

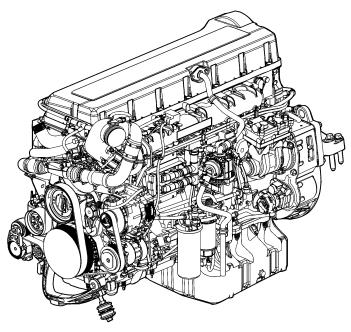
# Service Bulletin Trucks

Date Group No. Page 10.2007 **210 139** 1(47)

Engine, Replacement Volvo D16F

VNL, VT

## **Engine, Replacement**



W2005773

This information covers the proper procedure for replacing the Volvo D16F engine in a VT or VNL chassis.

## **Contents**

- "Special Tools" page 2
- "Engine, Replacement" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

PV776-20180330 USA26169.ihval

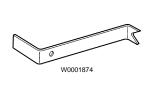
# **Tools**

# **Special Tools**

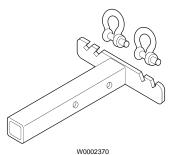
For special tools ordering instructions, refer to Tools Information, group 08.



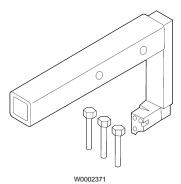
**DBT2V700**Coolant Extractor



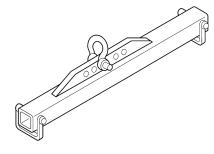
J44773 Air Line Release Tool



**J47038-1**Engine Lifting Plate



J47038-2 Engine Lifting Bracket



J47038-6
Engine Lifting Fixture



W0002179

**85104846**STC Fitting Release Tool



**85108826** Transmission Line Tool, 15 mm



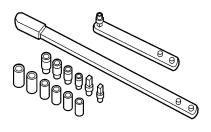
**85108827** Transmission Line Tool, 18 mm



9996049 Coolant Drain Hose



**88800014** Flywheel Turning Tool



J44392
Drive Belt Tensioner Tool

## **Engine, Replacement**

See also:

- "Engine, Replacement" page 1
- "Special Tools" page 2

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Special tools: DBT2V700, J44392, J44773, J47038-1, J47038-2, J47038-6, 85104846, 85108826, 85108827, 88800014, 9996049

## Removal

1

Apply the parking brake and place the shift lever in neutral.

2

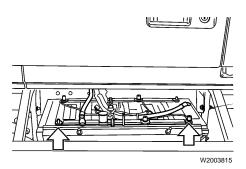
Cut tie straps and disconnect engine harness from the engine ECU. Move harness to the side.

3

Connect the EECU from the old engine to VCADs and save the old parameters. These saved parameters will be transferred to the new engine's ECU.

4

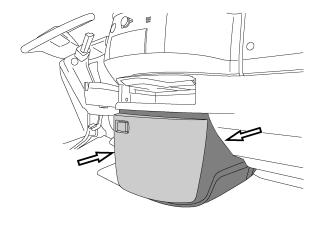
Remove all cables from ground (negative) battery terminals.



5

Place an approved container under the oil pan and remove the drain plug.

**Note:** Use only hand tools when removing and tightening the drain plug. Do not use an air ratchet or similar air tool.



Remove the center dash trim panel and remove the engine cover.

Note: Depending on chassis, the passenger seat may need to be removed first to allow for engine cover removal.

W8003859

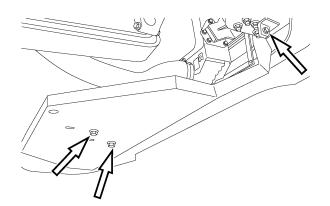
7

Release and raise the hood.

8

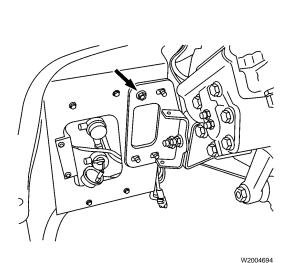
If applicable, remove the engine cover seal ring from the bulkhead.

If applicable, remove the rock guard from underneath the radiator.



W2006077





Connect the coolant extractor to the radiator and drain the engine coolant. Also, connect a drain hose to the EGR cooler and drain the coolant.

**Note:** An alternate method is to connect the drain hose to the drain fitting and drain the coolant into an approved container.

DBT2V700, 9996049

#### 11

Remove the fasteners securing the radiator/hood grille and remove the grille.

#### 12

Mark the locations of the bumper mounting fasteners for reassembly purposes.

#### 13

Disconnect the wiring harnesses for the headlights and fog/running lights and remove the nylon ties securing the harness.

#### 14

Remove three of the four bumper fasteners on each side. Loosen the remaining nut, but do not remove it at this time.

#### 15

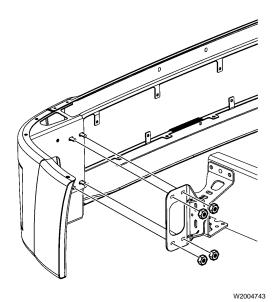
Close the hood in preparation of bumper removal.

No.

139



With the help of an assistant to hold the bumper, remove the two remaining fasteners and take off the bumper.

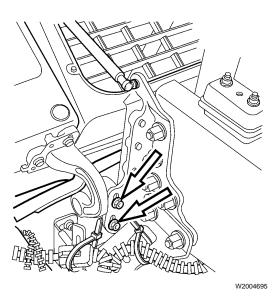


#### 17

Raise the hood.

#### 18

Mark the locations of the hood hinge mounting flange nuts on the frame mounts. Marking the position on the frame mount slotted holes will aid in hood alignment during reassembly.



#### 19

Cut wiring harness tie straps from the left side of the hinge and disconnect the hood-mounted headlight harness.

### 20

Remove the hood restraint cylinders and support the hood in the open position.

#### 21

With the help of an assistant, remove the hinge mounting fasteners that hold the hood hinge to the frame. Use a pallet with a protective covering to support the hood as the hinge fasteners are removed.

No.

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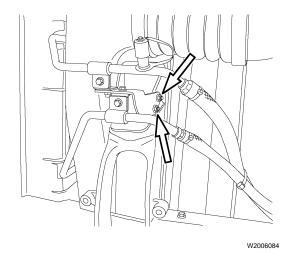
#### 22

Set the hood aside in a protected location.

#### 23

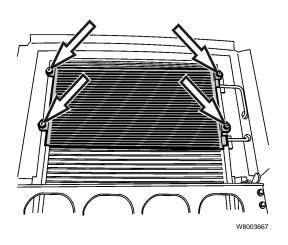
Remove the A/C condenser line bracket bolts from the left side of the radiator.

