M50/PSU IF NO. 3136

Selecting Correct Injection Pump Timing Button and Injection Pump Installation

Read through these instructions completely before beginning the actual installation. Perform the following steps in the order listed and refer to the illustrations for clarifications as required. Retain the packing list for use when ordering replacement parts

WARNING **This symbol is used throughout this instruction sheet to warn of possible serious personal injury or death.**

CAUTION **This symbol refers to possible equipment damage.**

Remove both battery cables from the battery. Disconnect negative battery cable first.

WARNING **Accidental starting of the engine might cause severe personal injury or death. Disconnect the battery cables when repairs are made to the engine, controls, or housing.**

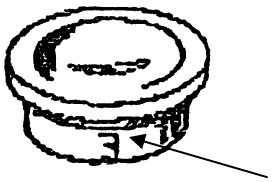
This instruction sheet applied to 2 and 4 cylinder Onan Diesel models DJBA, DJB, DJC, MDJB, MDJC, RDJC, MDJE, MDJF, RDJE, RDJEA, and RDJF using the AMBAC PSU or Model 50 Injection pump.

CAUTION **Keeping the fuel system clean is extremely important. A fine particle of dirt can ruin the injection system in a very short time. If the fuel system is opened for any reason, cap all openings and place the parts removed in clean diesel fuel. Before installing new or used parts, wash them in clean fuel and install them wet.**

CAUTION **Preservative oil applied to the new injection pump during assembly may cause the pump to stick. Forcing the plunger or gear will damage the pump. Dissolve preservative by soaking pump in clean filtered diesel fuel for 15 to 30 minutes.**

TIMING BUTTON CODE

The timing button has a code number or letter stamped on it that corresponds with its dimension in thousandths of an inch. See Table 1. Figure 1 shows the timing button. One of these buttons will provide the correct port closing.



CODE LETTER OR NUMBER STAMPED ON SIDE

FIGURE 1. TIMING BUTTON CODE

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TIMING BUTTON THICKNESS

The injection pump on each engine must be timed to that engine by using a timing button of specific thickness. Each new pump has its port closing dimension stamped on the pump mounting flange. This port closing dimension is measured at the factory using a number 11 or standard button.

Pump timing is critical. Use one of the two timing methods to determine correct new button thickness. If the correct button is not supplied with the replacement pump refer to Table 1 and order the correct one from AMBAC International.

TABLE 1. PLUNGER BUTTONS

Thickness	Part No.	Identification
.089" (2.26mm)	BO853-10	10 or L
.092" (2.34mm)	BO853-9	9 or K
.095" (2.41mm)	BO853-8	8 or J
.098" (2.49mm)	BO853-7	7 or H
.101" (2.56mm)	BO853-6	6 or F
.104" (2.64mm)	BO853-11	11
.107" (2.72mm)	BO853-5	5 or E
.110" (2.79mm)	BO853-4	4 or D
.112" (2.84mm)	BO853-3	3 or C
.116" (2.95mm)	BO853-2	2 or B
.119" (3.02mm)	BO853-1	1 or A
.122" (3.10mm)	BO853-12	12 or M
.125" (3.17mm)	BO853-13	13 or N
.128: (3.25mm)	BO853-14	14 or P
.131" (3.33mm)	BO853-15	15 or R
.134" (3.40mm)	BO853-16	16 or S

IMPORTANT: Plunger buttons are not included with Model 50 pumps or hydraulic heads. The required plunger button must be selected when the new pump, or an old pump with a new head is installed on an engine.

TIMING PSU OR MODEL 50 INJECTION PUMP

One of two methods can be used, to determine the proper timing button to correctly time the fuel injection pump to the engine.

Method 1: Timing by Calculation

This procedure is used, when all dimensions are available for replacing an old pump, before the pump is installed. Timing by calculation requires the port closing dimensions and button thickness from the pump being replaced. It also requires the port closing dimension of the new pump. Put the

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dimensions in the PORT CLOSING FORMULA and calculate the new button thickness. After determining the timing button thickness, find the button code in Table 1.

If injection pump is removed from the engine, make sure the steel shims between pump and cylinder block mounting remain the same. These shims maintain proper gear backlash.

