Fuel Injection Pumps, In-Line (005-012)

Table of Contents

Summary

Stepblock	Disconnect batteries		
Stepblock	Clean any debris from fuel injection pump.		
Stepblock	Remove fuel supply lines (Procedure 006-024, and injector supply lines to pump (Procedure 006-051).		
Stepblock	Remove control linkage (see OEM service manual), and fuel shutoff valve (Procedure 005-043).		
Stepblock	Remove air fuel control air tube (Procedure 006-001), and disconnect wastegate turbocharger control line (if applicable).		
Stepblock	Connect batteries, operate engine and check for leaks.		
Stepblock	Disconnect external oil fed lines.		
Stepblock	Locate cylinder Number 1 top dead center.		
Stepblock	Disengage timing pin.		
Stepblock	Remove fuel pump mounting bracket.		
Stepblock	Remove gear cover access cap, and nut and washer from fuel pump shaft.		
	Pull the fuel injection pump drive gear	Part Number 3163381 or Part Number	

Stepblock	loose from shaft.	3824469 with M8-1.25 x 50, grade 8.8 or equivalent.	
Stepblock	Remove four mounting nuts and fuel pump.		
Stepblock	Remove fuel injection pump.		
Stepblock	Verify cylinder Number 1 at top dead center.		
Stepblock Stepblock	Remove fuel pump access plug and timing pin.		
Stepblock	If timing tooth **not** aligned with hole, rotate fuel injection pump shaft until tooth aligned.		
Stepblock	Reverse position of pin.		
Stepblock	Install and secure timing pin with access plug.		
Stepblock Stepblock	Lubricate gear cover housing and pump mounting flange.	Use 50/50 mixture of clean engine oil and STP or equivalent.	
Stepblock	Install new pilot o-ring.		
Stepblock	Slide pump shaft through drive gear.		
Stepblock Stepblock	Push pump until flange and o-ring properly fit into housing bore.		
Stepblock	Install mounting nuts.	Torque: 43 N•m [32 ft-lb].	
Stepblock	Install retaining nut and washer.	Torque: 10 to 15 N•m [7 to 11 ft-lb].	
Stepblock	Disengage engine timing pin.		
Stepblock	Remove access plug and add lubricating engine oil.		
Stepblock	Remove fuel pump timing pin plug and reverse pin position.		
Stepblock	Install pin, plug, and sealing washer.		
Stepblock	Tighten fuel pump drive nut.	“A” Pump: 85 N•m [63 ft-lb], In-line Pumps P3000 and P7100: 195 N•m [144 ft-lb], and Nippondenso Pump: 123 N•m [91 ft-lb].	
Stepblock	Install gear cover access cap.	Hand-tighten.	
Stepblock	Install fuel injection pump mounting bracket capscrews.		
Stepblock	Tighten capscrews by hand.	Torque: 24 N•m [18 ft-lb].	

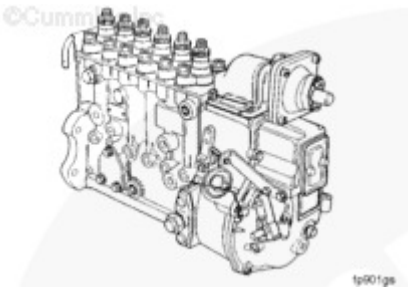
Stepblock	Connect external oil fed lines.		
Stepblock	Connect wastegate turbocharger control line (if applicable), and install air fuel control air tube (Procedure 006-001).		
Stepblock	Install fuel shutoff valve (Procedure 005-043), and control linkage (see OEM service manual).		
Stepblock	Install injector supply lines to pump (Procedure 006-051), and fuel supply lines (Procedure 006-024).		
Stepblock	Injection Pumps - Venting		
Stepblock	Vent air and fuel from Nippondenso EP-9 and Lucas CAV fuel injection pumps.	Energize fuel solenoid valve on Lucas CAV pump before venting.	
Stepblock	Loosen vent screw and operate priming lever until injection pump primed.		
Stepblock	Tighten vent screw.	Torque: 9 N•m [80 in-lb].	
Stepblock	Vent air through fuel drain manifold line.		

General Information

TOC

The Bosch® P7100 in-line fuel injection pump can be found on the following engine application:

- 1991 high-horsepower automotive ratings
- 1994 automotive, all 6B ratings
- 1996 emissionized high-horsepower industrial ratings.