**Note:** Do not disconnect the refrigerant lines from the A/C condenser.



### 24

Remove the bolts securing the A/C condenser to the front of the charge air cooler.



#### 25

Lift and move the A/C condenser (with lines attached) over the charge air cooler and radiator to the left fender area. Secure out of the way to prevent damage.



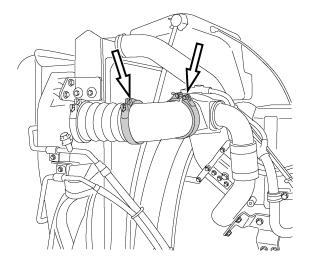
Remove upper hose clamps on the left side of the cooler. Remove the upper coolant hoses from the thermostat housing (including pipe). Remove bracket bolts from the cylinder head.

#### 27

Disconnect the deaeration line between engine and expansion tank. Remove rear hose clamp and loosen coolant hose to expansion tank from pipe.

### 28

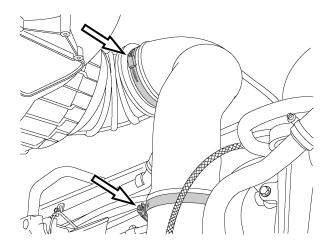
Loosen the clamps at the outlet of the charge air cooler and the inlet of the mixing chamber. Remove the charge air pipe between the mixing chamber and cooler.



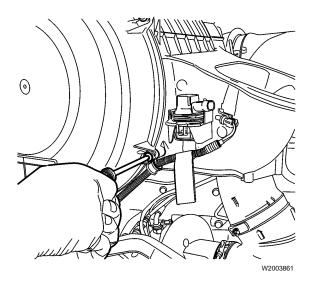
W2006294

#### 29

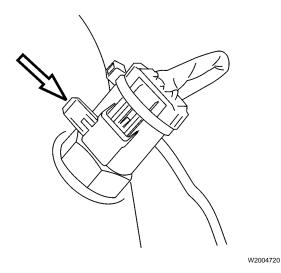
Loosen the clamps securing the main fresh air pipe at the air cleaner and at the turbocharger inlet elbow. Remove the main fresh air pipe.



W2006008

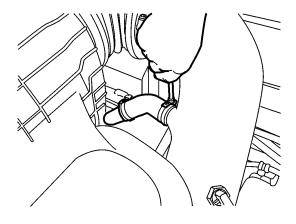


Disconnect and remove the air filter restriction gauge wiring harness from the air filter housing.



#### 31

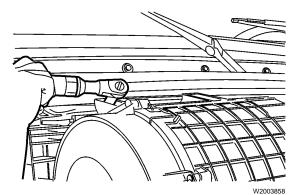
Disconnect the air temperature sensor wiring harness connector. First, remove the lock tab, then cut the tie strap and separate the connector from the sensor. Also, remove the sensor harness bolt and P-clamp securing the sensor harness to the fresh air pipe.

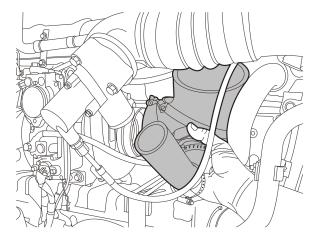


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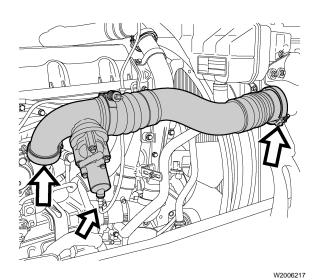
#### 32

Loosen and reposition the clamp of the air compressor fresh air hose at the main fresh air pipe.





W2005973



Remove the fasteners and lift the air filter housing away from the cab.

### 34

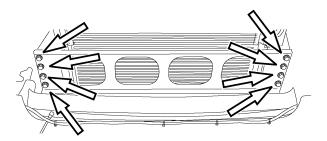
Loosen the clamps and remove the turbocharger inlet elbow.

### 35

Loosen the clamps and remove the charge air inlet pipe between the turbocharger and the charge air cooler.

Note: Remove the air line from the Discharge Recirculation Valve (DRV).

Remove all the fasteners securing the front closing cross member and remove the cross member.



W2006086

#### 37

Disconnect and plug the transmission oil cooler lines from the bottom of the radiator using the correct size special tool.

**Note:** Use a suitable receptacle to collect any transmission oil that may leak as the cooler lines are removed.

85108826, 85108827

#### 38

Remove the transmission cooler line clamps under the bell housing.

#### 39

Loosen the clamps for the lower radiator hoses, position the clamps out of the way and remove the lower radiator hoses. Also, remove the pipe from the engine.

**Note:** Use a suitable receptacle to collect any residual coolant as hoses are removed from the radiator.

#### 40

Disconnect the coolant level sensor located on the radiator right side. Cut tie straps to release sensor harness.

Support the weight of the cooling package using a mobile floor crane such as OTC 16-1815 or equivalent crane capable of safely lifting the cooling package. Position the crane and attach a chain using bolts, nuts and washers or strap to the lifting eyes of the radiator frame.

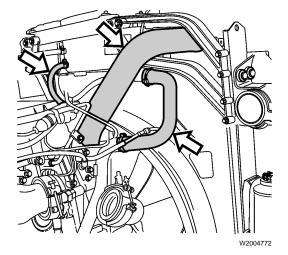


## WARNING

Failure to use a crane of sufficient capacity may allow the coolant package to fall or suddenly shift out of position causing damage to the product or personal injury.

#### 42

Disconnect the upper radiator hose, by-pass hose and static fill hose from the engine side of each connection.

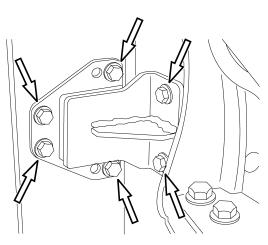


## 43

Disconnect the low coolant sensor harness connector from the sensor in the expansion tank.

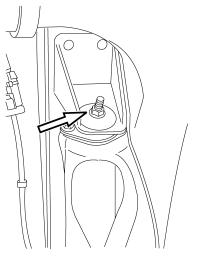
### 44

Remove the radiator lower rubber isolator mount bolts and remove the isolators from each side of the radiator.