CAUTION **Do not change the pump mounting shim's total thickness or the proper pump gear to camshaft gear mesh will be affected. The shim's thickness is established at the factory during engine assembly and does not change unless a new cylinder block is installed.**

PORT CLOSING FORMULA: The formula for determining the proper port closing (PC) timing button for a new or replacement pump is as follows:

1. **Remove old pump.**

2. **Determine port closing dimensions and original button thickness from old pump.**

   A. **Write down port closing dimension given on old pump flange and port closing dimension given on new pump flange. See example.**
   B. **Use a pair of channel lock pliers or screwdriver to remove tappet, retaining ring, and timing button from old injection pump (Figure 2). Use number or letter code on timing button to obtain dimension of old timing button from Table 1. This code should be the same as the code number stamped on injection pump (figure2).**

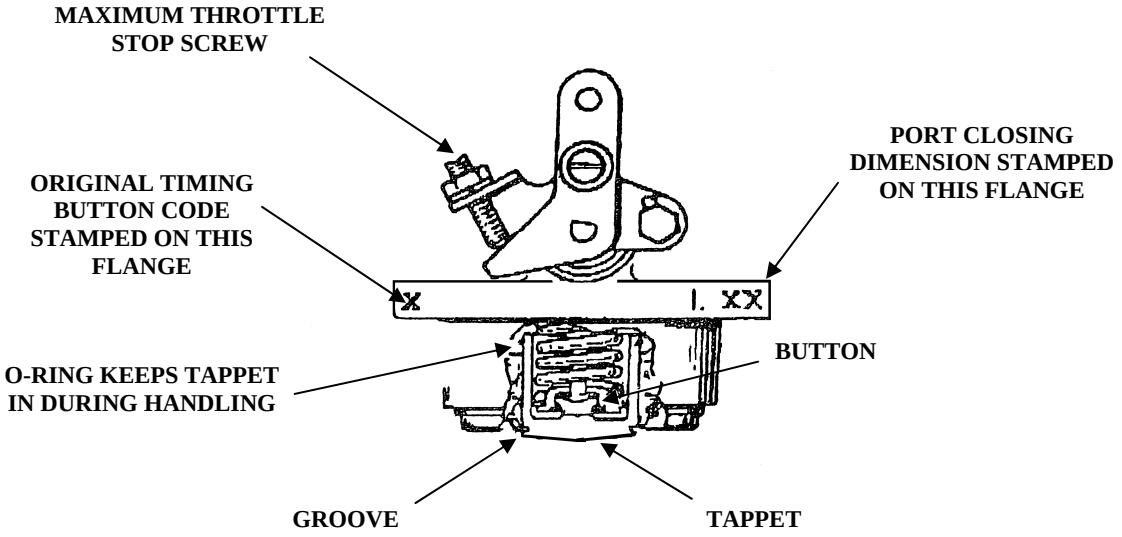

FIGURE 2. TAPPET REMOVAL

CAUTION **On all PSU pumps be sure to hold the pump drive gear securely to the pump body when removing the tappet. If not, the pump will come apart and be difficult to assemble. The**

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metering sleeve will drop off the plunger if the gear and plunger are removed. If the plunger port is not enclosed by the sleeve, there will be no fuel delivery and the pump will not operate.

3. **Add dimension on old pump flange to timing button dimension. See example:**

Example:	**Inches**	**(mm)**
Port closing dimension of old pump	**1.109**	**(28.168)**
Button thickness of old pump	**+.107**	**(2.719)**
Total	**1.216**	**(30.887)**
Port closing dimension of new pump	**-1.094**	**(27.788)**
Required button thickness of new pump	**.122**	**(3.099)**

4. **Subtract port closing dimension given on new pump flange from total dimension for old pump.**

5. **Use dimension calculated to select new timing button that is nearest the calculated dimension. Install new timing button in pump and install tappet on pump.**

6. **Install injection pump. Refer to INJECTION PUMP INSTALLATION.**

INJECTION PUMP INSTALLATION

Be sure the steel shims between the pump and the cylinder block mounting are the same. These shims maintain proper gear backlash. The number stamped on the cylinder block injection pump mounting pad indicates the proper shim thickness. This thickness does not change when a new pump is installed. It only changes when a new cylinder block is installed.

