05-6.13] |
| 22 | 141630 | .2435-.2465 | [6.18-6.26] |
| 25 | 141631 | .2485-.2515 | [6.31-6.38] |
| 27 | 141632 | .2535-.2565 | [6.44-6.49] |
| 30 | 141633 | .2585-.2615 | [6.56-6.64] |
| 32 | 141634 | .2635-.2665 | [6.69-6.77] |
| 35 | 140922 | .2685-.2715 | [6.82-6.89] |
| 37 | 140418 | .2735-.2765 | [6.94-7.02] |
| 40 | 137370 | .2785-.2815 | [7.07-7.15] |
| 42 | 140923 | .2835-.2865 | [7.20-7.28] |
| 45 | 138862 | .2885-.2915 | [7.33-7.40] |
| 47 | 140924 | .2935-.2965 | [7.45-7.53] |
| 50 | 140925 | .2985-.3015 | [7.58-7.66] |
| 52 | 139618 | .3035-.3065 | [7.71-7.78] |
| 55 | 139619 | .3085-.3115 | [7.83-7.91] |
| 57 | 140926 | .3135-.3165 | [7.96-8.04] |
| 60 | 140927 | .3185-.3215 | [8.09-8.16] |
| 62 | 141636 | .3235-.3265 | [8.21-8.29] |
| 65 | 141637 | .3285-.3315 | [8.34-8.42] |
| 67 | 141638 | .3335-.3365 | [8.47-8.54] |
| 170 | 145947 | .3385-.3415 | [8.59-8.67] |
| 172 | 145948 | .3435-.3465 | [8.72-8.80] |
| 175 | 145949 | .3485-.3515 | [8.85-8.92] |
| 177 | 145950 | .3535-.3565 | [8.98-9.05] |
| 180 | 145951 | .3585-.3615 | [9.10-9.18] |
| 182 | 145952 | .3635-.3665 | [9.23-9.31] |
| 185 | 145953 | .3685-.3715 | [9.35-9.43] |
| 187 | 145954 | .3735-.3765 | [9.48-9.56] |
| 190 | 145955 | .3785-.3815 | [9.61-9.69] |
| 192 | 145956 | .3835-.3865 | [9.74-9.81] |
| 195 | 145957 | .3885-.3915 | [9.87-9.94] |
| 197 | 145958 | .3935-.3965 | [9.99-10.07] |
| 200 | 145959 | .3985-.4015 | [10.12-10.20] |
| 202 | 145960 | .4035-.4065 | [10.25-10.32] |
| 205 | 145961 | .4085-.4115 | [10.37-10.45] |
| 207 | 145962 | .4135-.4165 | [10.50-10.58] |
| 210 | 145963 | .4185-.4215 | [10.63-10.70] |
| 212 | 145964 | .4235-.4265 | [10.76-10.83] |
| 215 | 145965 | .4285-.4315 | [10.88-10.96] |
| 217 | 145966 | .4335-.4365 | [11.01-11.09] |
| 220 | 145967 | .4385-.4415 | [11.14-11.21] |
| 222 | 145968 | .4435-.4465 | [11.26-11.34] |
| 225 | 145969 | .4485-.4515 | [11.39-11.47] |
| 227 | 145970 | .4535-.4565 | [11.52-11.59] |
| 230 | 145971 | .4585-.4615 | [11.65-11.72] |
| 232 | 145972 | .4635-.4665 | [11.77-11.85] |
| 235 | 145973 | .4685-.4715 | [11.90-11.97] |
| 237 | 145974 | .4735-.4765 | [12.03-12.10] |

**Table 18-9: PT (type H) Fuel Control Plunger**

| Code No. | Assembly No. | *Inch ±.0015 | *[mm] ±.038 |
|---|---|---|---|
| 10 | 3015772 | 0.220 | [5.588] |
| 15 | 3015773 | 0.230 | [5.842] |
| 20 | 3015774 | 0.240 | [6.096] |
| 25 | 3015775 | 0.250 | [6.350] |
| 30 | 3015776 | 0.260 | [6.604] |
| 35 | 3015777 | 0.270 | [6.858] |
| 40 | 3015778 | 0.280 | [7.112] |
| 45 | 3015779 | 0.290 | [7.366] |
| 50 | 3015780 | 0.300 | [7.620] |
| 55 | 3015781 | 0.310 | [7.874] |
| 60 | 3015782 | 0.320 | [8.128] |
| 65 | 3015783 | 0.330 | [8.382] |
| 170 | 3015784 | 0.340 | [8.636] |
| 180 | 3015785 | 0.360 | [9.144] |
| 190 | 3015786 | 0.380 | [9.652] |
| 200 | 3015787 | 0.400 | [10.160] |
| 210 | 3015788 | 0.420 | [10.668] |
| 220 | 3015789 | 0.440 | [11.176] |
| 230 | 3015790 | 0.460 | [11.684] |

*Inside diameter of plunger.