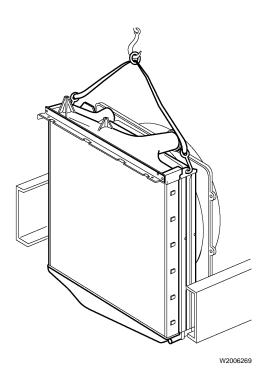


W2006097

Remove both radiator support bolts and isolators from the upper portion of the radiator.



W2006098



#### 46

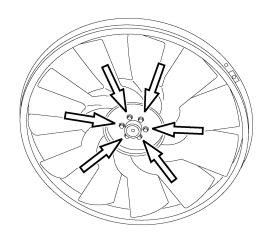
Lift straight up on the radiator assembly, then move the coolant package forward and away from the chassis. Secure the coolant package in an upright position to protect the cooling fins of the radiator and charge air cooler.

**Note:** Install protective covers on the radiator and charge air cooler openings.

## 47

Remove the fasteners securing the fan ring to the fan ring supports and remove the ring from the engine.

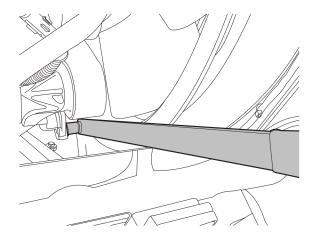
Remove the fasteners securing the fan blade to the fan hub and remove the fan from the engine.



W2006089

Using tool J44392, pry the belt tensioner away from the fan and water pump drive belt and remove the belt.

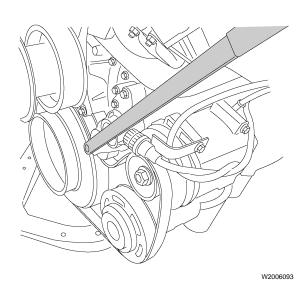
J44392



W2006031

Place a 1/2 inch ratchet or special tool in the accessory drive belt tensioner, relieve the tension on adjuster and slip belt off the A/C compressor pulley. Do not remove the belt from the engine.

J44392

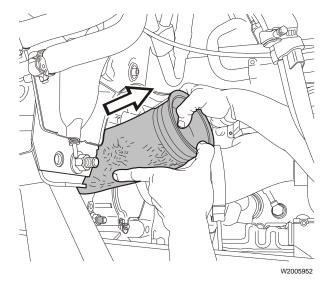


Remove the A/C compressor by first cutting the harness ties and disconnecting A/C harness plug. Remove A/C suction line support bracket bolt from the inlet manifold and remove the compressor mounting bolts to free the compressor from the engine brackets. Secure the A/C compressor to the chassis frame.

**Note:** Allow A/C compressor hoses to remain connected.

#### 52

Loosen the clamps and remove the exhaust pipe from between the diffuser pipe and the Diesel Particulate Filter (DPF) muffler inlet pipe. Lift the pipe over the diffuser and out from under the cab.



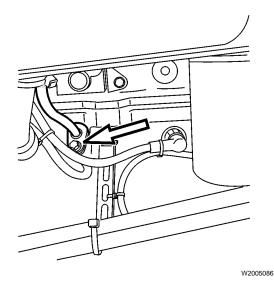
#### 53

Loosen hose clamps on heater pipes and remove hoses from pipes.

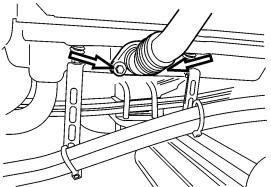
**Note:** Collect any residual coolant in a suitable catch container.

#### 54

Loosen hose clamps on lower radiator hard pipe and coolant hoses connecting to the fuel filter heater. Remove coolant hoses from filter.

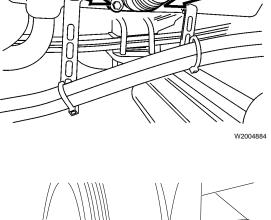


Remove the capscrew securing the oil dipstick tube and remove the dipstick tube from the side of the oil pan.



#### 56

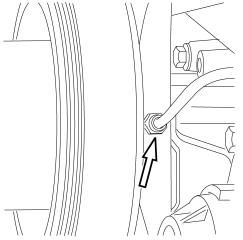
Remove the fasteners securing the oil filler tube to the oil pan and remove the tube.



### 57

Remove the fan clutch air line from the fan clutch hub using the air line release tool and cut tie straps to position the line out of the way.

J44773



W2006094

Disconnect DRV solenoid air supply line from the left frame rail side of the engine.

Disconnect the fuel inlet and return lines from the fuel pump.

**Note:** Use a suitable fuel collection container to catch any residual fuel that may be in the fuel lines.

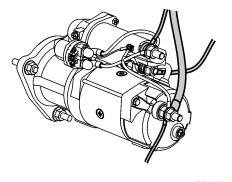
#### 60

Remove the power steering pump mounting bolts and secure the pump (with lines attached) to the suspension leaf spring.

**Note:** Fuel pump remains attached to rear of power steering pump.

### 61

Disconnect all wiring from the starter motor. Remove cable supports on the engine right side.



W2004714

#### 62

Disconnect fuel lines on engine left side (utilize quick disconnects). Cut any wire ties securing the fuel lines.

**Note:** Use a suitable fuel collection container to catch any residual fuel that may be in the fuel lines.

85104846

#### 63

Remove the battery cable loom brackets on the bell housing and move both negative and positive battery cables out of the way.

#### 64

Cut the nylon ties securing the wiring harness to the left front and left side, then disconnect the interface harness connector.

#### 65

Cut all ties securing the harness across the top of the transmission, then disconnect all switches.

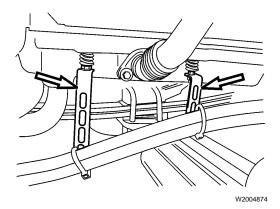
#### 66

If equipped, disconnect the block heater harness and remove the ties securing the harness.

Disconnect ground wires on the left side between engine block and frame.

#### 68

Remove the ties securing the transmission cooler hoses to the support brackets at the oil pan.



#### 69

Remove the front section of the drive shaft from between the transmission and the back section of the front drive shaft, then secure the drive shaft to the frame.

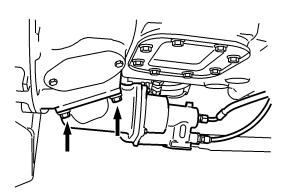
### 70

If equipped, remove the slave cylinder line bracket.

## 71

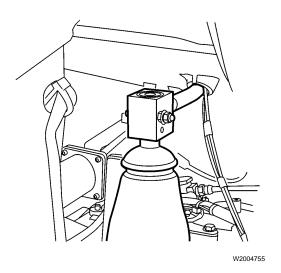
If equipped, remove the slave cylinder and fork assembly. Secure clutch cylinder to frame rail.