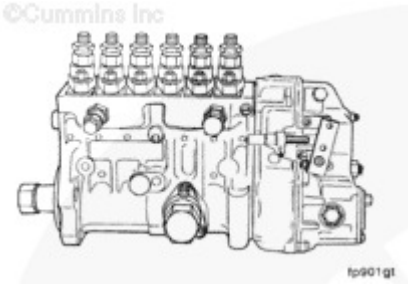


SMALL | MEDIUM | LARGE

Next

The Nippondenso EP-9 in-line fuel injection pump with the RSV governor can be found on the following engine application:

- Higher horsepower marine rating.



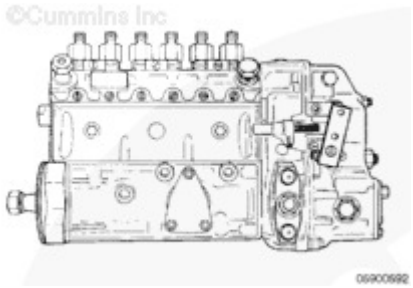
SMALL | MEDIUM | LARGE

Previous

Next

The Bosch® A-RSV in-line fuel injection pump can be found on the following engine application:

- Pre-1996 noncommissioned industrial ratings
- 1996 industrial emission ratings
- Marine
- Gensets.



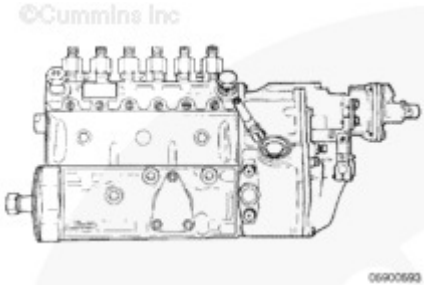
SMALL | MEDIUM | LARGE

Previous

Next

The Bosch® MW/RSV and MW/RQV in-line fuel injection pump can be found on the following engine application:

- 1996 and higher industrial emission ratings.



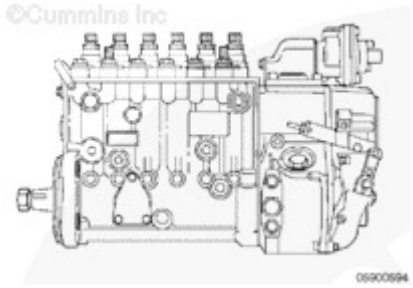
SMALL | MEDIUM | LARGE

Previous

Next

The Bosch® P3000/RQVK and P3000/RQV in-line fuel injection pump can be found on the following engine application:

- 1996 and higher high-horsepower industrial emission rating.



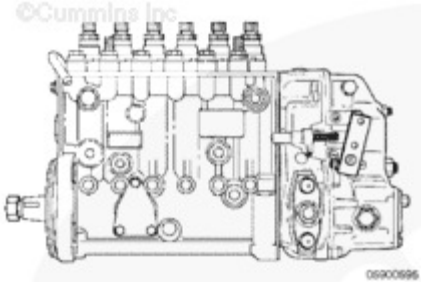
SMALL | MEDIUM | LARGE

Previous

Next

The Bosch® P3000/RSV In-line fuel injection pump can be found on the following engine application:

- 1996 and higher high-horsepower industrial emission ratings
- Marine.



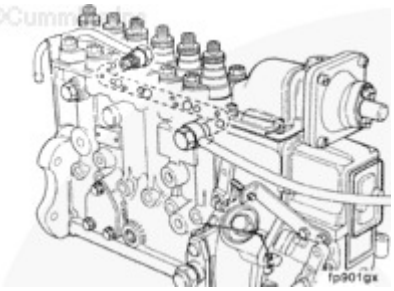
SMALL | MEDIUM | LARGE

Previous

Next

The pressure relief valve arrangement on the Bosch® P7100 fuel injection pump in the supply side of the fuel circuit creates a self-bleeding system for air introduced during replacement of the supply-side components.

Small amounts of air can be bled from the pump by operating the hand primer on the fuel transfer pump or by cranking the engine.

