GENERAL INFORMATION

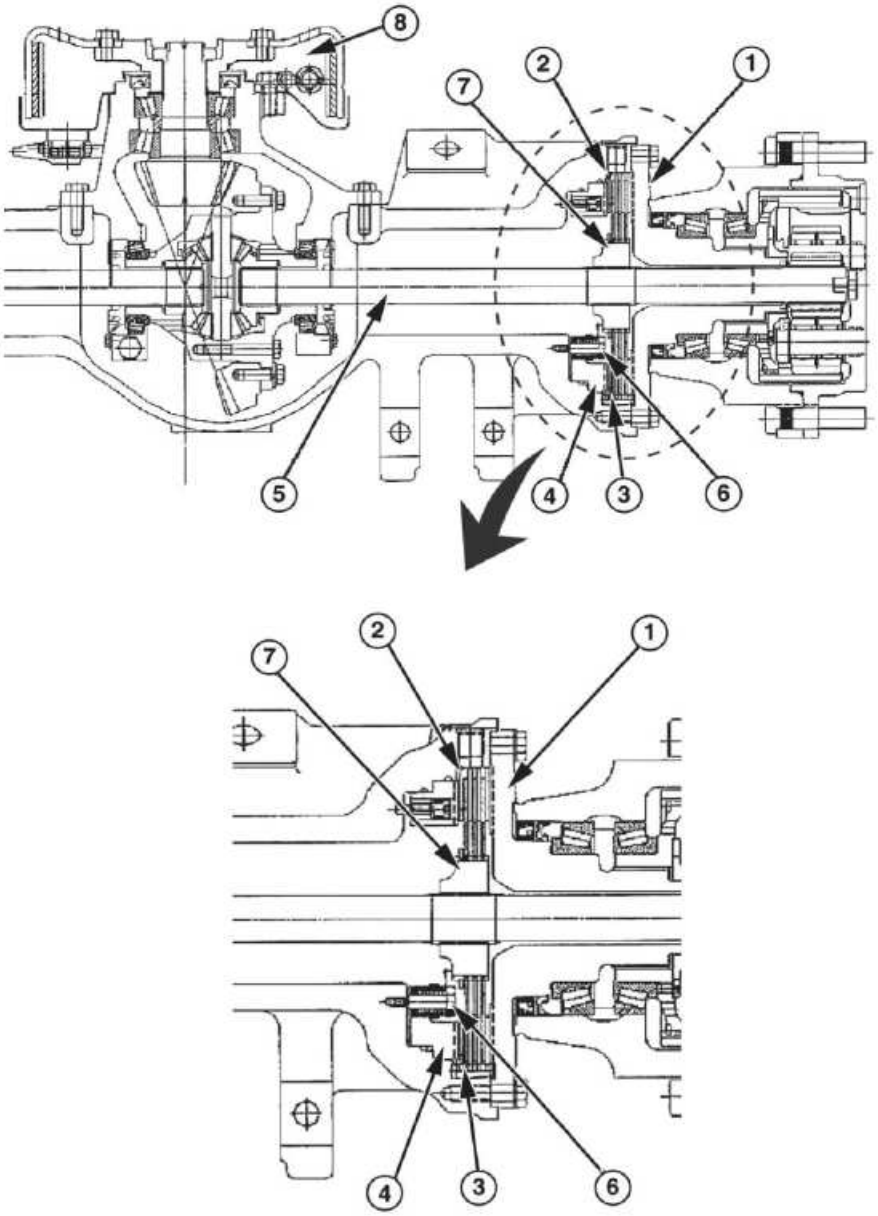
The Specification of PSI 4.3L SI Engine

GENERAL DESCRIPTION	
ENGINE TYPE:	90°4-Cycle V6, Water Cooled
COMBUSTION SYSTEM:	Naturally Aspirated
EXHAUST SYSTEM:	Cast Iron, Dry
VALVE CONFIGURATION:	Pushrod Actuated Overhead Valves - 2 Per Cylinder
	Auto Lash adjustment by hydraulic vavle lifter
CAMSHAFT DRIVING:	Timing Chain System
BALANCE SHAFT:	One Balance Shaft System
DISPLACEMENT:	4294 cc (262 CID)
BORE:	101.60 mm (4.00 in.)
STROKE:	88.39 mm (3.48 in.)
COMPRESSION RATIO:	9.8:1
COMPRESSION PRESSURE:	690 kPA (100 psi) Minimum
FIRING ORDER:	1-6-5-4-3-2
SPARK PLUGS	AC Delco R42LTS or R44LTS, 0.76 mm (0.03i n.) Air Gap
WEIGHT	296 Kg (653 lbs.), Wet
ROTATION:	Counter-Clockwise (CCW) when viewed from Flywheel End
FUELTYPE	LPG
GOVERNED SPEED:	2500 +/- 25 RPM
IDLE RPM:	750 +/- 25 RPM
IGNITION TIMING:	Electronic controlled by ECM
LP FUEL SYSTEM	
MIXER:	Diaphragm Type Air Valve Assembly inside, Downdraft
REGULATOR:	Two-Stage Negative Pressure Regulator
FUEL FILTRATION:	40 Microns Maximum
COOLING SYSTEM	
WATER PUMP ROTATION:	Serpentine Belt Drive - Clockwise (CW) when viewed from engine front
THERMOSTAT:	Opening Temperature: 82°C (180°F)
	Fully Open Temperature: 96°C (205°F)
COOLING WATER CAPACITY	7.3L