Note: Do not disconnect the lines.



W2004757





If equipped, disconnect the shifter/splitter air lines and supply air line, then remove the retainer bolt and lift the shift lever off the tower.

#### 73

Remove the lower bell housing bolts.

#### 74

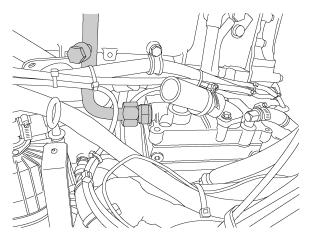
Remove the clip from the release bearing grease line, then position a transmission jack with a suitable capacity under the transmission and secure it.

#### 75

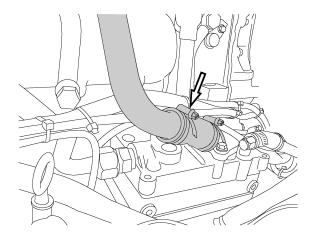
Remove the top bell housing bolts. Lower the transmission down slightly and move back away from the engine.

#### 76

Disconnect the air compressor supply line and remove the air outlet line from the compressor head. Remove the support brackets from the outlet lines. Disconnect the compressor signal line from the compressor.



W5001572



Remove the coupling hose clamp securing the fresh air inlet pipe at the air compressor. Remove the bracket bolts at the cylinder head and remove air compressor inlet pipe from the engine.

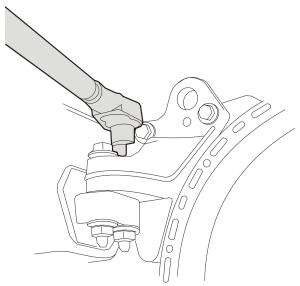


### 78

Remove the air compressor coolant hoses. Also, remove the oil pressure pipe to the air compressor and disconnect and mark any sensor electrical connector located behind the compressor.

## 79

Loosen the rear motor mount bolts. Do not remove the bolts at this time.



W2005367

Slide center engine lifting bar over the valve cover and install pin. Place lifting chain to engine lift eyes and secure chain to bracket. Bolt on front section of the engine lifting bracket to cylinder head and install pin in bar. Torque-tighten lifting bracket bolts to  $80 \pm 10 \text{ Nm}$  ( $60 \pm 7 \text{ ft-lb}$ ).



Use only the chains, clevis and lifting plate provided with these special tools. Failure to use the correct special tool components may allow the engine to fall, causing serious personal injury or death.

80 ± 10 Nm

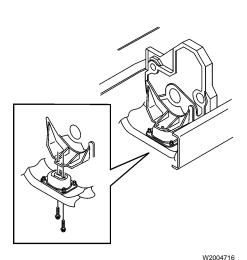
(60 ± 7 ft-lb) J47038-1, J47038-2, J47038-6

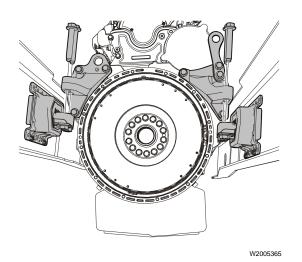
#### 81

Support the weight of the engine using a mobile floor crane such as OTC 16-1813 or equivalent crane capable of safely lifting the engine. Position the crane and hook up to the bar as close as possible. Raise the crane slightly to apply tension to the chain.

#### 82

Remove the front engine mount bolts.





Remove the engine rear mounting bolts. Engine may need to be lifted slightly to allow the bolts to be released.

Remove the torque limiter from the engine.

#### 85

With the help of an assistant, lift the engine up off the supports, and remove the engine from the chassis out the front of the frame.

Note: Carefully move the engine out away from transmission making sure that lines or wires are not damaged during engine removal.



The engine is very heavy and extreme caution must be exercised while it is being removed. Failure to use proper equipment and failure to keep your body clear may result in serious personal injury or death if the engine should fall or suddenly shift out of position.

#### 86

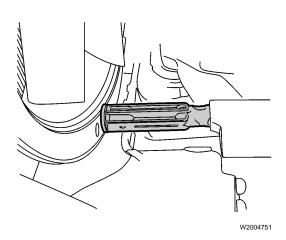
Position the old engine on a suitable engine stand capable of safely supporting the engine's weight. This will allow for a safe parts transfer to the new engine.

## 87

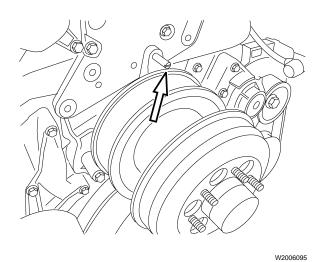
Remove the engine lifting tools.

J47038-1, J47038-2, J47038-6

# Component Transfer



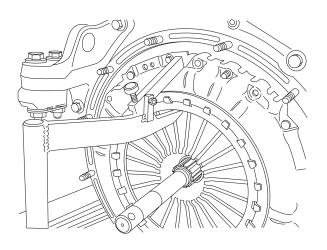
Remove the fan ring brackets, left upper, right and left lower fan ring mounts.



**2** Remove the upper fan hub mounting fastener and install alignment stud.

**3** Remove the remaining mounting fasteners securing the fan hub to the front of the engine and remove the fan hub.

# **4** Remove the ground and positive cables from the alternator.



I-Shift pressure plate shown (typical)



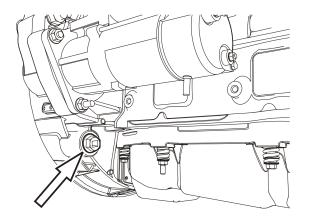
Remove the clutch pressure plate bolts and separate the pressure plate and clutch discs from the flywheel.

Note: Loosen the bolts in a crisscross pattern in order to prevent pressure plate from bending.



Remove the flywheel housing dust plug and install flywheel housing turning tool 88800014. Lock the flywheel using the turning tool and a breaker bar.

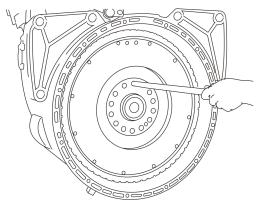
88800014



W0002368



Remove the flywheel bolts and washers. Next, using a pry bar, tip the flywheel away from the crankshaft and remove the flywheel from the rear of the engine.



W2005379

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No. **139** 

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#### 9

Remove the oil pan mounting fasteners and transmission cooler line brackets from the old engine. Install the oil pan mounting fasteners and transmission cooler line brackets on the new engine.

