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# Fuel Injection Pump, Rotary (005-014)

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## Summary

Stepblock	Stepblock	Prepare engine for removal of rotary fuel injection pump.		
Stepblock	Front Gear Train: Remove access cap, gear retaining nut and washer.			
Stepblock	Disengage pin after locating top dead center.			
Stepblock	Locate top dead center for cylinder Number 1.			
Stepblock	Loosen CAV fuel injection pump lock screw and position washer.			
Stepblock	Tighten lock screw against drive shaft.	Torque: 7 N•m [62 in-lb]		
Stepblock	Loosen injection pump lock screw and position washer.			
Stepblock	Tighten lock screw until contact made with shaft.	Torque: 12 N•m [106 in-lb]		

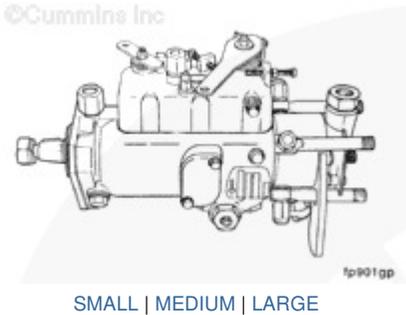
Stepblock	Tighten screw against shaft.	Torque: 30 N•m [22 ft-lb]	
Stepblock	Pull drive gear loose from drive shaft.		
Stepblock	Remove mounting nuts and pump.		
Stepblock	Remove gasket and clean surface.		
Stepblock	Rear Gear Train: Permanently mark pump flange to match mark on fuel pump mounting plate.		
Stepblock	<b>DO NOT</b> remove timing pin until repair completion.		
Stepblock	Special washer on Bosch® VE pump <b>must</b> be removed and lock screw tightened.	Torque: 40 N•m [29 ft-lb]	
Stepblock	Remove fuel pump mounting plate nuts and bolts.		
Stepblock	Remove pump, mounting plate and gear pump as assembly.	Gear <b>must not</b> rotate during removal.	
Stepblock	Remove gasket and clean surface.		
Stepblock	Mark a tooth on fuel gear pump relative to fuel pump mounting plate.		
Stepblock	Remove retaining nut and washer. Remove gear.		
Stepblock	Loosen fuel pump to mounting plate nuts. Remove pump.		
Stepblock	Remove gasket material and clean surface.		
Stepblock	Front Gear Train: Verify cylinder Number 1 at top dead center.		
Stepblock	Install new gasket.		
Stepblock	Stepblock	Install pump. Tighten mounting nuts.	Finger tight. Pump <b>must</b> be free to move in slots.
Stepblock	Install pump drive shaft nut and spring washer.	Torque: 15 to 20 N•m [133 to 177 in-lb]	
Stepblock	If installing original pump, rotate to align with scribe marks.	Torque: 24 N•m [18 ft-lb]	
Stepblock	If no scribe marks, rotate pump against direction of drive rotation. Tighten nuts.	Torque: 24 N•m [18 ft-lb]	
Stepblock	Mark injection pump flange.	Mark on housing.	
Stepblock	Loosen CAV pump lock screw and position washer.	Torque: 20 N•m [177 in-lb]	

Stepblock	Stanadyne DB4 Pump: Loosen pump lock screw and position washer. Tighten lock screw.		
Stepblock	Loosen Bosch® pump lock timing screw and install special washer. Tighten lock timing screw.	Torque: 13 N•m [115 in-lb]	
Stepblock	Disengage timing pin before rotating crankshaft.		
Stepblock	Tighten pump retaining nut.	See detail.	
Stepblock	Install access cap.		
Stepblock	Disengage timing pin.		
Stepblock	Tighten pump retaining nut.	See detail.	
Stepblock	Install access cap.		
Stepblock	Rear Gear Train: Verify cylinder number 1 is at top dead center.		
Stepblock	Install new pump gasket on mounting plate.		
Stepblock	Install pump to mounting plate.	Torque: 18 N•m [159 in-lb]	
Stepblock	If installing original pump, rotate pump to align scribe marks.		
Stepblock	Install pump gear on pump shaft, align mark on gear with mark on mounting plate.		
Stepblock	Install drive shaft nut and spring washer. Tighten retaining nut.	Torque: 98 N•m [72 ft-lb]	
Stepblock	Install new pump cover plate gasket, pump, mounting plate and gear to rear gear housing. Install cover plate gasket.	Torque: M8 = 18 N•m [159 in-lb]; M10 = 30 N•m [22 ft-lb]	
Stepblock	On Bosch® fuel pumps, install special washer, that is wired to pump, under lockscrew.		
Stepblock	Disengage timing pin.		
Stepblock	Tier 2/Stage II Timing Adjustment		
Stepblock	Disengage timing pin. Remove special washer on Bosch® VE pumps and tighten lockscrew against drive shaft.	See detail.	
Stepblock	Remove access cap, retaining nut and washer.		
Stepblock	Remove fuel pump gear.	See detail.	

Stepblock	Thoroughly clean and dry drive shaft taper and drive gear bore.	Use residue-free cleaner and compressed air.	
Stepblock	Ensure engine is locked and can <b>not</b> rotate.		
Stepblock	Install pump gear onto shaft, with washer and retaining nut. Remove top dead center timing pin from camshaft and timing pin on damper, if used.		
Stepblock	Tighten gear pump retaining nut.	See detail.	
Stepblock	Stepblock	Loosen Bosch® pump lock timing screw and install special washer. Tighten lock timing screw.	Torque: 13 N•m [115 in-lb]
Stepblock	Install access cap and check barring tool is removed.		
Stepblock	Recheck timing. If timing within tolerance, remove gauge and replace plug.	Torque: 10 N•m [89 in-lb]	
Stepblock	Tighten pump retaining nut.	See detail.	
Stepblock	Install access cap.		
Stepblock	Install remaining components.	See detail.	
Stepblock	Connect batteries, operate engine and check for leaks.		