Tier 3 Certified Mobile Engine Maintenance Requirements

Perform the following maintenance on the engine at the hours indicated and at equivalent hour intervals thereafter.								
	Interval Hours							
	10	250	500	800	1000	1500	2000	2500
General Maintenance Section								
Visual check for fluid leaks	X							
Check engine oil level	X							
Check coolant level	X							
Change engine oil and filter	**Every 250 hours or monthly**							
Check LPG system for leaks	Prior to any service or maintenance activity							
Inspect accessory drive belts for cracks, breaks, splits or glazing					X			
Inspect electrical system wiring for cuts, abrasions or corrosion							X	
Inspect all vacuum lines and fittings for cracks, breaks, or hardening			X					
Engine Coolant Section								
Clean debris from radiator core	**Every 100 hours or 60 days of operation**							
Change coolant							X	
Inspect coolant hoses for cracks, swelling or deterioration					X			
Engine Ignition System								
Replace spark plugs						X		
Inspect battery case for damage					X			
Check spark plug wires for cuts abrasions or hardening							X	
Replace distributor cap and rotor						X		
Replace spark plug wires						X		

Disc Brake



(1) Spindle. (2) Steel plate. (3) Disc plate. (4) Service piston. (5) Drive shaft. (6) Service piston adjust bolt. (7) Spline collar. (8) Parking brake.

- Sealed up structure of hydraulic disc brake system secures good brake performance.
- Since it is able to use the brake for the long time, there is no need to replace the lining as drum type brake does.
- Major components are 3 disc plates (3), 4 steel plates (2) and service piston (4).

Pinions and Gears

WARNING

Spiral bevel and hypoid pinions and gears are machined in matched sets. When a pinion or ring gear of a set needs to be replaced, both gear and pinion must be replaced at the same time.

Inspect the pinions and gears for wear or damage. Gears that are worn or damaged must be replaced.

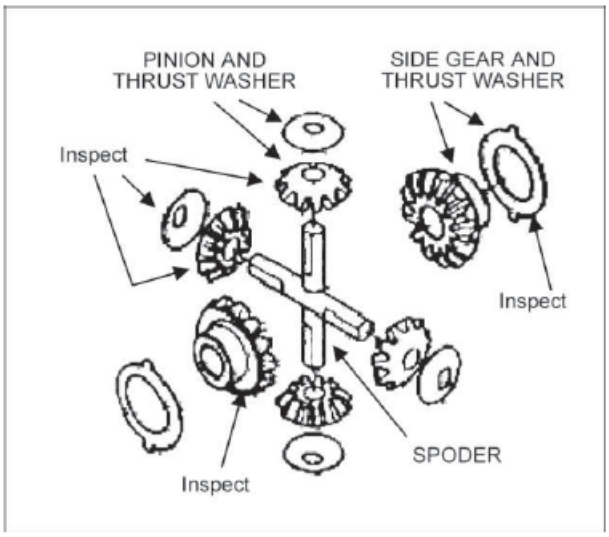
Main Differential Assembly

WARNING

Always replace thrust washers, differential side gears and pinion gears in full matched sets. A higher stress of original parts and early failure of the entire assembly will result if a new part is used in combination with parts that are older or worn.

Inspect the main differential assembly. Parts that are damaged must be replaced. Inspect the following parts for wear or stress.

- Inside surfaces of both case halves.
- surfaces of all thrust washers.
- Trunnion ends of the differential pinion shaft.
- Teeth, splines and thrust surface of differential side gears.
- Teeth, bore and thrust surface of differential pinions.



Axle Shafts

Inspect axle shafts for wear and cracks at the flange, shaft and splines. Replace axle shafts, if required.