#### 10

Remove the air, oil and water line fittings from the old engine. Install the air, oil and water line fittings on the new engine.

#### 11

If equipped, remove the preheater relay, wiring and bracket from the old engine. Install the preheater relay, wiring and bracket on the new engine.

#### 12

If equipped, remove the engine block heater from the old engine. Install the engine block heater onto the new engine.

#### 13

Remove the heater brackets from the harness cover on the old engine. Install the heater brackets to the harness cover on the new engine.

#### 14

Remove the alternator from the old engine. Install the alternator on the new engine.

#### 15

Remove the fasteners securing the A/C/alternator belt tensioner and remove the tensioner. Install the A/C/alternator belt tensioner on the new engine.

#### 16

Remove the fasteners securing the fan and water pump belt tensioner and remove the tensioner. Install the fan and water pump belt tensioner on the new engine.

#### 17

Remove the starter from the old engine. Install the starter on the new engine.

#### 18

Remove the fasteners securing the air compressor and remove the air compressor. Install air compressor onto the new engine.

#### 19

Remove the air compressor inlet hard pipe from the old engine. Install the air compressor inlet hard pipe onto the new engine.

Install a new engine coolant filter and by-pass hard pipe, if equipped.

#### 21

Remove the fuel filter/separator from the old engine. Install the fuel filter/separator on the new engine.

#### 22

Remove the fuel separator coolant hoses from the old engine. Install the fuel separator coolant hoses onto the new engine.

#### 23

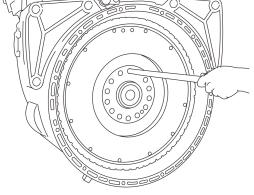
Remove the fan hub mounting studs from the old engine. Install the fan hub mounting studs on the new engine.

#### 24

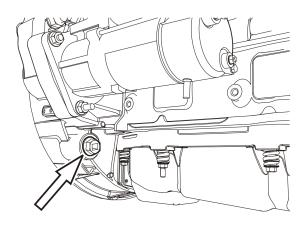
Remove the lower fan ring mounting studs from the old engine. Install the lower fan ring mounting studs on the new engine.

#### 25

Carefully clean the flywheel and crankshaft contact surfaces, then position the flywheel on the crankshaft and hand-tighten the flywheel bolts snug.



W2005379



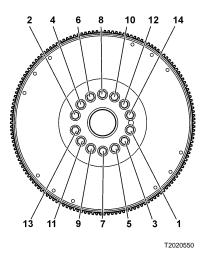
#### 26

Remove the flywheel housing dust plug from the new engine and install flywheel turning tool 88800014. Lock the flywheel in position using the turning tool and a breaker bar.

88800014

Using the proper tightening sequence, torque-tighten the flywheel bolts as follows:

- Step 1 60 ± 5 Nm (44 ± 4 ft-lb)
- Step 2 Turn additional 120 ± 10 degree angle of tightening.



#### 28

Remove the flywheel turning tool and reinstall the dust plug.

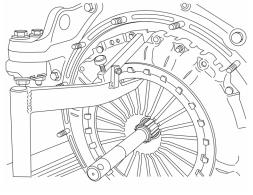
#### 29

Check condition of the pilot bearing, clutch disc, clutch throw out bearing and clutch pressure plate. Replace worn parts as necessary.

#### 30

Install the clutch and pressure plate assembly onto the flywheel. Torque-tighten the clutch-to-flywheel bolts to 65 Nm (48 ft-lb). Ensure the caging bolts are removed from the clutch/pressure plate assembly.

**Note:** Torque-tighten the bolts to specification in a crisscross pattern to prevent pressure plate from bending.



W4002944

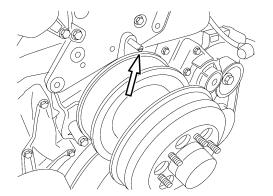
I-Shift pressure plate shown (typical)

#### 31

Remove the clutch and pressure plate installation tools.

## 32

Install the ground and positive cables onto the alternator.



W2006095

Install an alignment stud in the fan hub upper mounting location, and position the fan hub from the old engine onto this stud.

Install the fan hub lower mounting fasteners and remove the alignment stud from the upper location.

#### 35

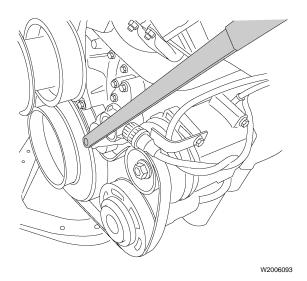
Install the fan hub upper fastener and torque-tighten all fan hub fasteners to specification.

Check the condition of both of the original A/C/alternator and water pump/fan belts. Check for dry cracks or scuff marks and replace with new belts if any of these conditions are present.

#### 37

Per the accessory routing decal, route the A/C/alternator belt. Place a 1/2 inch ratchet or special tool in the accessory drive belt tensioner notch. Install drive belt by prying tensioner away from the belt to relieve the tension on the adjuster and allow the belt to slip onto the A/C compressor pulley. Release tension and remove tool.

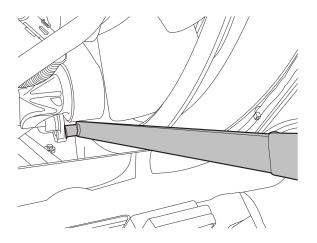
J44392



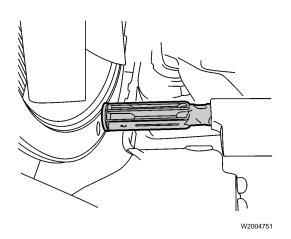


Using tool J44392, pry the belt tensioner away from the fan and water pump drive belt and install the belt.

J44392



W2006031



### 39

Install the three fan ring brackets, left upper, right and left lower fan ring mounts.

## Installation

1

Attach the rear lifting bracket to the new engine, slip center engine lifting bar on rear bracket and install pin, bolt on front section of the engine lifting bracket and install pin in bar.

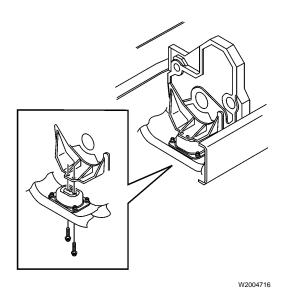


Use only the chains, clevis and lifting plate provided with these special tools. Failure to use the correct special tool components may allow the engine to fall, causing serious personal injury or death.