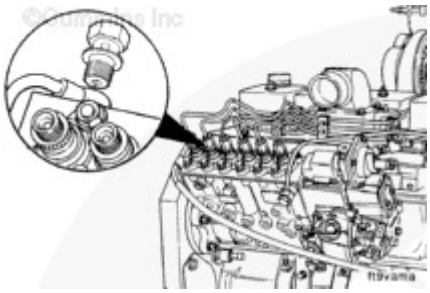


SMALL | MEDIUM | LARGE

Previous

Next

The Bosch® P7100 in-line fuel injection pump has a jump-over tube to route return fuel and entrapped air from the pressure relief valve directly to the supply tank.

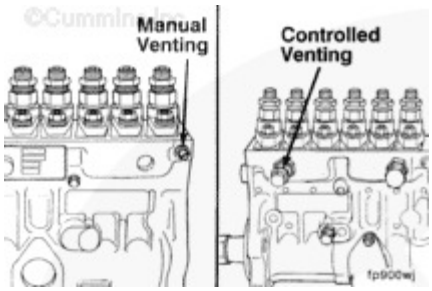


SMALL | MEDIUM | LARGE

Previous

Next

The Nippondenso EP-9 in-line fuel injection pumps will require additional venting prior to initial start-up, pump replacement, or if engine fuel runs out.



SMALL | MEDIUM | LARGE

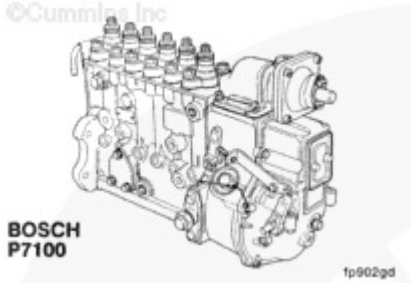
Previous

Next

Fuel Injection Pump (In-Line Type)

Beginning in 1991, the B Series engine used the Bosch® P7100 in-line fuel injection pump on higher horsepower automotive ratings. In 1994, all automotive 6B Series engines used the Bosch® P-7100 in-line fuel injection pump.

B Series industrial ratings and marine (after 1996) engines use the Bosch® “A” in-line fuel injection pumps.



SMALL | MEDIUM | LARGE

Previous

Next

The B Series engine also uses the Nippondenso EP-9 with RSV governor on 1996 or earlier engines with a 250 and 300-horsepower marine rating.

Refer to the B Series Marine Operation and Maintenance Manual, Bulletin 3810466, for additional information.

SMALL | MEDIUM | LARGE

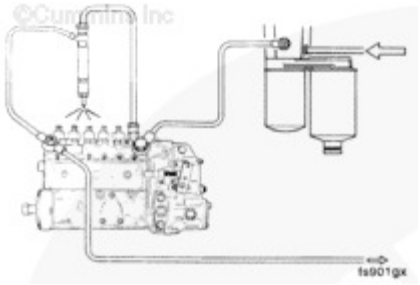
Previous

Next

The fuel injection pump performs the three basic functions of:

1. Metering the exact amount of fuel for each injection cycle
2. Producing the high fuel pressure required for injection

3. Delivering the high-pressure metered fuel to each cylinder at the precise time.



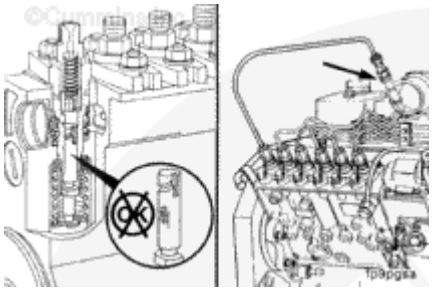
SMALL | MEDIUM | LARGE

Previous

Next

Individual plungers are used in the pumps to develop and distribute the high pressure required for injection.

A worn or damaged plunger in the pump will affect **only** one cylinder.



SMALL | MEDIUM | LARGE

Previous

Next

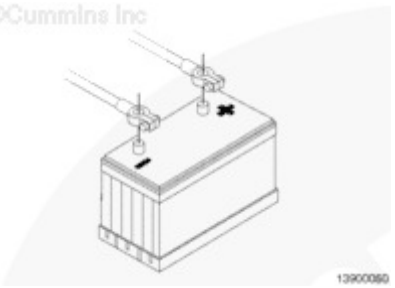
Preparatory Steps

TOC

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.



SMALL | MEDIUM | LARGE

Previous

Summary 1

Next

WARNING

Fuel is flammable. Keep all cigarettes, flames, pilot lights, arching equipment, and switches out of the work area and areas sharing ventilation to reduce the possibility of severe personal injury or death when working on the fuel system.