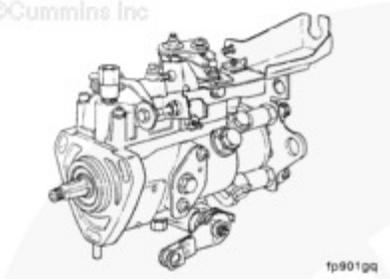
## General Information

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<p>Fuel System Identification</p> <p>The B Series engine uses many different fuel injection pumps, depending on the horsepower rating and application.</p> <p>The Lucas CAV DPA distributor-type fuel injection pump can be found on the following engine applications:</p> <ul style="list-style-type: none"> <li>• Marine</li> <li>• Industrial.</li> </ul>		 <p>Next</p>
<p>The Lucas CAV DPS distributor-type fuel injection pump can be found on the following engine application:</p> <ul style="list-style-type: none"> <li>• European and U.K. automotive ratings.</li> </ul>		

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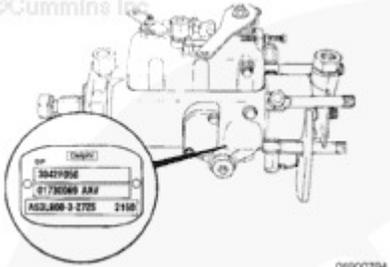
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<p>The Delphi DP210 distributor-type fuel injection pump can be found on the following applications:</p> <ul style="list-style-type: none"> <li>• Industrial (Tier 2/Stage II Certified).</li> </ul>	
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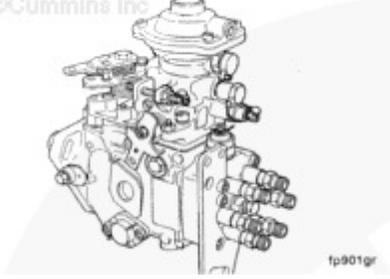
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<p>The Bosch® VE distributor-type fuel injection pump can be found on the following engine applications:</p> <ul style="list-style-type: none"> <li>• Industrial</li> <li>• 1991 low-horsepower automotive ratings.</li> </ul>	
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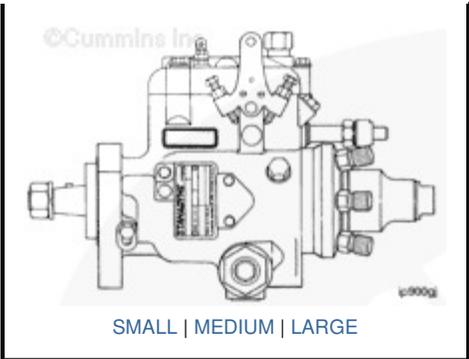
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<p>The Stanadyne DB4 distributor-type fuel injection pump can be found on the following engine application:</p> <ul style="list-style-type: none"> <li>• Gen Sets</li> </ul>	
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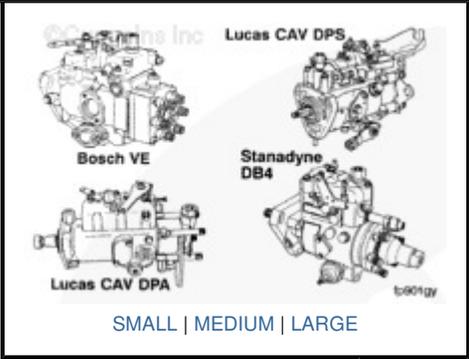
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**Fuel Injection Pump (Distributor Type)**

The fuel injection pumps, Bosch® VE, Lucas CAV DPA, Stanadyne DB4, Lucas CAV DPS, and Delphi DP210, are rotary distributor pumps. These pumps perform the four basic functions of:

1. Producing the high fuel pressure required for injection
2. Metering the exact amount of fuel for each injection cycle
3. Distributing the high-pressure, metered fuel to each cylinder at the precise time
4. Varying the timing relative to engine speed.



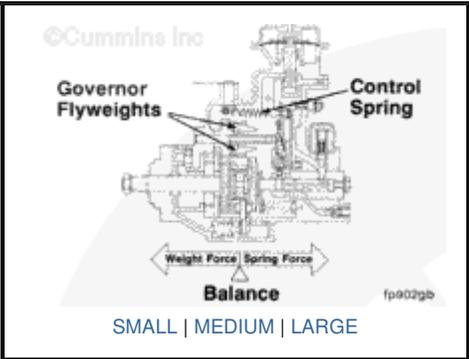
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**Distributor-Type Pump Governor**

Balance between the governor flyweights and control lever position controls the metering of the amount of fuel to be injected.

The fuel injection pump governor performance and setting can affect engine power. Special equipment and qualified personnel are required to verify governor performance. If the seals are broken on the external Bosch® VE adjustment screw, the fuel rate can, perhaps, be out of adjustment.



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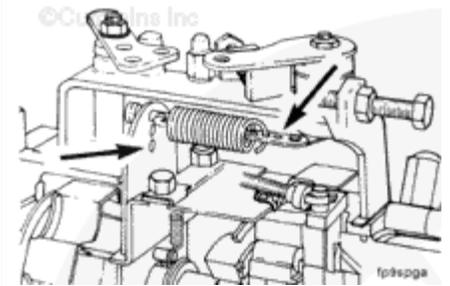
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The Lucas CAV DPA/DPS fuel injection pump uses a coded spring connection to change the governor setting. Incorrect connection of the governor spring can affect performance.

Adjustments and rating changes are described in the Master Repair Manual, Injector Pumps and Injectors,



Bulletin 3666037.



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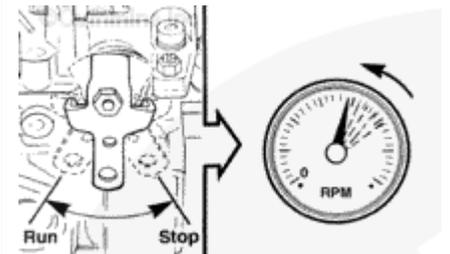
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### Manual Shutdown Levers

Both fuel injection pumps are equipped with mechanical shutdown levers. These levers are spring-loaded in the run position. **Not** all applications will use these manual shutdown controls and there will be no cable or rod connected to the lever.

**NOTE: Partial actuation of the mechanical shutdown levers will affect fuel flow and engine power.**



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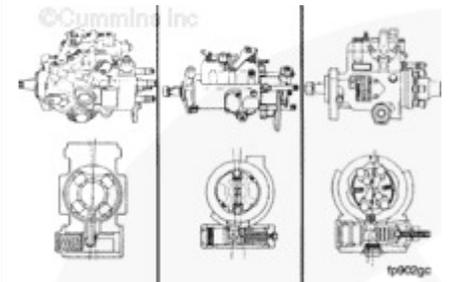
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### Advance Timing Mechanism

Regulated pressure produced by a vane supply pump in both fuel injection pumps is used to advance the timing as the engine speed increases. A return spring is used to retard the timing as the engine speed is reduced. If a spring breaks, the timing will go to the advance position, resulting in torque loss, fuel knock, and possible engine overheating.

Retarded (late) timing will result in torque loss, high fuel consumption, and white to black smoke.

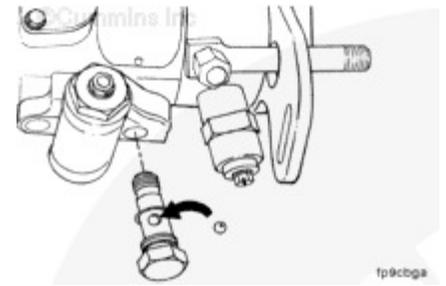


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The Lucas CAV DPA/DPS advance timing mechanism uses a check ball in the circuit which, if omitted during assembly, will result in no timing advance. If the fuel injection pump has been replaced or the mechanism has been removed to fix a leak, the problem can be that the check ball is missing.



