



**JOHN DEERE**

## tm2138 - 3120, 3320, 3520 and 3720 Compact Utility Tractors Repair Manual - Injection Pump Timing—EPA Engines

### **CAUTION:**

*Avoid Injury! DO NOT adjust the fuel injection pump timing. For most engine problems, the fuel injection pump timing will not have to be adjusted. If the engine performed well at one time, then performance dropped, the fuel injection timing is NOT the problem.*

*Fuel injection timing, once set by the engine manufacturer, should NOT change during the life of the engine.*

### **IMPORTANT:**

**Avoid Damage!** Fuel injection pump timing should NOT change during the life of the engine unless the pump has been altered illegally, or there is excessive wear to the injection pump camshaft lobes and lifters.

First check the fuel quality, fuel supply, fuel injectors, air intake system, and engine compression in all cylinders before considering fuel injection timing problems.

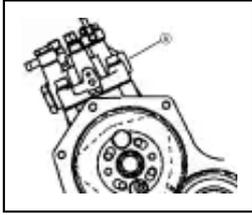
If all other possibilities have been ruled out and it is determined that the fuel injection pump and governor assembly are in need of repair, they must be replaced **ONLY** as complete assemblies.

Only an authorized factory trained technician is allowed to remove and install these assemblies.

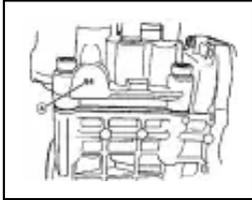
### **Equipment:**

JDG10436 – TNV Diesel Engine Timing Tool Kit

### **Checking Fuel Injection Timing:**



LVAL13903-UN: Fuel Injection Pump



LVAL13904-UN: Fuel Injection Pump

**LEGEND:**

A - Timing Index Number Stamp

1. Locate and record the fuel injection pump timing index number stamped on the boss (A) of the engine side of the fuel injection pump housing. Treat this number as though there is a decimal point between the two digits. i.e. 64 = 6.4.
2. The Fuel Injection Reference (FIR) number for the 3720 is shown below. Record the number.

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John Deere Model	Yanmar Engine Model	FIR (Fuel Injection Reference Number)
3720	3TNV84HT-BJT	4.5
3520	3TNV84T-BMJT	2.0
3320	3TNV88-BMJT	5.0

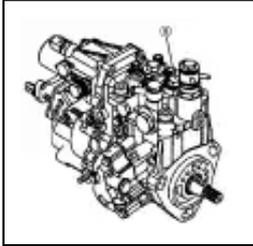
- Insert the numbers you have recorded into the following equation:

**(Fuel Injection Pump Timing Index Number X2) + FIR Number = FIT° (Fuel Injection Timing in Degrees)**

**Numbers from the 3720 will be used for the example.**

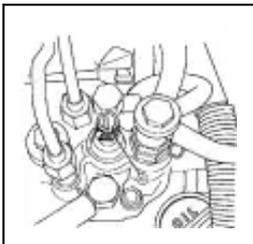
**Example: Fuel Injection Pump Timing Index Number is 64. Add decimal point, number is now 6.4 X2 = 12.8 + FIR number of 4 . 5 = 17.3° FIT° (Fuel Injection Timing in Degrees) BTDC**

3. Turn off the fuel valve and clamp the fuel return hose shut.



LVAL13905-UN: .

4. Clean the top of the injector pump to prevent dirt from entering the pump when plunger plug is removed. Remove the forward fuel injection pump plunger plug (B) on top of the fuel injection pump.

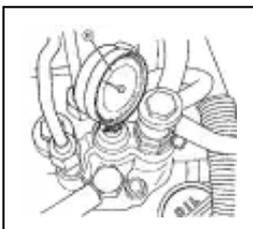


LVAL13906-UN: Plunger Plug

**LEGEND:**

B - Plunger Plug

5. Install a dial indicator adapter (C) and clamp from the JDG10436 timing tool kit into the pump plunger opening.

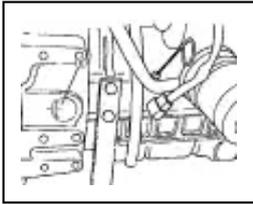


LVAL13907-UN: Dial Indicator Adapter

**LEGEND:**

## C - Dial Indicator Adapter

6. Install the dial indicator (D) with extension into the adapter. Move the indicator up and down while watching the dial. When the dial gets to the midway point of travel, tighten clamp.



LVAL13908-UN: Dial Indicator

### **LEGEND:**

D - Dial Indicator

7.

### ***NOTE:***

*The following references to rotating the crankshaft are from the coolant pump end of the engine and are adjusted by turning the crankshaft pulley.*

Using a wrench on the crankshaft pulley bolt, rotate the crankshaft in a clockwise direction while looking through the flywheel inspection port (E).