WARNING

Some state and federal agencies have determined that used engine oil can be carcinogenic and cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil. If not reused, dispose of in accordance with local environmental regulations.

- Clean any debris from the fuel injection pump.
- Remove the fuel supply lines. Refer to Procedure 006-024.
- Remove the injector supply lines to the pump. Refer to Procedure 006-051.
- Remove the control linkage. See the OEM service manual.
- Remove the fuel shutoff valve. Refer to Procedure 005-043.
- Remove the air fuel control air tube. Refer to Procedure 006-001.
- Disconnect wastegate turbocharger control line (if applicable).

SMALL | MEDIUM | LARGE

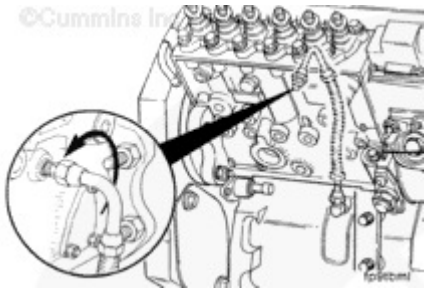
Previous
Next
Summary 2
Summary 3
Summary 4
Summary 5

Remove

TOC

Disconnect the external oil feed line at the inboard side of the fuel injection pump (if applicable) and the main oil rifle.

Disconnect the external oil feed line at the rear of the pump or AFC latchout if applicable.



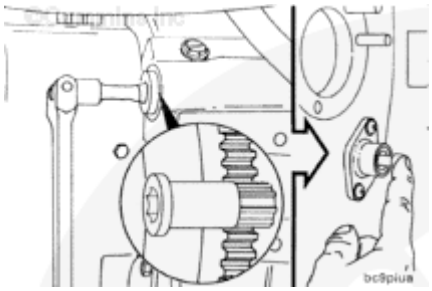
SMALL | MEDIUM | LARGE

Previous
Summary 7

Next

Locate top dead center for cylinder Number 1. Push the top dead center pin into the hole in the camshaft gear while slowly barring the engine.

NOTE: Be certain to disengage the timing pin after locating top dead center.

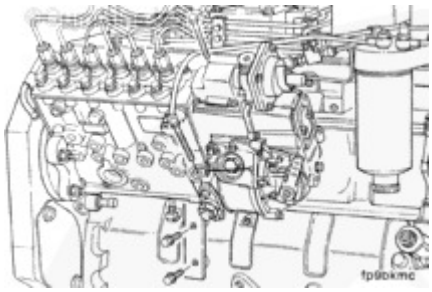


SMALL | MEDIUM | LARGE

Previous | Summary 8

Next | Summary 9

Remove the fuel injection pump mounting bracket, if applicable.



SMALL | MEDIUM | LARGE

Previous | Summary 10

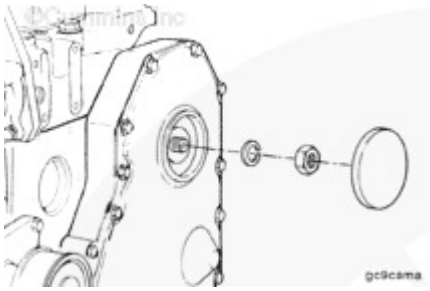
Next

CAUTION

Do not drop the nut and washer. Dropping the nut and washer will result in the need to remove the front cover.

Remove the gear cover access cap.

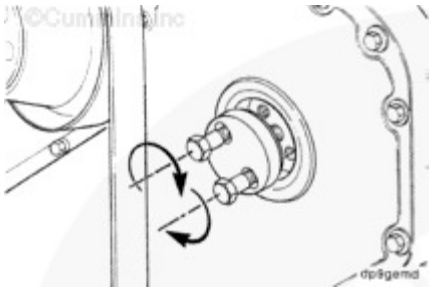
Remove the nut and washer from the fuel injection pump shaft.