Repairing or Replacing Parts

Replace worn or damaged parts of an axle assembly. The following are some examples to check for repair and possible replacement:

- Replace and fastener if comers of the head are worn.
- Replace washers if damaged.
- Replace oil seals or grease seals at the time of axle repair.
- Clean parts and apply new liquid gasket material where required when the axle is assembled.
- Remove nicks, marks and burrs from parts having machined or ground surfaces including axle shaft splines. Use a fine file, India stone, emery cloth or crocus cloth for this purpose.

WARNING

Threads must be without damage and clean so that accurate adjustment and correct torque values can be applied to fasteners and parts.

- Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.
- Tighten all fasteners to correct torque values.

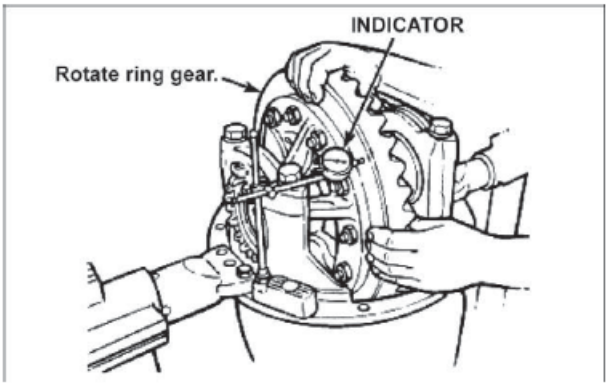
Adjustment after Assembly

Checking the Ring Gear Back face Runout

Runout Specification: Maximum 0.20 mm (0.008 inch)

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Set the dial indicator to zero (0).
4. Rotate the ring gear and read the dial indicator. The runout must not exceed 0.20mm (0.008 inch).

If runout exceeds specifications, remove the differential and ring gear assembly from the carrier. Refer to "Disassembling the Differential Carrier Assembly" in Section "Disassembly" and follow Steps 5 and 6.



5. Check the differential parts, including the carrier, for problems that may cause the ring gear runout to exceed specifications. Repair or replace parts.
6. Re-install the differential and ring gear into the carrier. Refer to "Assembling the Differential Case" in Section "Assembly" of this manual.
7. Repeat the preload adjustment of the differential bearings.

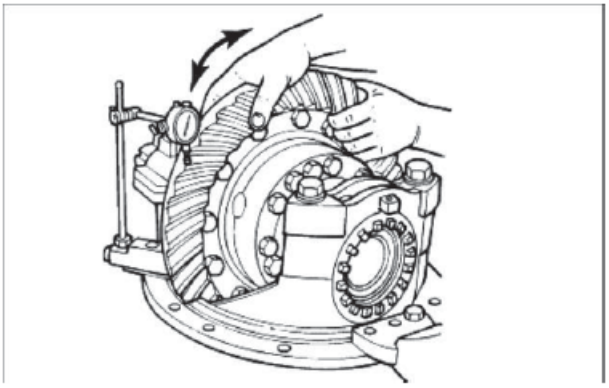
Adjusting Gear set Backlash

Backlash specification: 0.18-0.23 mm (0.007-0.009 inch)

If the old gear set is installed, adjust the backlash to the setting that was measured before the carrier was disassembled.

If a new gear set is installed. adjust the backlash to the correct specification for new gear sets.

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust a dial indicator so that the plunger or pointer is against the tooth surface, near the heel end of the gear tooth. Set the indicator dial to zero (0).



3. Hold the drive pinion in position.
4. Read the dial indicator, while rotating the ring gear a small amount in both directions, against the drive pinion teeth.

NOTE: When you adjust backlash, move the ring gear ONLY. DO NOT move the drive pinion.

5. If the backlash reading is within specification, continue checking tooth contact patterns. Otherwise, adjust backlash. Refer to Step 6, and check, following Steps 1-4.

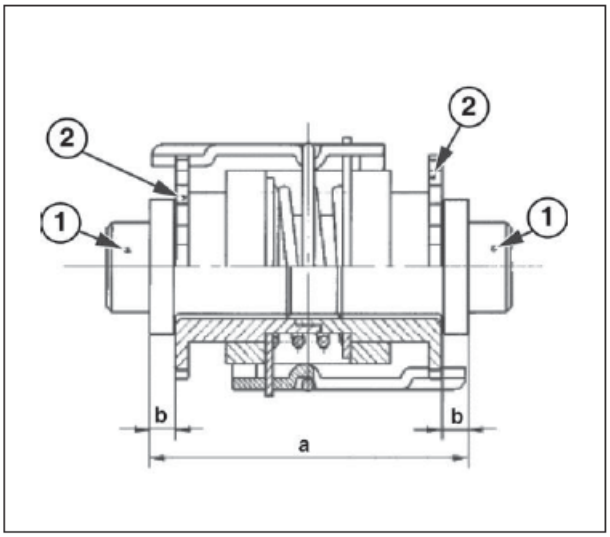
Wheel Brake Adjustment

The brakes make an adjustment automatically when an application is made in forward and reverse. With each application, there will be an adjustment made, until the lining-to-drum clearance is made small enough to stop the movement of the automatic adjuster.