**Table 18-10: Aneroid Bellows Spring Specifications**

| Part No. | Color Code | Coils | Free Length In. [mm] | Wire Dia. In. [mm] | Load Lb.@In. [kg@mm] |
|---|---|---|---|---|---|
| 115083 | White | 6 | 1.50 [38] | 0.092 [2.34] | 9.83@1.05 [4.46@26.7] |
| 115084 | None | 5.5 | 1.50 [38] | 0.105 [2.67] | 12.6@1.05 [5.71@26.7] |
| 115085 | Orange | 5.5 | 1.50 [38] | 0.105 [2.67] | 15.4@1.05 [6.98@26.7] |
| 115086 | Blue | 5.5 | 1.50 [38] | 0.105 [2.67] | 18.2@1.05 [8.25@26.7] |
| 116203 | Red | 6 | 1.44 [36] | 0.080 [2.03] | 7.0@0.830 [3.17@21.1] |
| 116567 | Yellow | 6 | 1.53 [39] | 0.099 [2.51] | 16.0@1.05 [7.26@26.7] |
| 124033 | Green | 6 | 1.375 [35] | 0.088 [2.24] | 8.18@1.00 [3.71@25.4] |
| 218083 | Black | 5.5 | 1.50 [38] | 0.105 [2.67] | 21.0@1.05 [9.53@26.7] |

**Table 18-11: Aneroid Starting Check Valve Spring Specifications**

| Part No. | Free Length Inch [mm] | Opening Pressure psi [kPa] |
|---|---|---|
| 114745 | 1.75 [44.4] | 23-31 [159-214] |
| 120073 | 1.39 [35.3] | 12-20 [ 83-138] |
| 219022 | Assembly | 6-8 [ 41-55 ] |
| 3015026 | Assembly | 13-18 [ 90-124] |

**Table 18-12: Calibration Recheck Specifications (Example: Code 3512 shown in parenthesis)**

| Column I | Column II | Column III |
|---|---|---|
| **Check** | **One Test Stand To Another** | **Tested and Adjusted on Engine and Rechecked On Fuel Pump Test Stand** |
| Governor Break or Cut Off (1930/1950) | ±10 rpm from the Publication Values (1920/1960) | Governor Speed to the Maximum Cut Off Publication Value ±10 rpm (1900/1960) |
| Idle Pressure (60 psi @ 500 rpm) | ±10% of Publication Value or ±1 psi whichever is greater. (54/66 psi @ 500 rpm) | Do Not Change if it is correct on the engine. |
| Calibration Pressure at Rated Speed, Test Stand (180 psi) on Eng. Rail (167/185 psi) | Publication Value ±2 psi (178/182 psi) | Publication Value ±2 psi (165/187 psi) |
| Check Points | Publication Range ±2 psi | Publication Range ±(5% of Test Stand Recheck Value +2 psi) |
| No. 1 (121/127 psi) | (119/129 psi) | (113/135 psi) |
| No. 2 ( 86/ 92 psi) | ( 84/ 94 psi) | ( 80/ 98 psi) |
| AFC Plunger Setting (83 psi) | Publication Value ±10 psi (73/93 psi) | Publication Value ±10 psi (73/93 psi) |
| No-Air Setting (58 psi) | ±5% of Publication Value (55/61 psi) | Publication Value ±7 psi (Use Engine Flow Area Method of Checking (51/65 psi) |
| Throttle Leakage (75 cc/min.) | ±15 cc/min. (60/90 cc/min.) | Publication Values ±25 cc/min. (50/100 cc/min.) |
| Throttle Travel (27/29 deg.) | ±1 deg. from Publication Value (26/30 deg.) | ±1 deg. from Publication Value (26/30 deg.) |
| Air Signal Attenuator (3007434-Air) (8/10.4 units) | Same as Publication Value (8/10.4 units) | Same As Publication Value (8/10.4 units) |
| Air Signal Attenuator (3020760-Hyd) (400/500 cc/min. @ 40 psi) | Same as Publication Value (400/500 cc/min. @ 40 psi) | Same As Publication Value (400/500 cc/min. @ 40 psi) |

**Table 18-13: Gear Pump Flow**

| Gear Pump | Minimum RPM | Total Flow |
|---|---|---|
| 7/16 [11.11] | 2100 | 625 lb./hr. |
| 3/4 [19.05] | 2100 | 1175 lb./hr. |
| 1 [25.40] | 1600 | 1175 lb./hr. |
| 1-1/4 [31.75] | 1400 | 1200 lb./hr. |
| PT-H | 1400 | 1900 lb./hr. |

**Table 18-15: Factory Approved Engine Idle Speeds**

| Engine Series | Idle Speed RPM |
|---|---|
| J and C | 625 ± 20 |
| H, NH and NT | 600 ± 20 |
| V-12-1710 | 550 ± 20-30 |
| V6-200, V8-265 and V-903 | 650 ± 25 |
| V8-350 and VT8-430 | 550 ± 20-30 |
| V6-140, V8-185 and V-555 | 625 ± 25 |
| KT-1150 | 600 ± 20 |
| KT-2300 | 600 ± 20 |