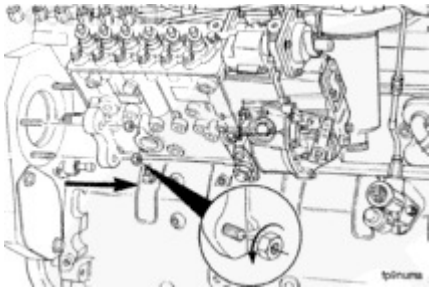


SMALL | MEDIUM | LARGE

Previous | Summary 11

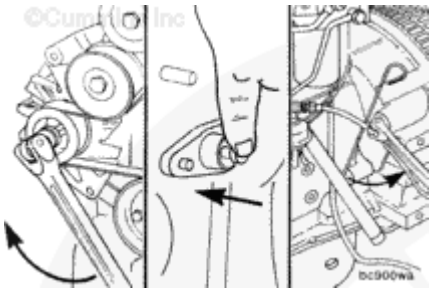
Next

Use fuel pump gear puller, Part Number 3163381 or Part Number 3824469 with M8-1.25 x 50 capscrews, grade 8.8 or equivalent. Pull the fuel injection pump drive gear loose from the shaft.		 SMALL | MEDIUM | LARGE Previous Next Summary 12

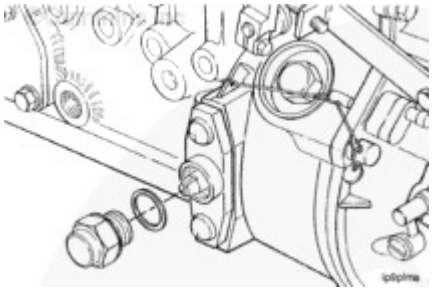
Remove the four mounting nuts. Remove the fuel injection pump.		 SMALL | MEDIUM | LARGE Previous Next Summary 13 Summary 14

Install

TOC

Make certain that the engine has cylinder Number 1 at top dead center.		 SMALL | MEDIUM | LARGE Previous Next Summary 15

Remove the access plug.

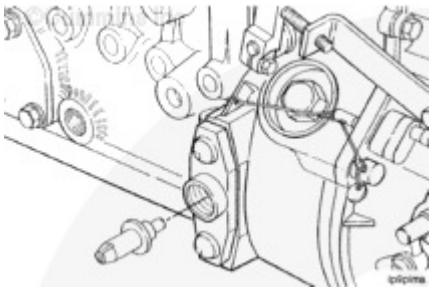


SMALL | MEDIUM | LARGE

Previous

Next

Remove the timing pin.



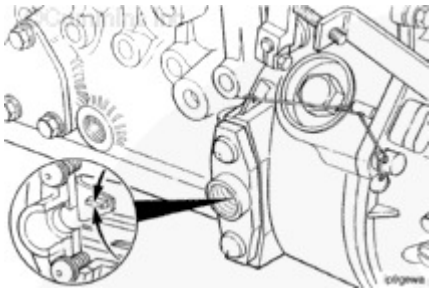
SMALL | MEDIUM | LARGE

Previous

Next

Summary 16

If the timing tooth is **not** aligned with the timing pin hole, rotate the fuel injection pump shaft until the timing tooth aligns.



SMALL | MEDIUM | LARGE

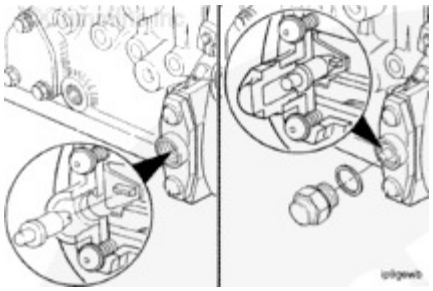
Previous

Next

Summary 17

Reverse the position of the timing pin so the slot of the timing pin will fit over the timing tooth in the pump.

Install and secure the timing pin with the access plug.



SMALL | MEDIUM | LARGE

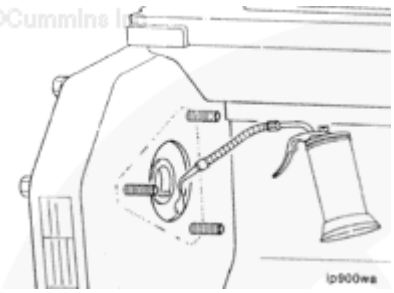
Previous

Next

Summary 18

Summary 19

Use a 50/50 mixture of clean lubricating engine oil and STP, or equivalent, to lubricate the gear cover housing to make certain that the fuel injection pump will slide into the gear cover housing easily.