Brake setting is essential when:

1. Renewing, removing or mounting the automatic adjuster.
2. Mounting new brake shoes and brake drums at all stages of repair.
3. Repair work on the brake, where by the basic setting of the threaded bolts has been altered at the automatic adjuster.

Setting work, as well as checking of the clearance between the brake shoes and brake drum must be carried out when the brake is cold. The driving and parking brake must always be adjusted together.



Brake Adjuster (1) Adjusting Screws. (2) Adjusting Wheels.

Setting Procedure

During setting, the parking brake must be released, i.e. the cables should not be tensioned.

1. Jack up the vehicle
2. Release the brake cables
3. Remove the brake drum
4. Carefully raise the adjusting lever by using a screw driver or similar tool through the opening in the brake plate to permit the adjusting wheel to turn freely.
5. Adjust the brake diameter to meet diameter = mm by turning the adjusting wheel.
6. During this setting work, take care to ensure an even distance “b” of the adjusting screws (1) to the relevant adjusting wheel (2).

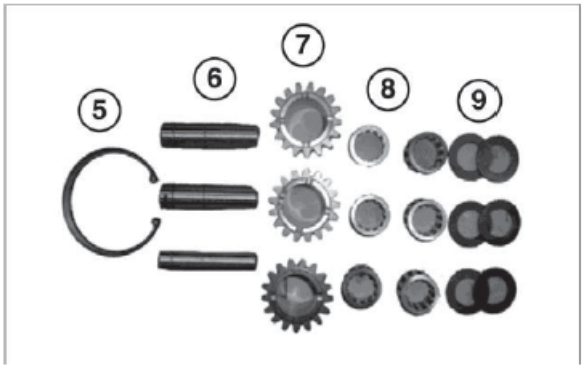
Remark:

Precise adjustment of the relevant brake diameter is decisively important for the function of the automatic adjuster. An insufficient high setting could result in damage to the adjuster.

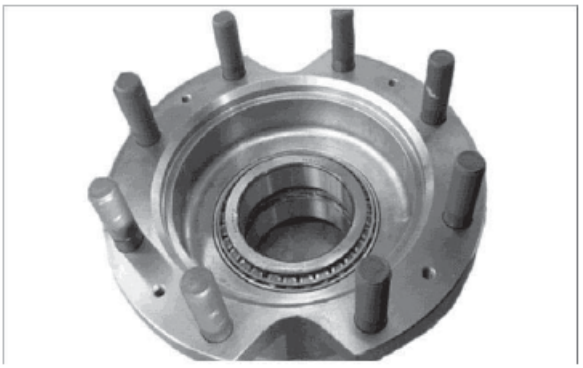
Remark:

The brake cables may not be pretensioned, as otherwise it is not possible to guarantee perfect function of the adjuster.

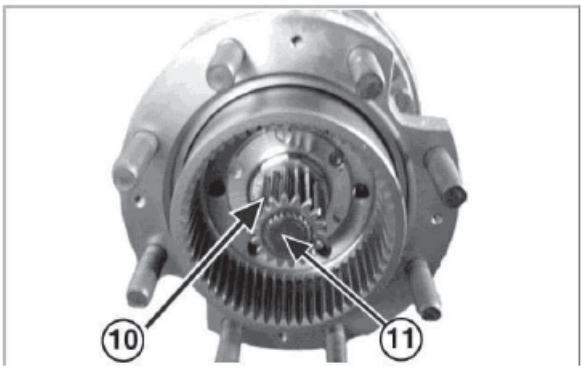
7. Mount the brake drum.
8. Release hexagonal for fastening the automatic adjuster.
9. Actuate the brake several times to centre the brake shoes/ the adjuster in the brake drum.
10. Afterwards tighten hexagonal screw to a torque of 120 + 20 N•m (88.6 + 14.7 lb•ft).
11. Tighten the hands brake lever. The wheels should be equally difficult to turn in this setting.