LVAL13909-UN: Shows number 1 Cylinder TDC mark



LVAL13910-UN: Shows injection timing marks in degrees BTDC on engines up to May of 2008.

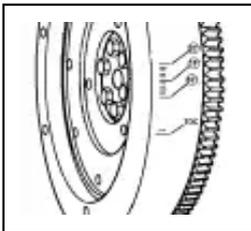
8.

**NOTE:**

*A typical flywheel will have a timing mark grid for each cylinder. Any grid can be used to check the fuel injection timing. Flywheels on machines made after May 2008 shown in MX40499 above have marks for every degree from 10 to 20. On these flywheels highlight the calculated (target) timing mark and proceed to step 10.*

*Flywheels on machines made before May 2008 do not have marks for every degree. On the pre May 2008 flywheel shown in MX40481 the pair of marks above the TDC mark are 11 and 12° BTDC and the next mark up is 14°. As calculated earlier the timing should be 17.3° BTDC. Timing specs are to  $\pm 1^\circ$  so if your calculation has a decimal point, round it up or down to the nearest degree. In this case round it down to 17°.*

*If the timing calculations on your engine do not coincide with the marks stamped in the flywheel you must determine where the calculated BTDC mark should be and mark the flywheel. This particular engine does not have a mark at 17° so you will have to determine where the 17 ° BTDC mark should be and place the mark on the flywheel. Timing marks are more easily accessed from bottom of flywheel housing. Turn the flywheel to access the marks. The 14° mark is shown below. One degree on the flywheel is 2.9 mm, so you need to add a mark (A)  $3 \times 2.9\text{mm} = 8.7 \text{ mm}$  to the right of the 14° mark to be at 17° BTDC.*



LVAL13911-UN: Shows injection timing marks in degrees BTDC on engines after May 2008

Rotate the crankshaft until the injection timing marks are visible.

9.



LVAL13912-UN: Flywheel Timing Marks

**LEGEND:**

A - Target Timing Mark

Highlight the target timing mark (A) on the flywheel.

10. Rotate the crankshaft counter clockwise until the dial indicator shows that the injection pump plunger is at the bottom of it's stroke. Turn the crankshaft back and forth slightly to confirm a point where the dial indicator shows no movement. Zero the dial indicator.
11. Slowly rotate the crankshaft clockwise until the dial indicator shows a pump plunger lift of 2.5 mm (0.098 in.).



LVAL13913-UN: Timing Inspection Hole

**LEGEND:**

B - Timing Reference Mark

C - flywheel target timing mark

12. Put a timing reference mark (B) at the center of the timing inspection hole in the flywheel housing.
13. Check the position of the flywheel target timing mark (C) in relation to the mark on the flywheel housing or engine backplate. If the two marks are aligned, the timing is correct. If the marks do not align, the fuel injection timing must be adjusted. Proceed to Step 1 under "Adjusting Fuel Injection Timing" below.
14. If the timing is correct, remove the dial indicator and adapter. Install the the plunger plug and copper gasket and tighten. Install the flywheel inspection port cover. Open fuel shutoff valve and remove clamp from fuel return line.

15. Prime the fuel system. Operate engine and check for leaks.

### Adjusting Fuel Injection Timing:

1. Leave the dial indicator on the fuel injection pump. Make sure the dial still shows 2.5 mm (0.098 in.).
2. Rotate the flywheel until the target timing mark and the timing reference mark on the flywheel housing or backplate are aligned.
3. Note the reading on the dial indicator. If the reading is less than 2.5 mm (0.098 in.) the timing is retarded. If the dial indicator reading is greater than 2.5 mm (0.098 in.) the fuel injection timing is advanced.
4. Loosen the nuts fastening the fuel injection pump to the timing gear case or front plate.

5.

**NOTE:**

*Some engine models may require the intake manifold and fuel injection pump insulator be removed to access the inner fuel injection pump retaining nuts.*

Loosen the rear bracket(s) on on the fuel injection pump.

6.

**NOTE:**

*Loosening the the high pressure injection line nuts on the fuel injection pump may make rotating the pump easier.*

Rotate the fuel injection pump until the dial indicator reads 2.5 mm (0.098 in.). To advance timing, rotate top of injector pump away from the engine. To retard timing, rotate top of injector pump toward the engine.