SMALL | MEDIUM | LARGE

Previous

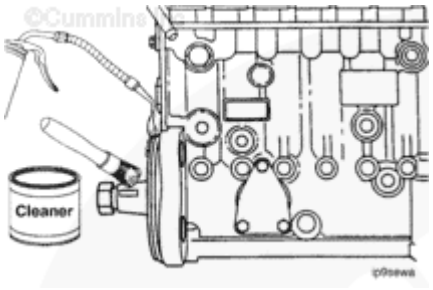
Next

WARNING

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

WARNING

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



SMALL | MEDIUM | LARGE

CAUTION

The fuel injection pump drive gear inside diameter and the shaft outside diameter must be clean and dry before installing the gear. Failure to do so can result in slipped timing.

NOTE: Before installing the fuel pump drive gear, clean the injection pump shaft and gear tapers with residue-free cleaner, Part Number 3824510, by spraying into the gap between the shaft and the gear. Dry with compressed air.

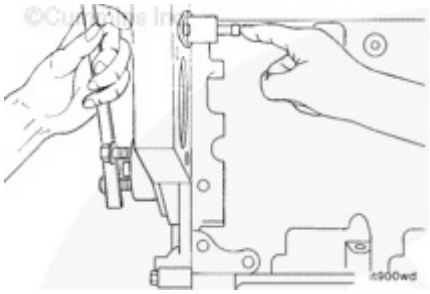
NOTE: The in-line fuel injection pump driveshaft has a provision for a Woodruff key: however, it is not required. Timing mark alignment is not required for the in-line drive gear.

Previous
Next
Summary 20

NOTE: Make certain that the engine has cylinder Number 1 at top dead center.

Make certain that the o-ring seals for the fill orifice and pilot are correctly installed and are **not** damaged.

Install new pilot o-ring.

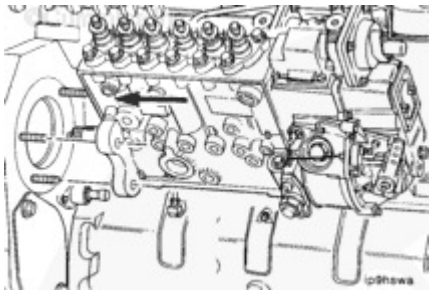


SMALL | MEDIUM | LARGE

Previous
Next
Summary 21

Slide the pump shaft through the drive gear and position the pump flange onto the mounting studs.

Push the pump forward until the mounting flange and o-ring are properly fitted into the gear housing bore.

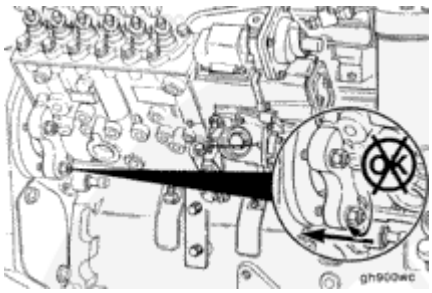


SMALL | MEDIUM | LARGE

Previous
Next
Summary 22

CAUTION

Do not attempt to pull the pump flange into the gear housing with the mounting nuts as damage to housing can occur.



SMALL | MEDIUM | LARGE

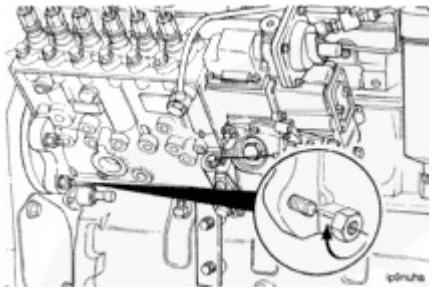
Previous | Next | Summary 23

Install the mounting nuts.

Torque Value:	43 n.m	[32 ft-lb]

Install the support bracket (if equipped).

Torque Value:	32 n.m	[24 ft-lb]



SMALL | MEDIUM | LARGE

Previous | Next | Summary 24

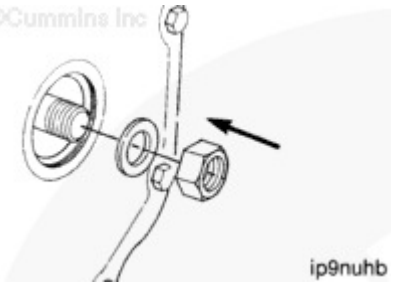
CAUTION

Do not drop the nut and washer. Dropping the nut and washer will result in the need to remove the front cover.

Install the retaining nut and washer.