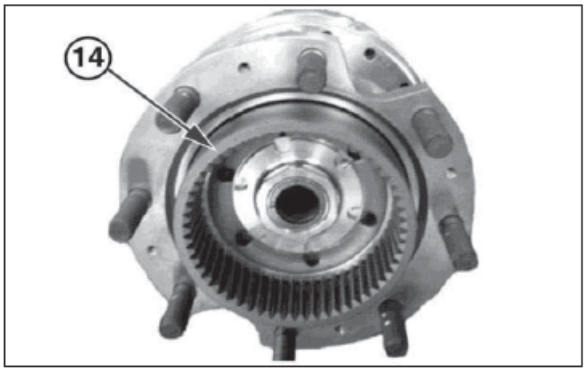
7. Remove needle bearing (8), planetary gear (7) and thrust washer (9).



10. After removing bolt (13), remove ring gear (14) and torque plate assembly from the axle tube.

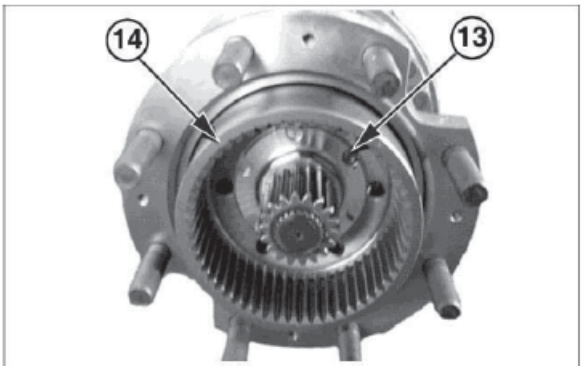


8. Remove sun gear (10) and drive shaft (11)



11. Remove snap ring from the ring gear (14) and disassemble the internal gear carrier.

9. Remove snap ring (12) and then, remove sun gear (10) from the shaft (11).



12. Remove bearing cup from the wheel hub by using jig and hammer. Shaft seal will be damaged.

Engine Mechanical

Diagnostic Information and Procedures

Base Engine Misfire Diagnosis	
Checks	**Action**
Engine Performance diagnosis procedures are covered in Engine Controls and should be consulted for diagnosis of any Drivability, Emissions or Malfunctioning Indicator Lamp (MIL) concerns. The following diagnosis covers common concerns and possible causes. When the proper diagnosis is made, the concern should be corrected by adjustment, repair or replacement as required. Refer to the appropriate section of the service manual for each specific procedure. This diagnostic table will assist in engine misfire diagnosis due to a mechanical concern such as a faulty engine camshaft, worn or damaged bearings or bent valve pushrod. This table will not isolate a crossed fuel injector wire, faulty fuel injector or any other drivability component failure that may cause a misfire. The Powertrain On-Board Diagnostic System checks must be performed first. When using this table to make a Base Engine Misfire diagnosis, begin with the preliminary information below and then proceed to the specific category.	
Preliminary	1. Perform a visual inspection of the following: • A loose or improperly installed engine flywheel or crankshaft balancer • Worn, damaged or misaligned accessory drive system components 2. Listen to the engine for any abnormal internal engine noises. 3. Inspect the engine for acceptable oil pressure. 4. Verify if the engine has excessive oil consumption. 5. Verify if the engine has excessive coolant consumption. 6. Perform a compression test on the engine.
Intake Manifold Leaks	An intake manifold that has a vacuum leak may cause a misfire. Inspect for the following: • Improperly installed or damaged vacuum hoses • Faulty or improperly installed lower intake manifold and/or gaskets Cracked or damaged lower intake manifold • Improperly installed MAP sensor • The sealing grommet of the MAP sensor should not be torn or damaged Improperly installed throttle body or damaged gasket • Warped intake manifold • Warped or damaged cylinder head sealing surface
Coolant Consumption	Coolant consumption may or may not cause the engine to overheat. Inspect for the following: • External coolant leaks • Faulty cylinder head gasket • Warped cylinder head • Cracked cylinder head • Damaged engine block

Oil Leak Diagnosis				
Step	**Action**	**Value(s)**	**Yes**	**No**
IMPORTANT You can repair most fluid leaks by first visually locating the leak, repairing or replacing the component, or by resealing the gasket surface. Once the leak is identified, determine the cause of the leak. Repair the cause of the leak as well as the leak itself.				
1	1. Operate the vehicle until it reaches normal operating temperature. 2. Park the vehicle on a level surface, over a large sheet of paper or other clean surface.	—	Go to Step 2	System OK
2	Can you identify the type of fluid and the approximate location of the leak?	—	Go to Step 10	Go to Step 3
3	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	—	Go to Step 10	Go to Step 4
4	1. Completely clean the entire engine and surrounding components. 2. Operate the vehicle for several kilometers (miles) at normal operating temperature and at varying speeds. 3. Park the vehicle on a level surface, over a large sheet of paper or other clean surface. 4. Wait (15 minutes). 5. Identify the type of fluid and the approximate location of the leak. Can you identify the type of fluid and the approximate location of the leak?	—	Go to Step 10	Go to Step 5
5	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	—	Go to Step 10	Go to Step 6