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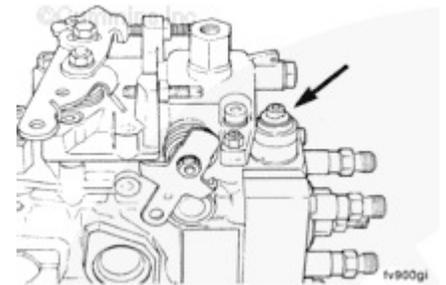
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### Electrical Shutoff Valves

The fuel injection pumps are equipped with electrical shutoff valves. These solenoid-operated valves block the supply of fuel to the high-pressure pumping and distribution components.

The Bosch® VE shutoff valve is located at the top rear of the pump.



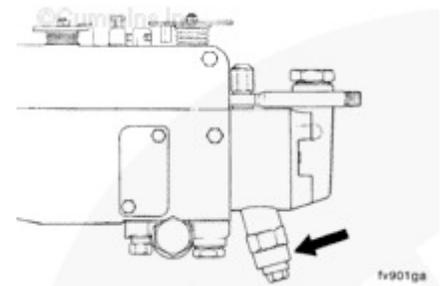
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The Lucas CAV DPA/DPS shutoff valve is located at the bottom rear of the pump.

Both 12- and 24-VDC activate-to-run and activate-to-stop solenoids are available.



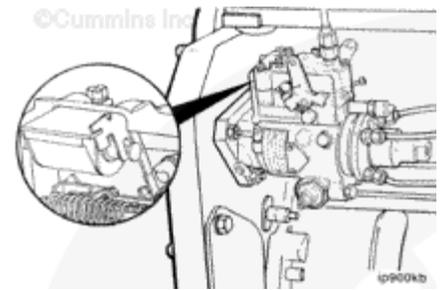
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The Stanadyne DB4 shutdown solenoid is located under the governor cover.

Both 12-VDC and 24-VDC activate-to-run and activate-to-stop solenoids are available.



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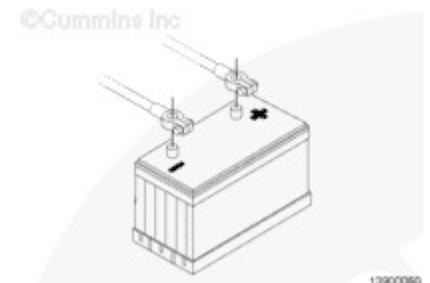
## Preparatory Steps

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### **⚠ WARNING ⚠**

Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

- Disconnect the batteries.



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### **⚠ CAUTION ⚠**

Do not remove the control lever. The fuel control lever on the Bosch® VE fuel injection pump is indexed to the shaft during pump calibration. If the lever has been removed and reinstalled incorrectly, engine speed and power will be affected.

Rotary Distributor Type Fuel Injection Pumps

Bosch® VE, Lucas CAV DPA, Stanadyne DB4, and Delphi DP210



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- Disconnect the fuel drain manifold. Refer to Procedure [006-021](#).
- Remove the injection pump supply line. Refer to Procedure [006-024](#).
- Remove the high-pressure lines. Refer to Procedure [006-051](#).
- Disconnect the electrical wire to the fuel shutoff valve. Refer to Procedure [005-043](#).
- Remove the fuel air control tube, if used. Refer to Procedure [006-001](#).
  
- Disconnect all control linkage. Refer to the OEM service manual
- Remove the pump support bracket. Refer to Procedure [005-033](#).

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Summary 1

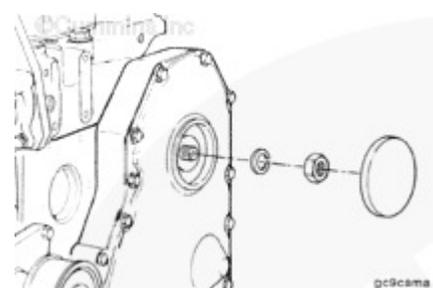
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## Remove

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### Front Gear Train

Remove the access cap, gear retaining nut, and washer.



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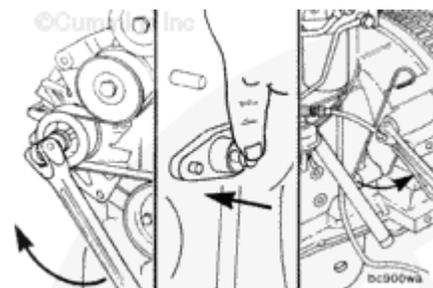
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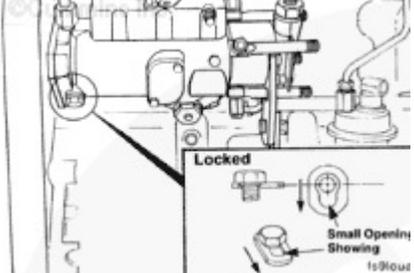
**NOTE:** Be sure to disengage the pin after locating top dead center.

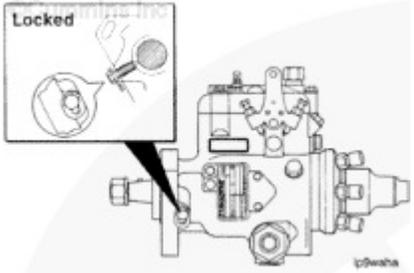
Locate top dead center for cylinder Number 1 by barring the engine slowly, while pushing in on the top dead center pin.



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			<a href="#">Summary 4</a>

<p>Lucas CAV DPA Pump and Delphi DP210</p> <p>Loosen the CAV fuel injection pump lock screw and position the special washer; then tighten the lock screw against the pump drive shaft.</p> <p>Torque Value:      7 n.m      [62 in-lb ]</p>		 <p>SMALL   MEDIUM   LARGE</p>	<a href="#">Previous</a>
			<a href="#">Summary 5</a>
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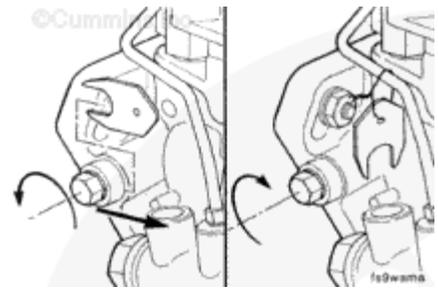
<p>Stanadyne DB4 Pump</p> <p>Loosen the Stanadyne DB4 fuel injection pump lock screw and position the special washer. Tighten the lock screw until contact is made with the fuel injection pump drive shaft.</p> <p>Torque Value:      12 n.m      [106 in-lb ]</p>		 <p>SMALL   MEDIUM   LARGE</p>	<a href="#">Previous</a>
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<p>Bosch® VE</p> <p>The special washer on the Bosch® VE injection pump <b>must</b> be removed so the lock screw can be tightened against the</p>			
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drive shaft.