Torque Value:	10 to 15 n.m	[89 to 133 in-lb]

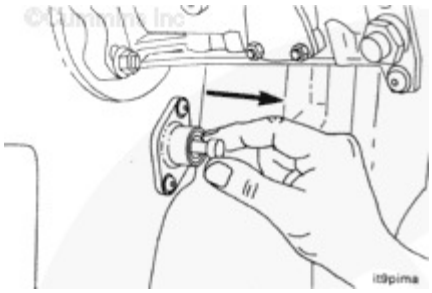
To prevent damage to the timing pins, do **not** exceed the torque value given. This is **not** the final torque value for the retaining nut.



SMALL | MEDIUM | LARGE

Previous | Next | Summary 25

Disengage the engine timing pin.



SMALL | MEDIUM | LARGE

Previous

Next

Summary 26

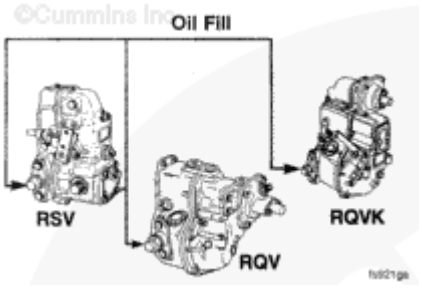
CAUTION

The governor housing must be prelubricated before engine operation. Failure to do so can result in premature governor wear.

Remove the access plug.

Add the following quantity of clean lubricating engine oil:

- RSV 450 mL [0.48 qt]
- RQV 750 mL [0.79 qt]
- RQVK 750 mL [0.79 qt]



SMALL | MEDIUM | LARGE

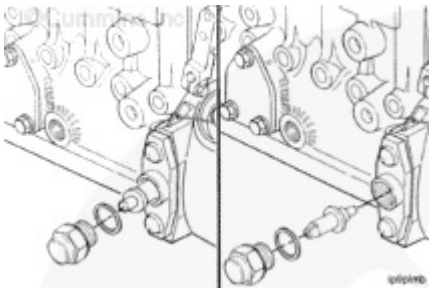
Previous

Next

Summary 27

Remove the fuel injection pump timing pin plug, reverse the position of the timing pin, and install the timing pin, plug, and sealing washer.

Torque Value:	27 n.m	[20 ft-lb]



SMALL | MEDIUM | LARGE

Previous

Next

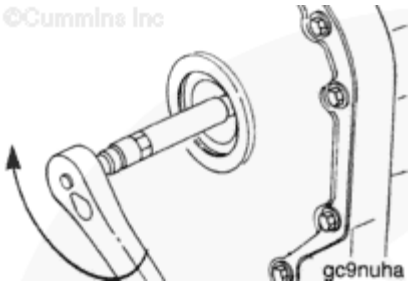
Summary 28

Summary 29

Tighten the fuel injection pump drive nut.

“A” Pump	85 n.m	[63 ft-lb]
P3000 and P7100	195 n.m	[144 ft-lb]
Nippondenso	123 n.m	[91 ft-lb]

Install the gear cover access cap hand-tight.



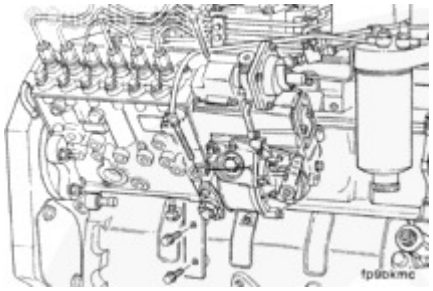
SMALL | MEDIUM | LARGE

Previous
Next
Summary 30
Summary 31

Install the fuel injection pump mounting bracket capscrews.

Tighten all capscrews by hand for proper alignment.

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

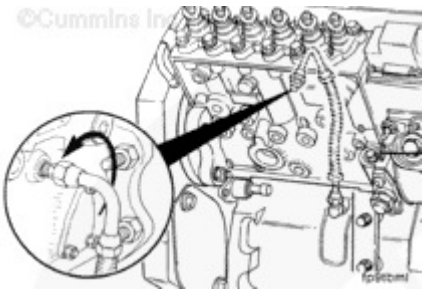


SMALL | MEDIUM | LARGE

Previous
Next
Summary 32
Summary 33

Connect the external oil feed line at the inboard side of the fuel injection pump (if applicable) and the main oil rifle.

Connect the external oil feed line at the rear of the pump or AFC latchout if applicable.