**Table 18-14: TMD Spring Specifications**

| Part Number | Color Code | Wire Diameter | Number Coils | Pounds Load | @ | Inches Length | Free Length |
|---|---|---|---|---|---|---|---|
| 70691 | Red | .075 | 10 | 4.34/3.34 | @ | 1.38 | 1.475/1.505 |
| 105096 | Yellow | .062 | 11 | 2.01/1.01 | @ | 1.38 | 1.470/1.490 |
| 112403 | Blue | .080 | 9 | 4.34/3.34 | @ | 1.38 | 1.440/1.470 |
| 186997 | Orange | .072 | 10 | 8.91/7.29 | @ | 1.12 | 1.435/1.355 |
| 204101 | | .023 | 6 | .300/.350 | @ | .400 | 0.650/0.660 |

**Table 18-16: Torque Limiting Valve Dynamometer Setting 500 Ft.Lbs. @ Maximum Torque Peak**

| Fuel Pump Code | CPL | Load | Rail | Flow | RPM |
|---|---|---|---|---|---|
| 2433 | 101 | 381 | 54 | 297 | 1600 |
| 2921 | 160 | 381 | 46 | 287 | 1600 |
| 2953 | 181 | 381 | 48 | 225 | 1400 |
| 2553 | 124 | 381 | 57 | 207 | 1600 |
| 2684 | 26 | 381 | 72 | 204 | 1600 |
| E005 | 183 | 381 | 106 | 375 | 1600 |

**Table 18-17: Torque Modification Device Pressure Regulators**

| Code No. | Part No. | Code No. | Part No. |
|---|---|---|---|
| 143 | 128770 | 202 | 215092 |
| 182 | 143906 | 203 | 217099 |
| 200 | 199099 | 204 | 3003150 |
| 201 | 202612 | | |

## Cummins Service Publications

The following Cummins Service Publications concerning the Cummins PT Fuel System can be purchased from any Cummins Distributor or Cummins Dealer.

Many publications have been translated into other languages. Cummins Distributors or Cummins Dealers have information on which publications are available in languages other than English.

For information about any Cummins publications, contact your local Cummins Distributor or Dealer.

| Bulletin Number | Publication Description |
|---|---|
| **PT (type G) Fuel Pump Calibration Tables** | |
| 3379182 | Codes 3200 and up — from January, 1976 to July, 1980 |
| 3379068 | Codes 2300 to 3199 — from January, 1970 to December, 1975 |
| 3379077 | Codes issued between October, 1963 and December, 1969 |
| 983533 | Codes issued before October 1963 — No Flowmeter Method |
| 3379101 | PT (type R) Fuel Pump Manual |
| 3379084 | Fuel Pump Rebuild and Calibration Procedure |
| 3379071 | Injector Rebuild Manual |
| **Fuel System Wall Charts** | |
| 3379081 | PT (type G) AFC Fuel Pump Cross Section and Flow |
| 3379082 | PT (type G) AFC-VS Fuel Pump Cross Section and Flow |
| 3379080 | PT (type D) Top Stop Injector Fuel Injection Cycle |
| 3379103 | PT (type G) Fuel System Flow Diagram — All Injectors |
| 3379130 | PT (type G) AFC Fuel Pump Parts — July, 1977 |
| 3379485 | PT (type G) AFC Fuel Pump Parts — July, 1979 |
| 3379172 | PT (type H) AFC Fuel Pump Cross Section and Flow |
| 3379090 | Guide to Troubleshooting |
| 3379133 | Control Parts List |
| 3379022 | Governors Used on Cummins Engines |
| 3379144 | Fuel Systems Publications Rack Program |
| 3379208 | Fuel Systems Publications Rack Update Subscription Service |
| **Cummins Training Aids Catalog** | |
| **Film Recall Booklets (These publications have 33 mm slide training films available)** | |
| 3387049-OR | PT (type G) AFC Fuel Pump Calibration |
| 985577-R | PT (type G) Fuel Pump Calibration |
| 983602-R | PT (type G) Fuel Pump Operation Adjustment |
| 983603-R | PT (type R) Fuel Pump Operation Adjustment |
| 983609-R | Theory of Cummins PT Fuel System |
| 983601-R | Principles of PT Mechanical Governor |
| 985576-R | Injector Calibration |
| 985575-R | Injector Leakage Tester ST-990 |
| 983657-R | PT (type D) Injector Disassembly and Assembly |
| 985605-R | Cummins Aneroids |
| 985618-R | Troubleshooting PT Fuel System — Program 1 |
| 985620-R | Troubleshooting PT Fuel System — Program 2 |
| 985621-R | Troubleshooting PT Fuel System — Program 3 |
| 985622-R | Troubleshooting PT Fuel System — Program 4 |
| 3387137-R | Troubleshooting Driveability Complaints |

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