1. **Turn engine in direction of rotation (clockwise when viewed from the front of engine) until number one cylinder is on a compression stroke and the PC mark on flywheel lines up with timing pointer on gear case (Figure 0206). Rotation clockwise also takes out all gear backlash in that direction.**

   Look into injection pump mounting hole to verify that one intake lobe points outward and down 45 degrees.

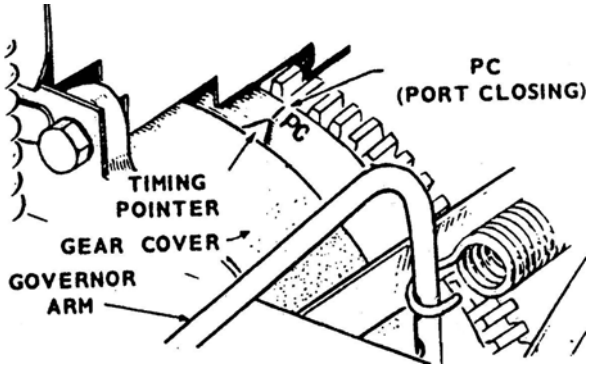

Fig. 0206—Port closing injection timing mark is stamped on margin of diesel engine flywheels. Numerical value in degrees BTDC may be shown. Refer to text.

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2. **Remove screw (Figure 9) on side of injection pump. Rotate drive gear until a .125 inch (3.175 mm) brass rod can be inserted into drive gear slot. This locks the gear in position when installing injection pump on engine.**

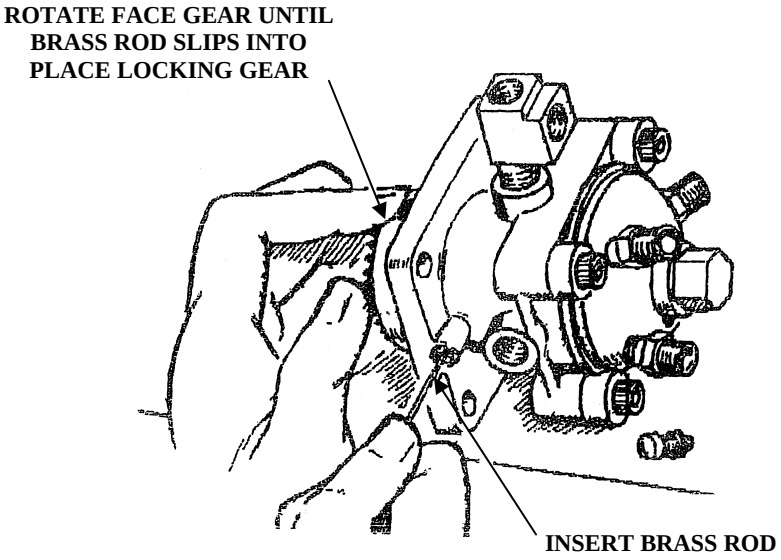

FIGURE 9. INSERT BRASS ROD

3. **With injection pump drive gear locked, place pump in mounting hole. Hold pump firmly against cylinder block. A slight spring pressure indicates that the pump and camshaft gears are meshed (Figure 10).**

4.