SMALL | MEDIUM | LARGE

Previous
Next
Summary 34

Finishing Steps

TOC

- Connect wastegate turbocharger control line (if applicable)
- Install the air fuel control air tube. Refer to Procedure 006-001
- Install the fuel shutoff valve. Refer to Procedure 005-043
- Install the control linkage. See the OEM service manual
- Install the injector supply lines to the pump. Refer to Procedure 006-051
- Install the fuel supply lines. Refer to Procedure 006-024.

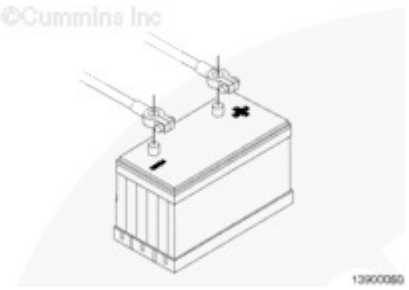
SMALL | MEDIUM | LARGE

Previous
Next
Summary 35
Summary 36
Summary 37

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.



SMALL | MEDIUM | LARGE

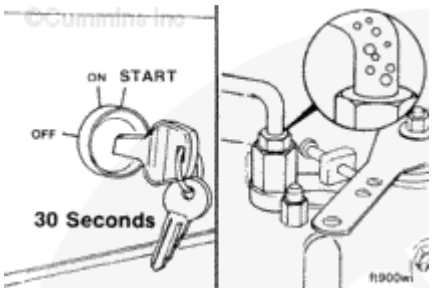
Previous
Next
Summary 6

Prime

TOC

Replacing the fuel supply lines, fuel filters, fuel injection pump, high-pressure fuel lines, and injectors will let air enter into 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.

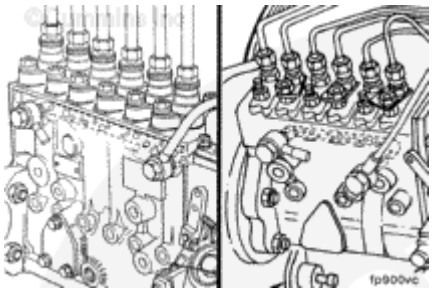
SMALL | MEDIUM | LARGE

Previous

Next

The MW, A, and P fuel injection pumps equipped with the engine-side fuel drain arrangement create a self-bleeding system for air introduced during replacement of the supply-side components.

For faster air purge, small amounts of air can be bled from the pump by operating the hand primer on the fuel transfer pump or by cranking the engine.



SMALL | MEDIUM | LARGE

Previous

Next

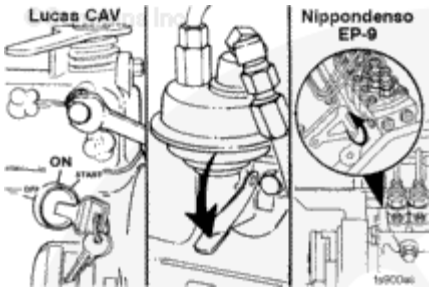
Injection Pumps - Venting

After priming the low pressure fuel lines (see Procedure 006-015, Fuel Filter — Spin-On Type), air/fuel can be vented from the illustrated vent locations on the Nippondenso EP-9 and the Lucas CAV fuel injection pumps. The Lucas CAV fuel injection pump requires that the fuel solenoid valve be energized before venting.

Loosen the vent screw, and operate the priming lever on the fuel transfer pump until the fuel injection pump is primed.

Tighten the vent screw.

Torque Value:	9 n.m	[80 in-lb]



SMALL | MEDIUM | LARGE

Previous

Next

Summary 38

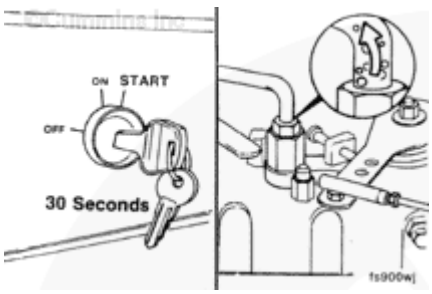
Summary 39

Summary 40

Summary 41

CAUTION

It is necessary to turn the keyswitch to the ON position. Because the engine can start, be sure to follow all safety precautions. Use the normal engine starting procedure.



CAUTION

When using the starting motor to vent the system, do not engage it for more than 30 seconds, or starter damage will occur. Wait 2 minutes before starting the engine again.

Air can also be vented through the fuel drain manifold line by operating the starting motor.

Last Modified: 24-Apr-2006