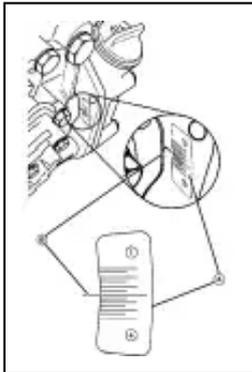
7. When the dial indicator reads 2.5 mm (0.098 in.) of pump plunger lift and the target timing mark on the flywheel is aligned with the reference mark on the flywheel housing or engine backplate, the injection timing is correct.
  8. Tighten the fuel injection pump mounting nuts and rear bracket(s).
  9. Remove the dial indicator and adapter. Replace the plug and copper gasket in the pump plunger opening and tighten. If removed, install intake manifold and pump insulator. Tighten the high pressure injection line nuts to specification. Open fuel shutoff valve and remove clamp from fuel return line. Prime the fuel system. Operate engine and check for leaks.
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Item	Measurement	Specification
Injector Line Nuts	Torque	30 - 35 N·m (22 - 25 lb ft)

### Installing a New or Recalibrated Injector Pump:

1. Locate and record the timing index number on the replacement injector pump.
2. Install O-ring on injector pump.
3. Be sure to align marks on gears made during removal. Align key on injector pump shaft with keyway in gear while sliding injection pump onto back of gear cover mounting plate. Install three mounting nuts. Do not tighten.
4. Install nut on timing gear. Hold crankshaft pulley nut with wrench and tighten injector pump timing gear nut to specification.

5.



LVAL13914-UN: Timing Grid Sticker

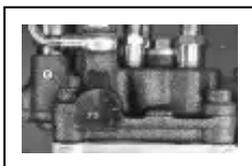
#### **LEGEND:**

A - Timing Grid Sticker

B - Center Mark

Install the timing grid sticker (A) supplied with the replacement injector pump onto the back of the timing gear case aligning the center mark on the sticker with the mark (B) made on the gear case during disassembly.

6.



LVAL13915-UN: Calibration Number

**LEGEND:**

A - Calibration Number

Calculate the difference between the calibration number (C) recorded off of the original pump and the number on the replacement pump.

- Whatever the calibration number is, treat it as if there were a decimal point between the two digits. Example: 68 would be 6.8

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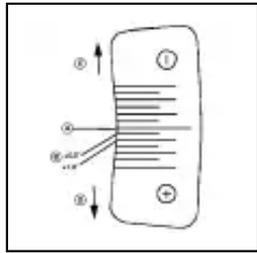
<b>Calibration Number Example A</b>	
Replacement Injection Pump =	7.3
Original Injection Pump =	6.8
Difference =	+0.5

- If the difference between the calibration numbers is a positive number, (the replacement pump number is higher than the original pump number), the injector pump mounting position must be advanced.

-: .

<b>Calibration Number Example B</b>	
Replacement Injection Pump =	7.3
Original Injection Pump =	7.8
Difference =	-0.5

- If the difference between the calibration numbers is a negative number, (the replacement pump number is lower than the original pump number), the injection pump position must be retarded.
- The rest of the the timing story will be using the calculation from example A.



LVAL15839-UN: Timing Sticker

**LEGEND:**

A - 0° Long Mark

B - 0.5° Advanced From the Center Mark

D - Advance

E - Retard

Each mark on the timing sticker represents 0.5° timing change.

- Long mark (A) in center of sticker represents 0°.
- The calibration number example A indicates that the replacement injector pump is to be installed at 0.5° advanced from the center mark (B) on the timing sticker.

7. Align the mark on the injector pump with the appropriate mark on the timing sticker and tighten injector pump retaining nuts to specification.
8. Install and tighten the injector pump rear support bracket.
9. Place a thin bead of John Deere form in place gasket on the cover, and install the cover.
10. Connect fuel shutoff solenoid wire.
11. Connect hoses to/from fuel filter.
12. Install the lower radiator hose and connect the coolant hoses to the cold start device.
13. Install the external lube line. When installing the line, put one copper washer between the mounting bolt head and lube line and the other between the lube line and housing.
14. Fill cooling system with proper coolant.

15.

**IMPORTANT:**

**Avoid Damage! When installing a new or repaired fuel**

**injection pump it is important to add engine oil to the pump for lubrication during the initial start up of engine. Add 150-200 cc (5-7 oz) of new engine oil to the fuel injection pump before operating engine. Injector pump can be damaged if operated without the proper amount of oil.**

Install fuel injection lines and tighten to specification.



LVAL13917-UN: Fill Plug

**LEGEND:**

C - Fill Plug

Remove the fill plug (C) and add 150-200 cc (5-7 oz) of new engine oil to the governor housing. Reinstall fill plug.

<b>Item</b>	<b>Measurement</b>	<b>Specification</b>
Injector Line Nuts	Torque	30 - 35 N·m (22 - 25 lb-ft)
Injector Pump Mounting Nuts	Torque	23 - 28 N·m (17-21 lb-ft)
Timing Gear Nut	Torque	78 - 88 N·m (58 - 65 lb-ft)

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