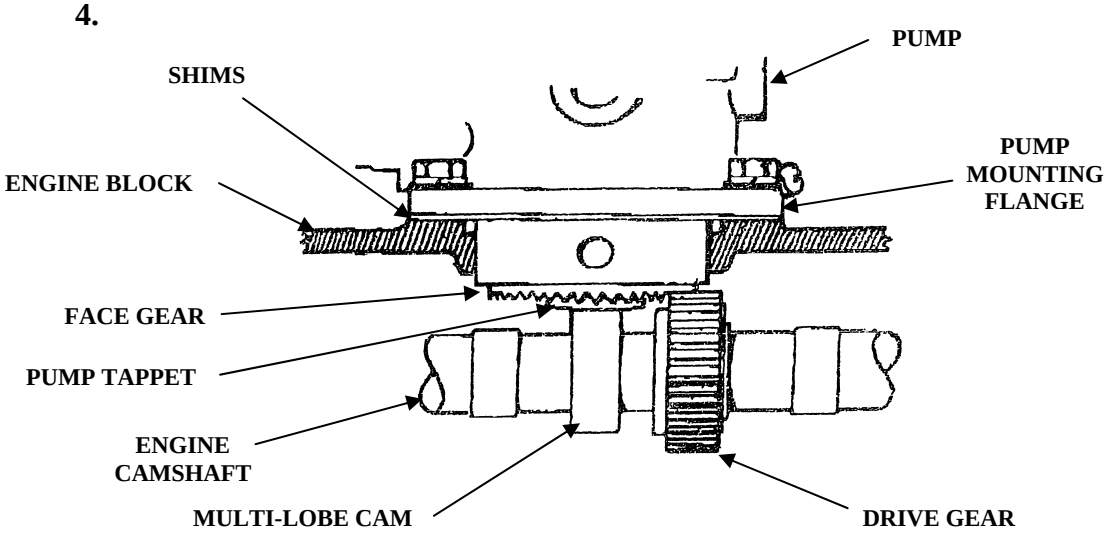

FIGURE 10. PUMP INSTALLED

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5. **If gears mesh, secure pump using a flat washer, lock washer, and nut on each stud. Torque nuts evenly to 5 to 16 ft.-lb. (20 to 22Nm).**
6. **Remove brass rod and install timing hole washer and screw.**

Method 2: Flow Timing Injection Pump

Use this procedure to time pump when dimensions from old pump are not available. Begin by installing pump which has been fitted with standard timing button (may be unmarked or marked number 11).

1. **Refer to Fig. 0210 and remove cap nut from delivery valve and delivery valve holder, then lift out delivery valve spring. Reinstall holder and cap nut. Note that early models do not have a delivery valve holder.**

2. **Rotate flywheel until PC mark on flywheel is about 15° from timing pointer in compression stroke of number 1 cylinder. Place fuel control at full speed position. Disconnect high pressure line from number 1 injector. Operate transfer pump priming lever (fuel should flow from disconnected injector line) while slowly turning flywheel clockwise. When fuel flow from line stops, this is port closing point and beginning of injection. At this point, port closing (PC) mark on flywheel should be aligned with timing pointer if timing button is correct.**

   A. **If timing pointer is ahead of port closing mark, timing is early and a thinner button is needed. If timing pointer is between PC and TDC marks, timing is late and a thicker button is must be installed.**
   B. **To select correct button size, carefully measure space between PC mark and timing pointer. Each 0.100 inch (2.54mm) on flywheel circumference is equivalent to 0.003 inch (0.076mm) button thickness. Refer to table 1.**

   Example. Standard button installed in pump for test is 0.104 inch (2.642 mm) thick. Flow of fuel stops 0.2 inch (5.08mm) after PC mark is passed indicating late timing. Referring to table 1, it will be noted that button of code 4 or D is 0.110 inch (2.794mm) thick or 0.006 inch (0.152 mm) thicker than standard button. Installing this button in place of test button should time injection pump correctly.

3. **After pump is correctly timed, reinstall delivery valve spring. Tighten delivery valve holder to torque of 65-70 ft.-lbs.. (90-95 N·m) and cap nut to 55-60ft.-lbs (75-80 N·m). Complete installation of pump as outlined.**

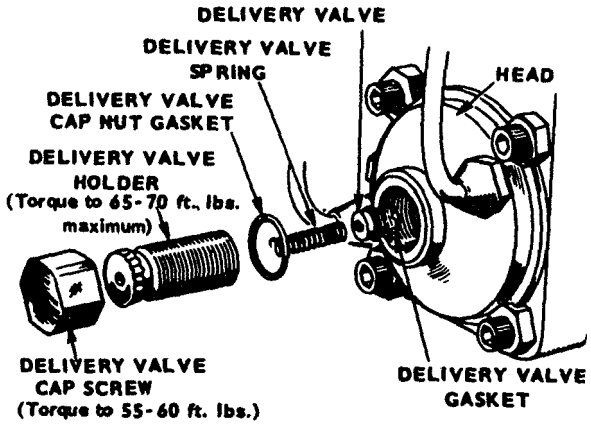

Fig. 0210—Exploded view of delivery valve assembly of PSU injection pump. Note that only delivery valve spring is removed when using Method II to time two and four cylinder engines. Refer to text for procedure.

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