Torque Value: 30 n.m [22 ft-lb]

**NOTE: Wire the washer to the pump.**



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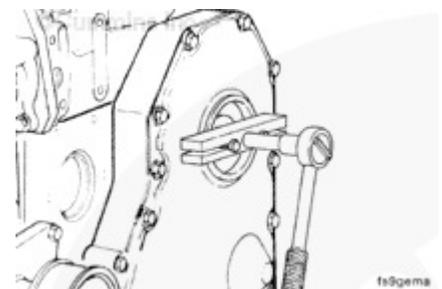
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Summary 9

Pull the fuel injection pump drive gear loose from the pump drive shaft.

Use fuel pump gear puller, Part Number 3163381 or Part Number 3824469, with M8-1.25 x 50 capscrews, Grade 8.8 or equivalent.



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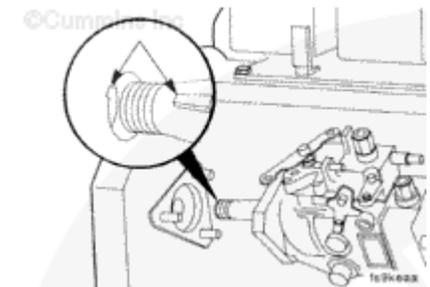
Summary 10

**CAUTION**

Do not drop drive gear key when removing the pump. Failure to do so can result in severe engine damage.

Remove the three mounting nuts and take off the fuel injection pump.

**NOTE: Fuel pumps on engines designed to meet Tier 2/Stage II Industrial emissions levels have straight holes ( not kidney slots) and do not use a timing key.**



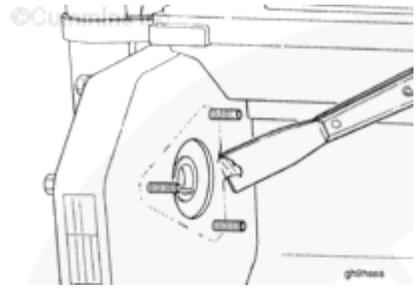
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Summary 11

Remove the gasket and clean the surface.



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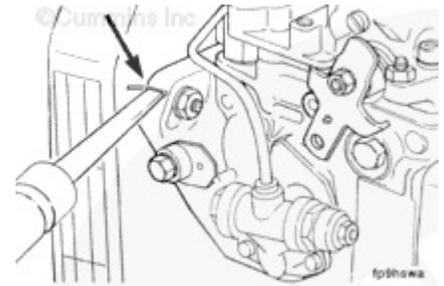
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### Rear Gear Train

Permanently mark the injection pump flange to match the mark on the fuel pump mounting plate.



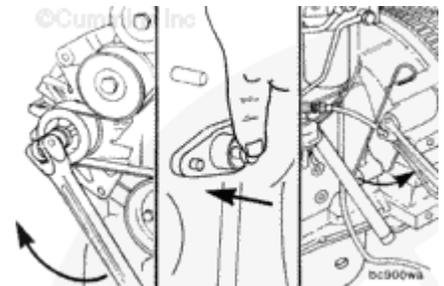
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Summary 13

Unlike the front gear train engine, do **NOT** remove the timing pin until completion of the repair. Failure to do so can result in difficult reassembly and incorrect timing of the fuel pump.



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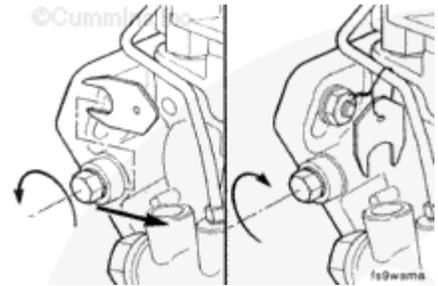
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Summary 14

**CAUTION**

Failure to properly torque the lock screw will result in improper timing of the pump during reassembly.



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Bosch® VE

The special washer on the Bosch® VE injection pump **must** be removed so the lock screw can be tightened against the drive shaft.

Torque Value:	40 n.m	[22 ft-lb]
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**NOTE:** Wire the washer to the pump.

**NOTE:** The torque specification for the rear gear train engine is higher than the front gear train engine, to prevent rotation of the pump shaft during installation of the fuel pump gear retaining nut.

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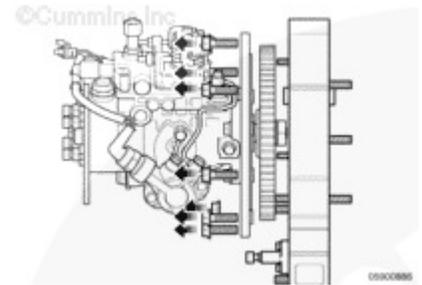
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Remove the mounting nuts and bolts affixing the fuel pump mounting plate to the rear gear housing.

Take off the fuel injection pump, fuel pump mounting plate, and fuel pump gear as an assembly.

**NOTE:** Make sure the gear does not rotate during removal; failure to do so can result in incorrect timing of the pump during installation.



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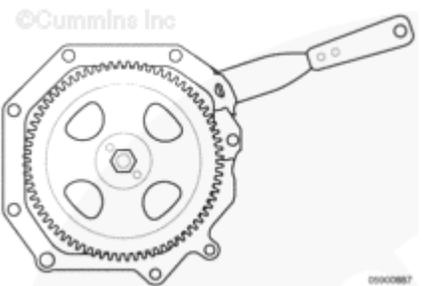
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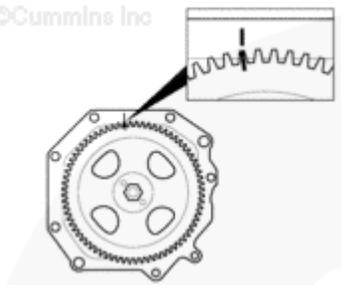
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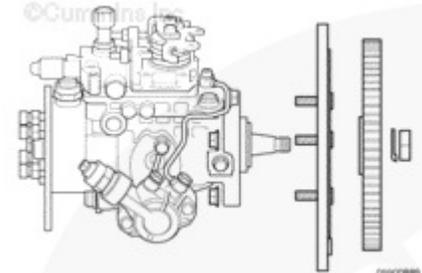
Remove the gasket and clean the surface.