J47038-1, J47038-2, J47038-6

#### 2

With the lifting tools correctly attached, remove the new engine from the shipping stand. Support the weight of the engine using a mobile floor crane such as OTC 16-1813 or equivalent crane capable of safely lifting the engine.



With the help of an assistant, position the engine in the chassis and install new engine mount-to-cushion bolts for the front mount. Hand-tighten the bolts snug using a socket and handle.

**Note:** Engine front mounting bolts are one time use only. New bolts must be obtained at installation.

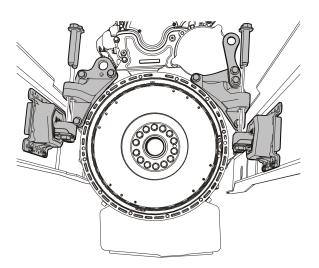


The engine is very heavy and extreme caution must be exercised while it is being installed. Failure to use proper equipment and failure to keep your body clear may result in serious personal injury or death if the engine should fall or suddenly shift out of position.



With the help of an assistant, position the rear of the engine over the rear mounts and lower the rear of the engine until the rear engine mounts are resting on the frame mounts. Install the vertical rear support bolts and hand-tighten the bolts snug using a socket and handle.

**Note:** Carefully position the replacement engine onto the chassis, making sure no lines or wires are pinched or damaged.



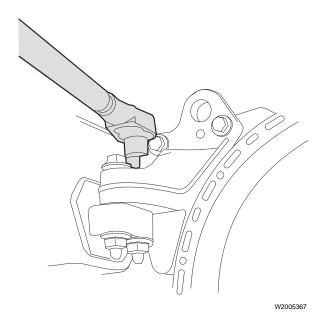
W2005365

5

Torque-tighten the **front** engine mount-to-cushion bracket support bolts to specification of  $140 \pm 25$  Nm  $(103 \pm 18 \text{ ft-lb})$ .

140 ± 25 Nm (103 ± 18 ft-lb)





Torque-tighten the vertical **rear** engine support bolts to specification of 540 ± 90 Nm (398 ± 66 ft-lb).

 $540 \pm 90 \text{ Nm}$  (398 ± 66 ft-lb)

### 7

Remove the engine lifting tools from the engine and back crane away from area.

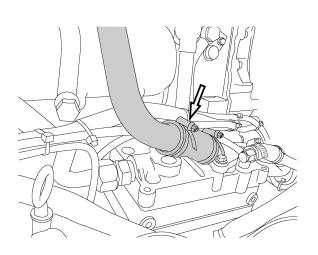
J47038-1, J47038-2, J47038-6

#### 8

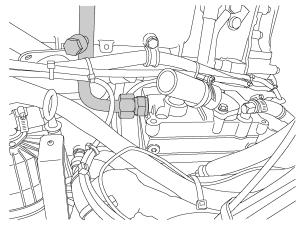
Connect the air compressor coolant hoses and secure clamps. Also, connect the oil pressure pipe to the air compressor and secure.

#### 9

Position the air compressor fresh air inlet pipe in position over the valve cover and connect the pipe to the coupling hose at the compressor. Tighten the coupling hose clamp and secure the pipe to the cylinder head.



W5001571



IU

Connect the air compressor supply line to the compressor. Install the support brackets for the supply line and A/C line at the intake. Connect the compressor signal line to the air compressor.

W5001572

#### 11

Install the torque limiter to the engine and front cross member.

#### 12

Position transmission to allow input shaft to align with clutch release bearing. Connect the release bearing grease line to the bell housing and secure it with a clip.

#### 13

Push the transmission against the flywheel housing and use the flywheel turning tool to rotate the engine slightly to allow the input shaft to align with the clutch disc. Install the top mounting bolts and secure.

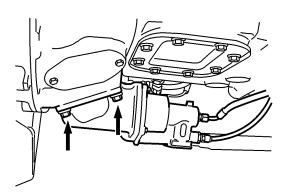
#### 14

Install and secure the lower mounting bolts and torque-tighten all transmission mounting fasteners to specification. Remove the transmission jack.

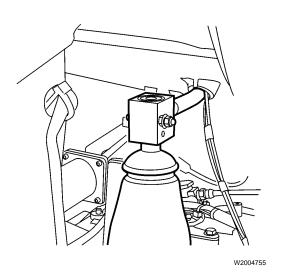
### 15

Connect the front section of the drive shaft to the transmission and the back section of the front drive shaft. Secure the drive shaft in place.

If equipped, install the slave cylinder and fork assembly.



W2004757



#### 17

If equipped, install the slave cylinder line brackets.

#### 18

If equipped, connect the shifter/splitter air lines and the supply air line. Then install the retainer bolt and slide the shift lever on the tower shaft and secure.

## 19

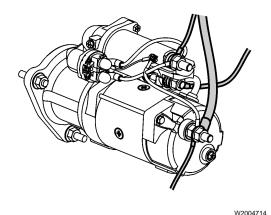
Route and connect all switches to the transmission harness. Secure the harness in place.

#### 20

Mount the transmission cooler lines underneath the bell housing.

## 21

Install battery cable bracket right side of bell housing and lay battery cables toward the starter and secure.



Route, connect and secure all wires and cables to the starter motor. Install all previously removed cable supports.

#### 23

Install the ground wire on the engine left side between the engine block and the chassis frame rail.

#### 24

Connect engine wiring harness. Secure harness using tie straps.

#### 25

Using a new O-ring, install the power steering pump onto the engine with inlet and pressure lines still attached. Top off power steering reservoir as required.

Note: Fuel pump remains attached to the rear of the power steering pump.

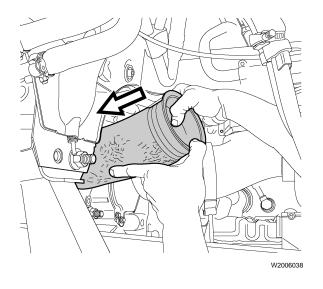
Using new sealing washers, reconnect the fuel inlet and return lines to the fuel pump and torque-tighten to specifications.

#### 27

Reconnect the air supply line to the DRV solenoid at the left frame rail side of the engine.

#### 28

Reconnect previously disconnected coolant hoses located under the truck cab. Also, reconnect the heater hoses to the heater core pipes and tighten all clamps securely.





Position the exhaust pipe between the diffuser pipe and the DPF muffler inlet pipe and loosely install the V-band clamps. Align all exhaust pipes and torque-tighten all V-band clamps to specification.