Drive Belt Vibration Diagnosis

Diagnostic Aids

The accessory drive components can have an effect on engine vibration. Such as, but not limited to the A/C system overcharged, the power steering system restricted or the incorrect fluid or an extra load on the generator. To help identify an intermittent or an improper condition, vary the loads on the accessory drive components.

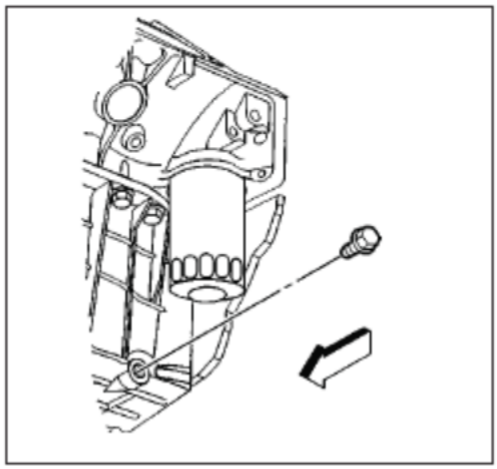
Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

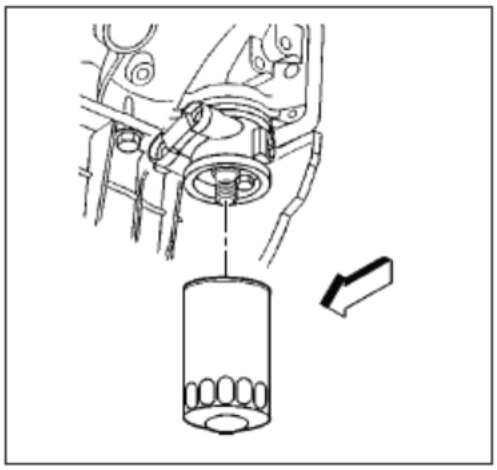
1. This test is to verify that the symptom is present during diagnosing. Other vehicle components may cause a similar symptom such as the exhaust system or the drivetrain.
2. This test is to verify that the drive belt(s) or accessory drive components may be causing the vibration.When removing the drive belt the water pump may not be operating and the engine may overheat. Also, DTC's may set when the engine is operating with the drive belt removed.
3. The drive belt(s) may cause a vibration. While the drive belt(s) is removed, inspect the condition of the belt.
4. Inspecting the fasteners can eliminate the possibility that a wrong bolt, nut, spacer or washer was installed.
5. This step should only be performed if the fan is driven by the drive belt. Inspect the engine cooling fan for bent, twisted, loose or cracked blades. Inspect the fan clutch for smoothness, ease of turning. Inspect for a bent fan shaft or bent mounting flange.
6. This step should only be performed if the water pump is driven by the drive belt. Inspect the water pump shaft for being bent. Also inspect the water pump bearings for smoothness and excessive lay. Compare the water pump with a known good water pump.
7. Accessory drive component brackets that are bent, cracked or loose may put extra strain on that accessory component causing it to vibrate

Draining Fluids and Oil Filter Removal

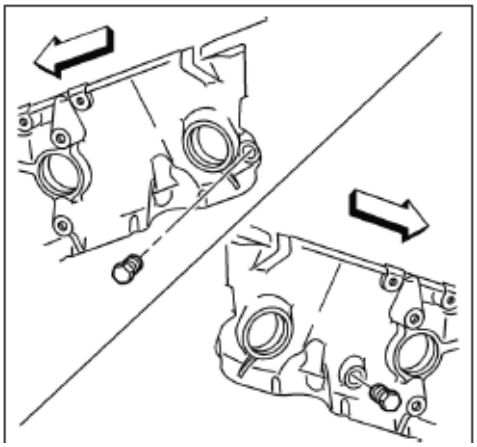
1. Remove the oil pan drain plug and allow the engine oil to drain into a suitable container.