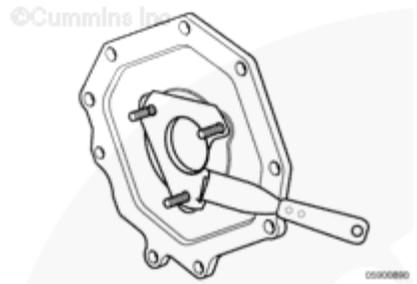
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<p>Mark a tooth on the fuel gear pump relative to the fuel pump mounting plate.</p>		<p>©Cummins Inc</p>  <p>SMALL   MEDIUM   LARGE</p> <p>Previous</p> <p>Next</p> <p>Summary 19</p>
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<p>Remove the fuel pump retaining nut and washer.</p> <p>Remove the fuel pump gear.</p> <p>Loosen the three mounting nuts attaching the fuel pump to the fuel pump mounting plate.</p> <p>Remove the fuel pump from the fuel pump mounting plate.</p>		<p>©Cummins Inc</p>  <p>SMALL   MEDIUM   LARGE</p> <p>Previous</p> <p>Next</p> <p>Summary 20</p> <p>Summary 21</p>
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<p>Remove the gasket material and clean the surface.</p>	 	
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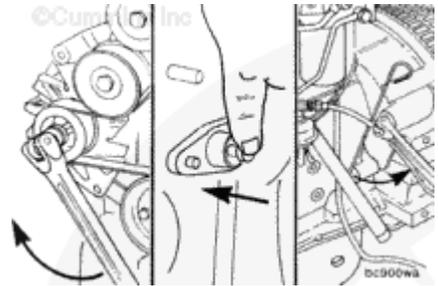
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## Install

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### Front Gear Train

Verify cylinder Number 1 is at top dead center by barring the engine slowly while pushing in on the top dead center pin.



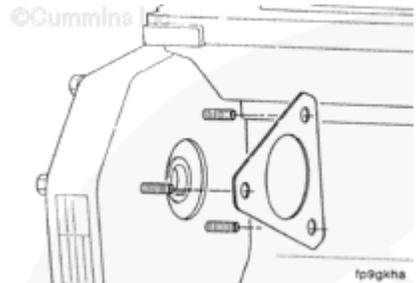
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Install a new gasket.



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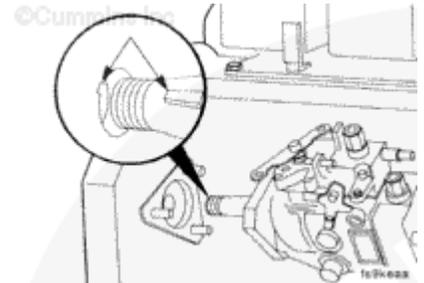
**CAUTION**

The drive shaft must be clean and free of all oil before installation. Failure to make certain the drive shaft is free of oil can result in the drive gear slipping on the shaft.

**NOTE:** The shaft of a new or reconditioned pump is locked so the key aligns with the drive gear keyway when cylinder Number 1 is at top dead center on the compression stroke.

Install the pump. Make sure the key does **not** fall into the gear housing.

**NOTE:** Fuel pumps on engines designed to meet Tier 2/Stage II Industrial emission levels do not use a timing key.



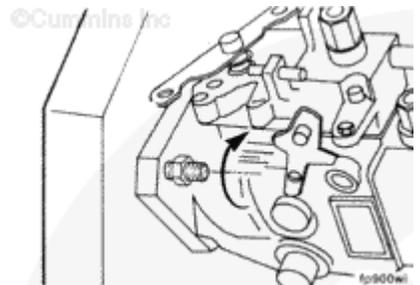
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Hand tighten the three mounting nuts. The pump **must** be free to move in the slots.

**NOTE:** Fuel pumps on engines designed to meet Tier 2/Stage II Industrial emissions levels have straight holes ( not kidney slots) and do not use a timing key.



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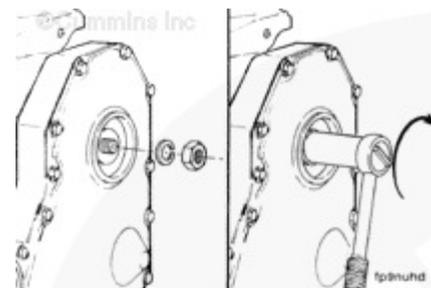
**CAUTION**



Be sure the timing pin is disengaged before the final torque step to avoid damage to the timing pin.

Install the pump drive shaft nut and spring washer. The pump will rotate slightly because of gear helix and clearance. This is acceptable, provided the pump is free to move on the flange slots and the crankshaft does **not** move.

Torque Value: 15 to 20 n.m [132 to 177 in-lb ]



SMALL | MEDIUM | LARGE

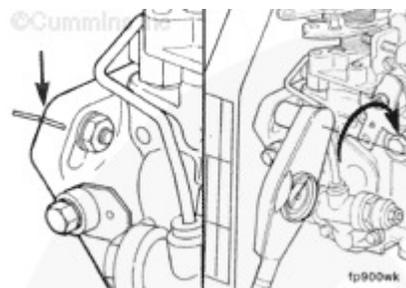
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Summary 26

If installing the original pump, rotate the pump to align the scribe marks.

Torque Value: 24 n.m [18 ft-lb ]



SMALL | MEDIUM | LARGE

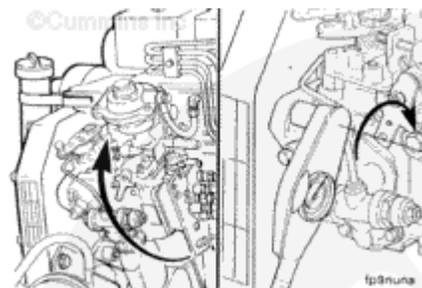
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Summary 27

If installing a new or rebuilt pump without scribe marks, take up gear lash by rotating the pump against the direction of drive rotation. Tighten the flange mounting nuts.

Torque Value: 24 n.m [18 ft-lb ]



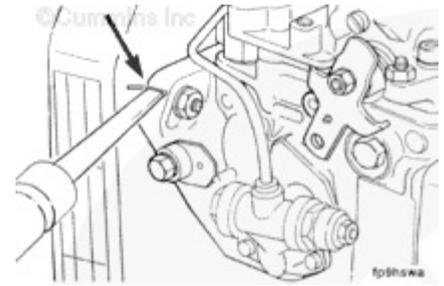
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Summary 28

Permanently mark the injection pump flange to match the mark on the gear housing.



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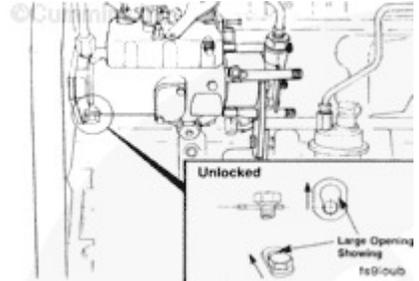
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Summary 29

### Lucas CAV DPA Pump and Delphi DP210

For CAV fuel injection pumps, loosen the lockscrew and position the special washer behind the lockscrew head.