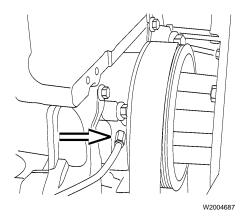
**Note:** Replace exhaust gaskets at each joint that is separated.



Mount the A/C compressor to the engine bracket and torque-tighten all fasteners to specification. Install the A/C suction line support bracket. Reconnect the A/C compressor clutch harness and secure the wires as needed.



Connect the supply air line to the fan hub. Secure supply air line to the engine harness using tie straps.

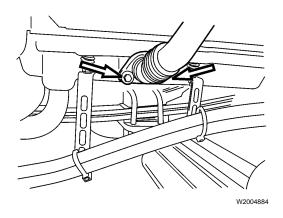


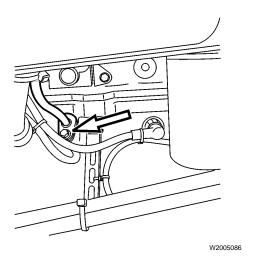
32

Install the lower radiator hard pipe hose and clamp. Tighten the clamp securely. Also, install hoses to the fuel separator if not previously done during parts transfer.

#### 33

Install the frame mounting bracket for the dipstick and filler tube.





Install new O-rings and install the oil filler tube onto the side of the oil pan and secure.

35

Install the oil dipstick tube onto the side of the oil pan and secure.

36

If equipped, route and connect the block heater wiring harness. Secure the harness in place.

37

Connect the ground wires to the left side of the engine block and secure them in place.

38

Connect the interface harness and secure it on the left front and left side of the block with nylon cable ties.

39

Connect the wires and harnesses to the A/C compressor, alternator and preheater relay (if equipped). Secure them in place.



Position the engine fan blade on the front of the fan hub and install the fan blade fasteners. Tighten all fasteners to specification.

#### W2006089

#### 41

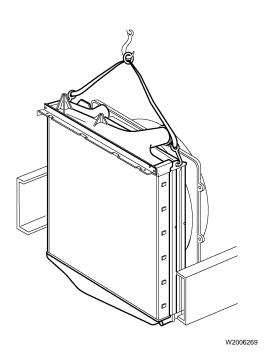
Position the fan ring on the mounts and install the fan ring fasteners. Tighten all fasteners to specification.

### 42

Using nylon cable ties, route and secure the wiring harness across the front of the valve cover.

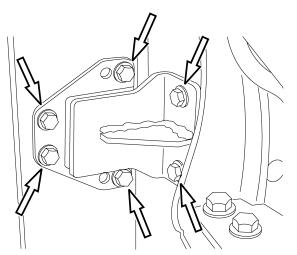
#### 43

Connect a suitable hoist and strap to the coolant package and position it in front of the truck.



#### 44

With the help of an assistant, position the coolant package in the frame and start all radiator bracket fasteners.



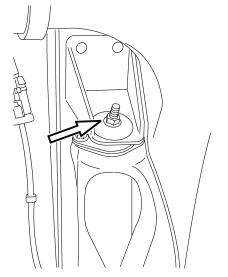
45

Install the lower radiator mounts on both sides and tighten the fasteners securely.





With assistance, install and tighten the radiator upper mounting bolts and isolators.



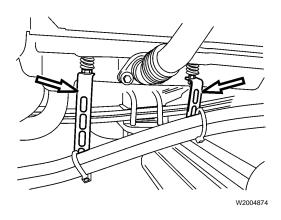
W2006098

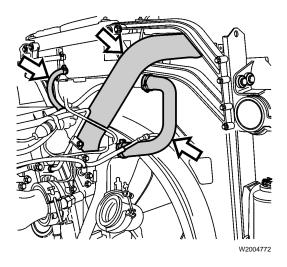
#### 47

Remove the hoist and lifting chain from the coolant package. Also, remove the protective covers from the radiator and charge air cooler openings.

### 48

Reconnect the transmission cooler lines to the radiator.





Route and secure the transmission cooler lines.

#### 50

Using a new O-ring, install and secure the radiator lower coolant hard pipe and hose. Position the clamps and tighten the hose clamps securely.

#### 51

Connect the upper radiator hose to the engine and secure the pipe bracket to the cylinder head. Connect the static fill and by-pass hoses to the expansion tank. Position the clamps and tighten the hose clamps securely. Also reconnect the harness connector to the low coolant sensor on the expansion tank.

#### 52

Connect the coolant level sensor located on the radiator right side. Secure sensor harness using tie straps.

#### 53

Fill the cooling system with the recommended coolant using the coolant extractor.

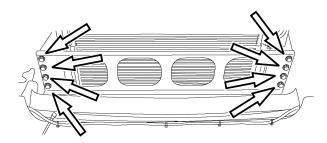
**DBT2V700** 

#### 54

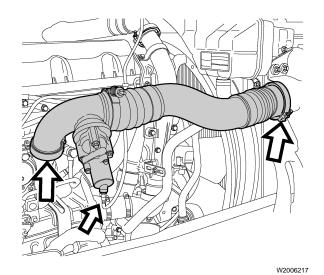
Using the recommended oil, replenish the engine oil to the correct level on the dipstick.

**Note:** Ensure oil pan drain plug is torqued to proper specification.

Install and secure the front closing cross member.



W2006086

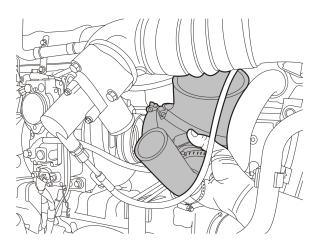


#### 56

Install new O-rings at the ends of the DRV and charge air cooler inlet pipe assembly. Inspect and lubricate the V-band clamps and install the pipe assembly. Tighten the clamps to  $7 \pm 1$  Nm (62  $\pm$  9 in-lb).

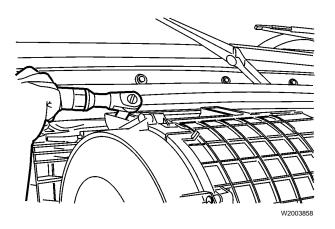
**Note:** Also, connect the air supply line to DRV and tighten the fitting securely.

7 ± 1 Nm (62 ± 9 in-lb)



#### 57

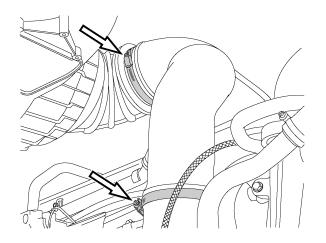
Install the turbocharger inlet elbow. Tighten the DRV and turbocharger inlet clamps.