2. Remove the oil filter (if applicable).
3. Discard the oil filter (if applicable).

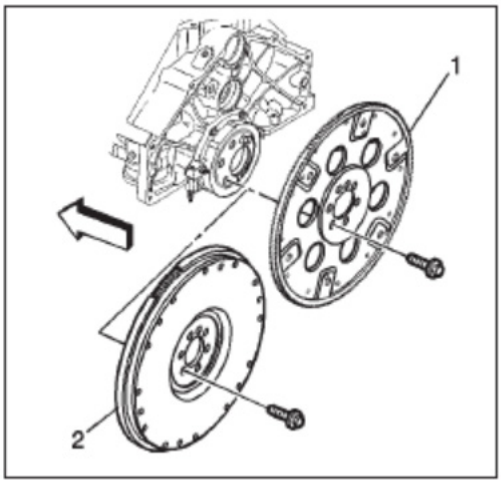


4. Remove both the engine block coolant drain hole plugs and allow the coolant to drain into a suitable container.



Engine Flywheel Removal

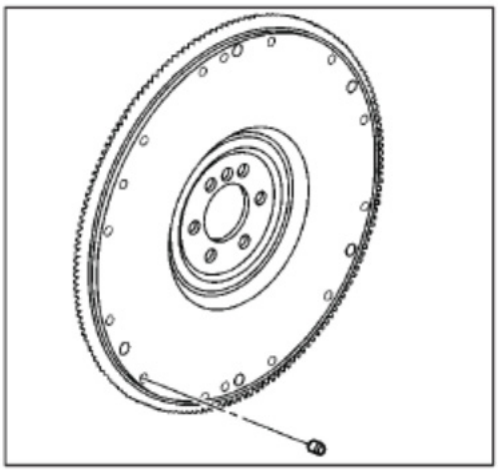
1. Remove the engine flywheel bolts.
2. Remove the engine flywheel (automatic transmission) (1), if applicable.
3. Remove the engine flywheel (manuals transmission) (2), if applicable.



IMPORTANT

If replacing the engine flywheel (manual transmission), then NEW flywheel weights must be installed into the NEW engine flywheel in the same location as the old flywheel weights in the old engine flywheel.

4. Note the position of any flywheel weights for assembly (if applicable).



Valve Lifter Removal

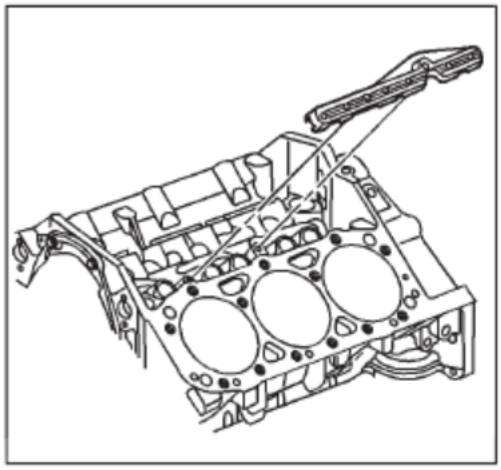
Tools Required

J 3049-A Valve Lifter Remover

IMPORTANT

Place the components in a rack so that the components can be reinstalled to their original location.

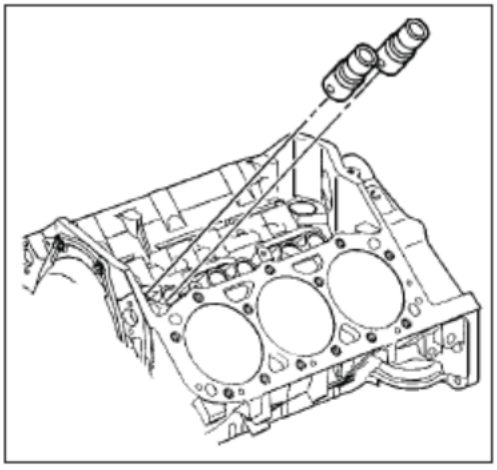
1. Remove the bolts and the valve lifter pushrod guide.



IMPORTANT

Place the valve lifters in the rack in the upright position in order to maintain the oil inside the valve lifters.

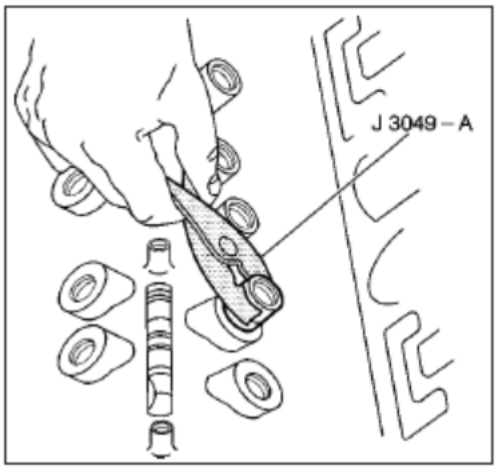
2. Remove the valve lifters.