Torque Value: 20 n.m [177 in-lb]



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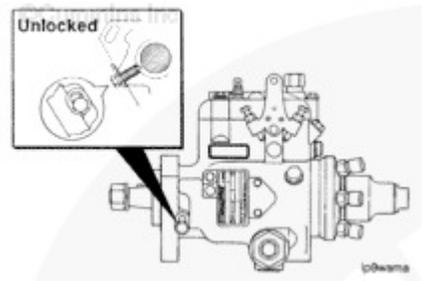
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Summary 30

### Stanadyne DB4 Pump

For Stanadyne DB4 fuel injection pumps, loosen the lock screw and position the special washer behind the lock screw head.

Tighten the lock screw.



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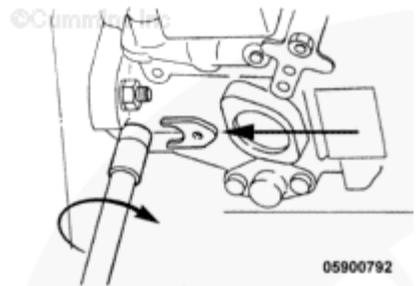
Summary 31

Bosch® VE

Loosen the Bosch® fuel pump lock timing screw and install the special washer that is wired to the fuel pump.

Tighten the Bosch® fuel pump lock timing screw.

Torque	13	[115 in-
Value:	n.m	lb ]



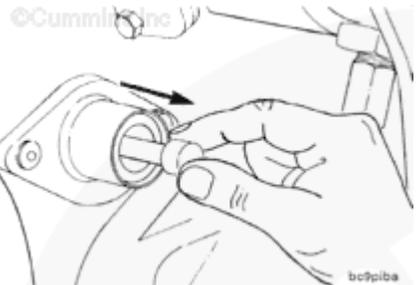
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Summary 32

Disengage the timing pin before rotating the crankshaft.



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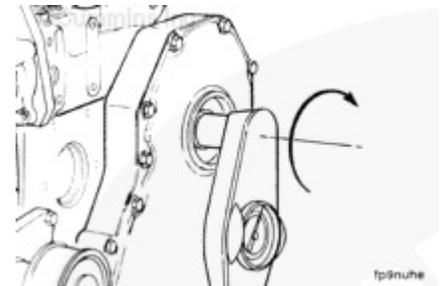
Summary 33

Summary 36

Tighten the pump retaining nut.



Bosch® VE (M14-1.5 nut)	98	n.m	[72 ft-lb ]
Bosch® VE (M12 nut)	65	n.m	[48 ft-lb ]
Lucas CAV/DPA	81	n.m	[60 ft-lb ]
Stanadyne	65	n.m	[48 ft-lb ]
Delphi DP21	93	n.m	[68 ft-lb ]

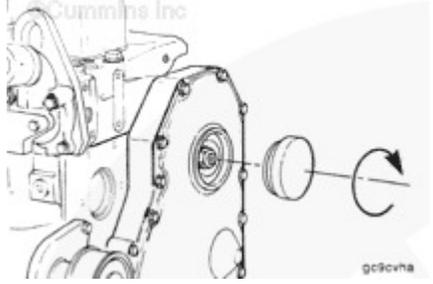


SMALL | MEDIUM | LARGE

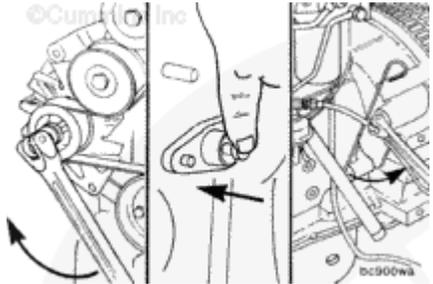
Previous

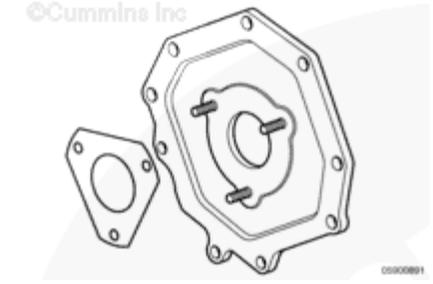
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Summary 37

<p>Install the access cap.</p>		 <p>SMALL   MEDIUM   LARGE</p>	
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		<p>Next</p>	<p>Summary 38</p>

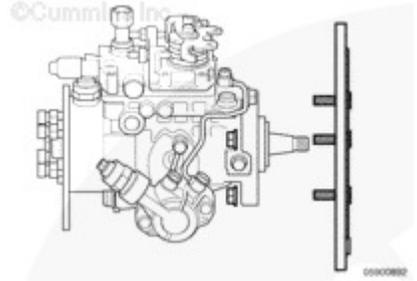
**Rear Gear Train**

<p>Verify cylinder number 1 is at top dead center by barring the engine slowly while pushing in on the top dead center pin.</p>		 <p>SMALL   MEDIUM   LARGE</p>	
		<p>Previous</p>	
		<p>Next</p>	<p>Summary 39</p>

<p>Install a new fuel pump gasket on the fuel pump mounting plate.</p>		 <p>SMALL   MEDIUM   LARGE</p>	
		<p>Previous</p>	
		<p>Next</p>	<p>Summary 40</p>

Install the fuel pump to the fuel pump mounting plate.

Torque Value:	18 n.m	[159 in-lb ]
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SMALL | MEDIUM | LARGE

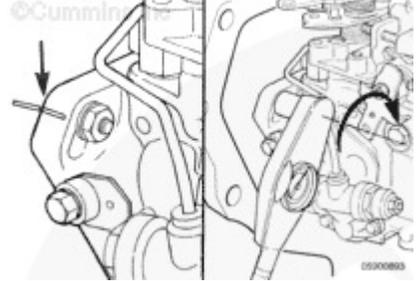
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Summary 41

If installing the original fuel pump, rotate the pump to align the scribe marks on the fuel pump mounting plate.

Torque Value:	18 n.m	[159 in-lb ]
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CAUTION

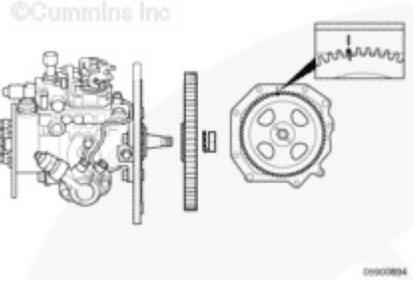
The drive shaft must be clean and free from oil before installation. Failure to make certain the drive shaft is free of oil can result in the drive gear slipping on the shaft.

Install the fuel pump gear on the fuel pump shaft.