Position the air filter housing against the cab and install fasteners to secure.



Install the main fresh air pipe between the air filter housing and the turbocharger air inlet elbow. Position the clamps and tighten to secure.

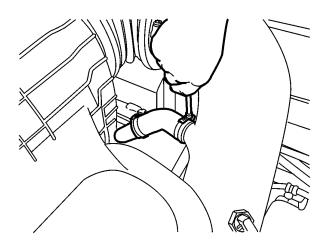


W2006005

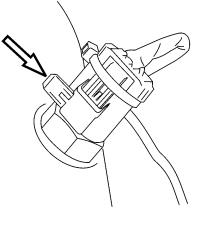
W2004719

## 60

Install the air compressor fresh air hose to the main fresh air pipe, position the clamp and tighten to secure.







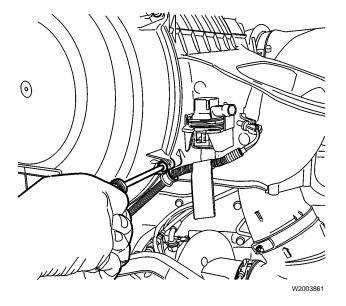


Install the air temperature sensor connector to the sensor. Insert the connector lock tab, push in place and secure with a tie strap. Install the P-clamp to secure the harness to the main fresh air pipe. Torque-tighten the P-clamp bolt to  $8 \pm 1.2 \text{ Nm } (6 \pm 1 \text{ ft-lb}).$ 

 $8 \pm 1.2 \text{ Nm}$  $(6 \pm 1 \text{ ft-lb})$ 



Connect and secure the air filter restriction gauge wiring harness-to-air filter housing.



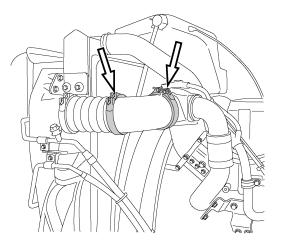
W2004720

### 63

Reconnect the deaeration line between the engine and expansion tank. Tighten the clamp securely.

#### 64

Reconnect the upper coolant hoses located at the thermostat housing (including pipe). Install the upper hose clamps on the left side of the cooler. Install bracket bolts to the cylinder head.



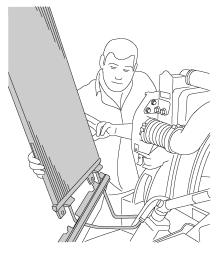
65

Using new O-rings, install the charge air cooler pipe between the mixing chamber and the charge air cooler. Inspect the outlet pipe-to-charge air cooler V-band clamp for wear, galled threads or other damage and replace if necessary. Lubricate v-inserts and T-bolt threads and position the clamp to secure outlet pipe to the charge air cooler. Torque-tighten to specification.

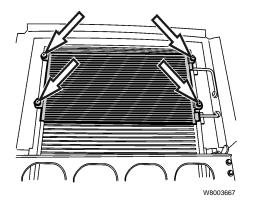


#### 66

Lift and move the A/C condenser (with lines attached) over the radiator assembly and into position at the front of the charge air cooler.

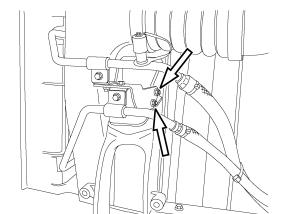


W2006199



## 67

Install and tighten the bolts to secure the A/C condenser to the charge air cooler.



Connect the A/C condenser line bracket bolts on the left side of the radiator.

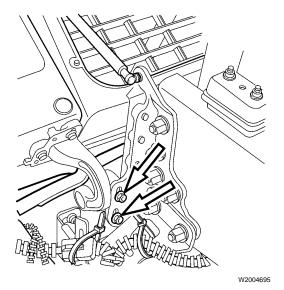
W2006084

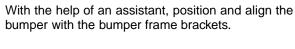
Install the hood by first moving it into position at the front of the vehicle.

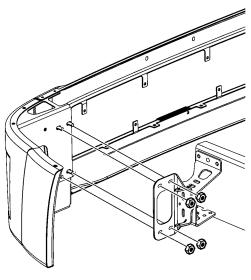
Note: An assistant is required to help lift and support the hood during installation. Use a pallet with protective covering to protect and support the hood.

### 70

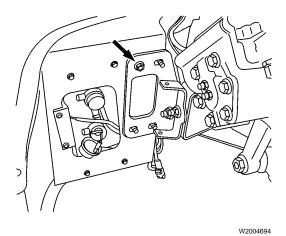
Position the hood hinge on the frame mounts and align the studs with the marks made before removal. Install the flange nuts and tighten to specification. Close the hood and check for proper hood alignment. Also, connect the hood restraint cylinders on both sides of the radiator supports.







W2004743



**72** 

Loosely install one nut on each side to retain the bumper. Install all remaining bumper nuts and tighten to specification.

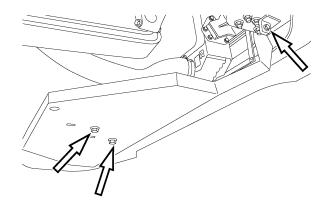
73

Connect the wiring harnesses for the headlights and fog/running lights. Secure the harnesses using tie straps.

74

Recheck the coolant and oil levels. Replenish the oil and coolant as necessary.

Install the rock guard to the frame underneath the radiator, if equipped.



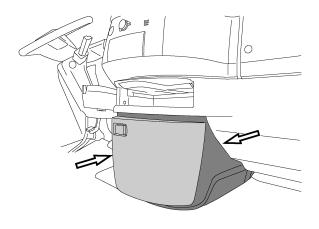
W2006077



Install the engine cover seal ring onto the bulkhead.

## **77**

Install the engine cover.



W8003859

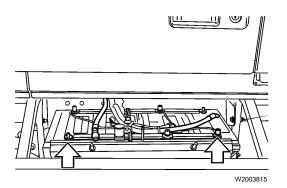
Install the center dash trim panel directly over the engine cover.

### 79

Install the radiator grille.

### 80

Install the inner splash guard assembly.



Install all previously removed cables to the ground (negative) battery terminals.

#### 82

Connect the EECU from the new engine to VCADs and transfer the previously stored parameters from the old engine to the new engine's ECU.

### 83

Connect the engine harness to the engine ECU. Secure the ECU portion of the engine harness using P-clamps and tie straps.

Program the engine/injector trim code configuration.

Using the hand primer pump found on the fuel filter housing, prime the fuel system.

#### 86

Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.