Align the mark on the fuel pump gear with the mark on the fuel pump mounting plate.

Install the fuel pump drive shaft nut and spring washer.

Tighten the pump retaining nut.



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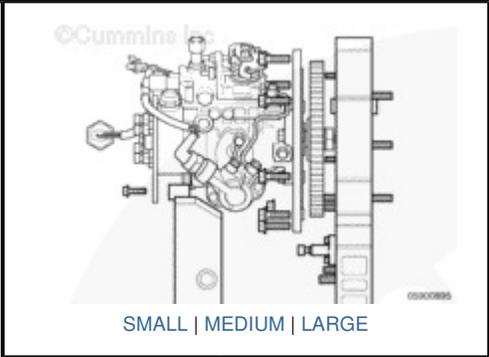
Summary 43

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Torque Value:	98 n.m	[72 ft-lb ]		
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With a new fuel pump cover plate gasket, install the fuel pump, fuel pump mounting plate, and fuel pump gear assembly onto the rear gear housing.

M8	18 n.m	[159 in-lb ]
M10	30 n.m	[266 in-lb ]

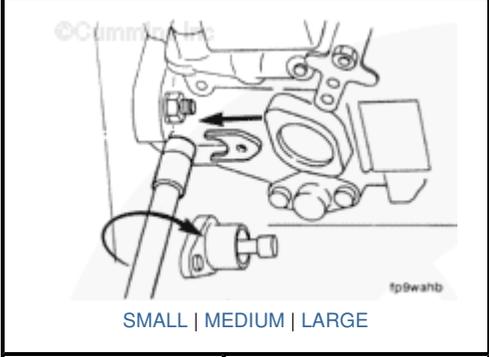


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Loosen the Bosch® fuel pump lock timing screw and install the special washer that is wired to the pump.

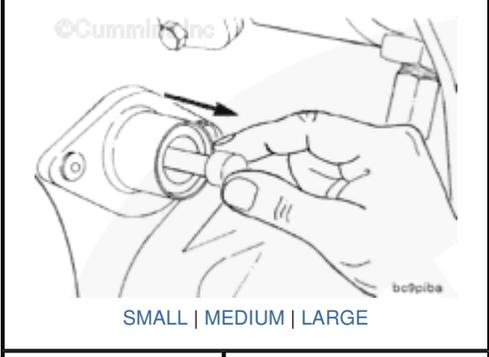
Tighten the Bosch® fuel pump lock timing screw.

Torque Value:	13 n.m	[115 in-lb ]
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Next	Summary 46

Disengage the timing pin before rotating the crankshaft.



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**Time**

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**Tier 2/Stage II Timing Adjustment**

If the pump timing is out by more than the specified tolerance as determined in Procedure [005-037](#) it is possible on Tier 2/Stage II engines, which no longer use the keyway in the fuel pump shaft, that the fuel pump gear has slipped on the fuel pump shaft. The fuel pump gear to pump shaft taper will need to be broken so the pump timing can be reset.

**NOTE: This procedure applies to front gear train Tier 2/Stage II engines only. Refer to Procedure directions in [005-037](#), when adjusting the fuel pump timing of engines equipped with kidney slots.**

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The top dead center timing pin **must** be disengaged. Bar the engine in the **clockwise** direction, when viewed from the front of the engine, until the dial indicator reading reflects the plunger travel specified on the engine dataplate. This point will be beyond top dead center. Lock the pump drive shaft at this position. Refer to Procedure [100-001](#) Engine Identification in Section E, for the engine dataplate location.

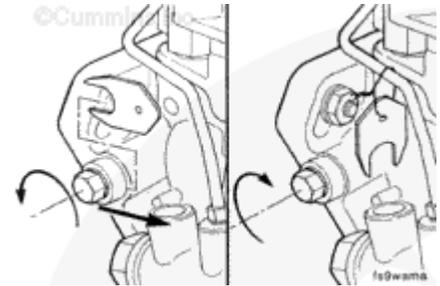
**NOTE: If barring the engine past the specified timing plunger travel value, turn the engine in an counterclockwise direction, when viewed from the front of the engine, past top dead center at least one quarter turn, then bring the engine back toward top dead center in a clockwise direction when viewed from the front of the engine, until the desired timing value is achieved.**

The special washer on the Bosch® VE injection pump **must** be removed so the lock screw can be tightened against the drive shaft.

Torque Value: 30 n.m [22 ft-lb]



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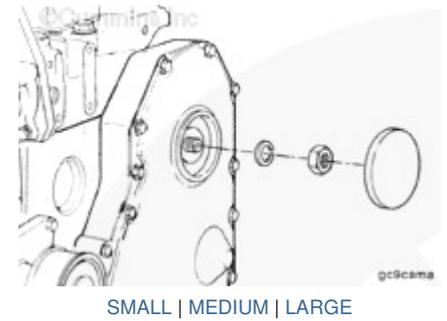
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Summary 49

**NOTE: Wire the washer to the fuel pump.**

Remove the access cap.  
Remove the fuel pump gear retaining nut and washer.



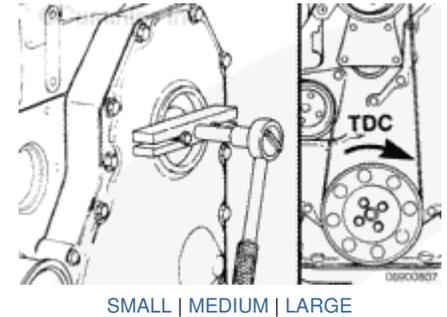
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To remove the fuel pump gear, use gear puller, Part Number ST647 or 3163381, to separate the fuel pump gear from the shaft.

With the gear loose from the fuel pump drive shaft, bar the engine in the opposite direction of rotation, when viewed from the front of the engine, past top dead center at least one quarter turn. Then bar engine in the direction of rotation to top dead center until the timing pin engages the camshaft.



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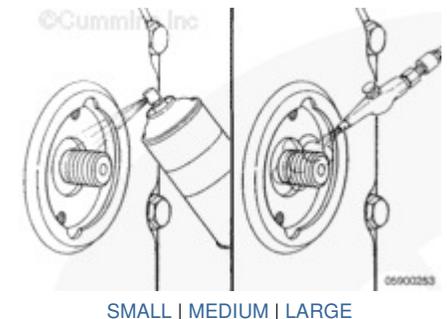
Summary 51

**⚠ WARNING ⚠**

When using solvents, acids, or alkaline materials for cleaning, follow the manufacturer's recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury.

**⚠ WARNING ⚠**

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause



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**personal injury.**

Clean the fuel injection pump drive shaft taper and drive gear bore with a residue-free cleaner. Dry both surfaces with compressed air.

Failure to clean and dry the shaft thoroughly can result in further timing slip after the engine is run.

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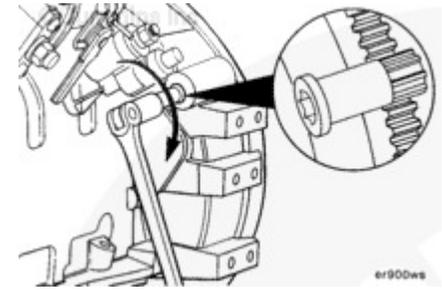
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**CAUTION**

Prior to torquing the fuel pump gear nut, make sure the engine is locked and can not rotate during final torquing of the fuel pump nut.

This can be achieved by using the engine barring tool to prevent the engine from rotating. Make sure the fuel pump is locked at this stage.



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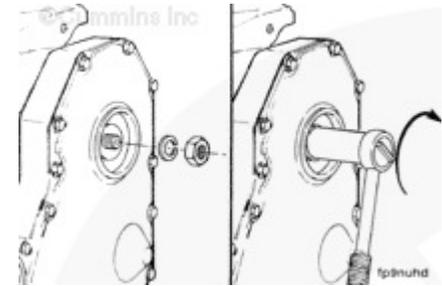
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Summary 53

Push the fuel pump gear onto the shaft and assemble the washer and nut.

Remove the top dead center timing pin from the camshaft and the timing pin on the damper, if used.

Tighten the fuel pump retaining nut.



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Bosch® VE (M14-1.5 nut)	98	n.m	[72 ft-lb ]
Bosch® VE (M12 nut)	65	n.m	[48 ft-lb ]
Lucas CAV/DPA	81	n.m	[60 ft-lb ]
Stanadyne	65	n.m	[48 ft-lb ]
Delphi DP21	93	n.m	[68 ft-lb ]

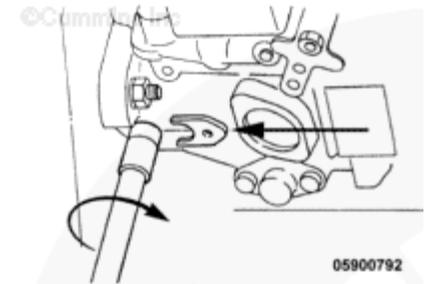
Bosch® VE

Loosen the Bosch® fuel pump lock timing screw and install the special washer that is wired to the fuel pump.



Tighten the Bosch® fuel pump lock timing screw.

Torque Value: 13 n.m [115 in-lb]



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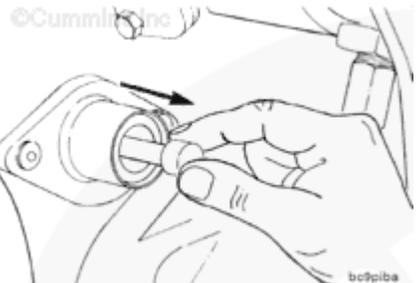
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**CAUTION**

To reduce the possibility of engine or timing pin damage, you must disengage the timing pin before attempting to bar or crank the engine.

Disengage the timing pin before rotating the crankshaft.



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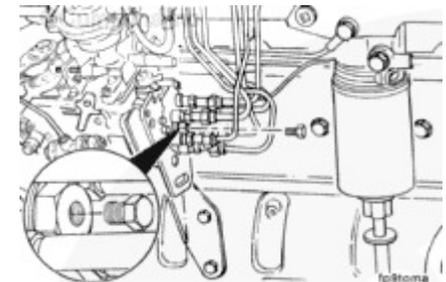
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Summary 56

Install the access cap and check to make sure the engine barring tool is removed, then recheck the timing as described in the previous steps.

If the timing is within tolerance, remove the timing gauge from the fuel pump and replace the plug.

Torque Value: 10 n.m [89 in-lb]



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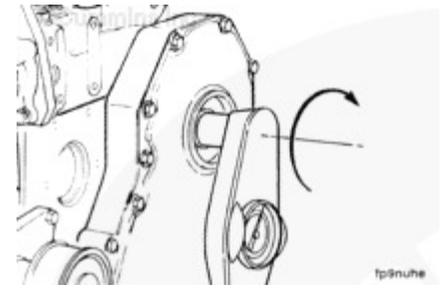
Summary 58

Tighten the gear pump retaining nut.

Bosch® VE (M14-1.5 nut) 98 n.m [72 ft-lb]



Bosch® VE (M12 nut)	65 n.m	[48 ft-lb ]
Lucas CAV/DPA	81 n.m	[60 ft-lb ]
Stanadyne	65 n.m	[48 ft-lb ]
Delphi DP21	93 n.m	[68 ft-lb ]



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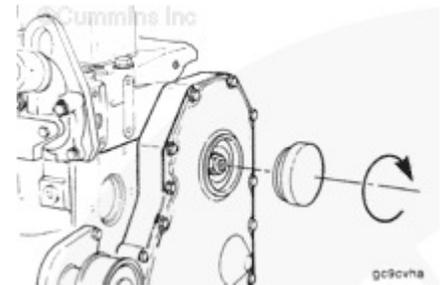
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Install the access cap.



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## Finishing Steps

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### Rotary Distributor Type Fuel Injection Pumps

Bosch® VE, Lucas CAV DPA, Stanadyne DB4, and Delphi DP210

- Install the injection pump support bracket. Refer to Procedure [005-033](#)



- Install all high-pressure fuel lines. Refer to Procedure [006-051](#)
- Install the injection pump supply line. Refer to Procedure [006-024](#)
- Connect the fuel drain manifold. Refer to Procedure [006-021](#)
- Connect the electrical wire to the fuel shutoff valve. Refer to Procedure [005-043](#)
- If required, install the air-to-fuel control valve. Refer to Procedure [006-001](#)
- Disconnect all control linkage. Refer to OEM service manual.

**NOTE: When connecting the cable and rod to the control lever, adjust the length so the lever has stop-to-stop movement. Adjust the length of the cable or rod to the mechanical shutdown lever so there is stop-to-stop movement.**

Replacing the fuel supply lines, fuel filters, fuel injection pump, high-pressure fuel lines, and injectors will let air enter the fuel system. Follow the specified procedure to bleed the air from the system.

- Refer to Procedure [006-015](#), Fuel Filter, Spin-On, for proper venting of the low pressure side of the fuel system
- Refer to Procedure [006-051](#), Injector Supply Lines (High Pressure), for venting of the high-pressure side of the fuel system.

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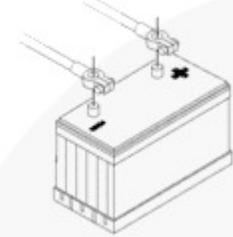
**WARNING**

Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

- Connect the batteries
- Operate the engine and check for leaks.



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