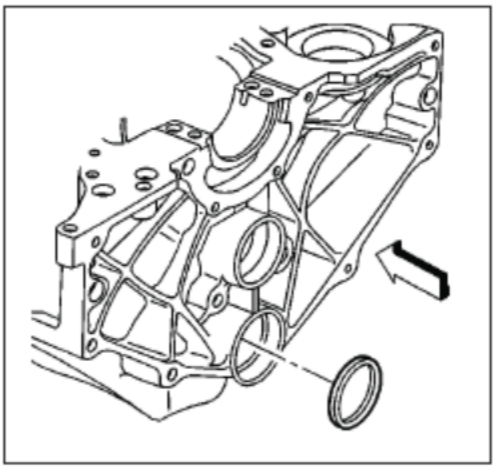


IMPORTANT

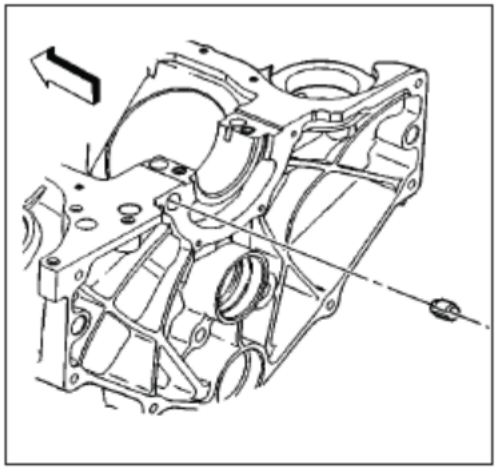
Some valve lifters may be stuck in the valve lifter bores because of gum or varnish deposits and may require the use of J 3049-A for removal.

3. Use the J 3049-A in order to remove the stuck valve lifters.

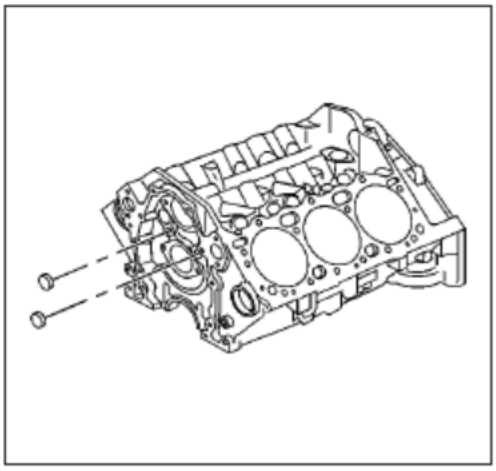




8. Remove the spring type S pin (crankshaft rear oil seal housing locator) (if required).



9. Remove the front oil gallery plugs or balls from the front of the engine block and discard.
10. Insert a 3/8 x 26 in. rod into the rear oil gallery holes in order to drive out the front oil gallery plugs or balls.

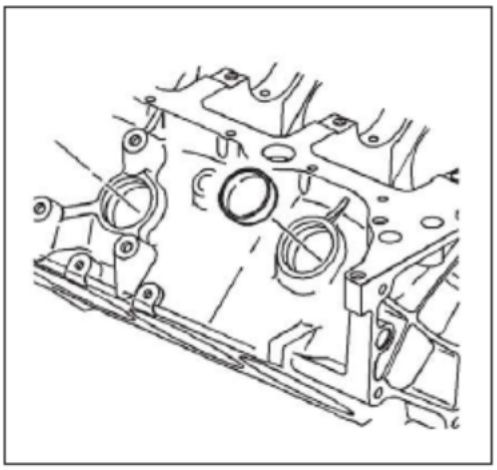


11. Remove the engine block core hole plugs.

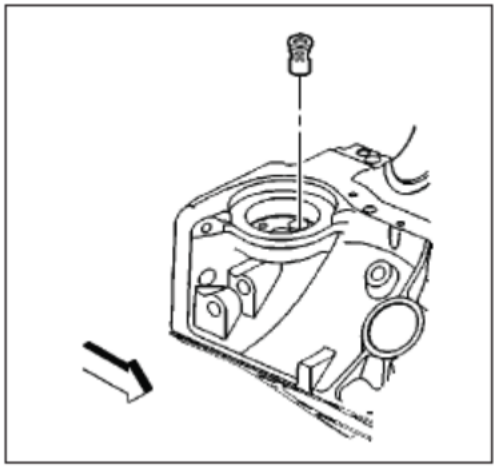
11.1. Use a suitable tool in order to drive the engine block core hole plugs into the coolant jacket.

11.2. Use a suitable tool in order to pull the engine block core hole plugs from the coolant jacket.

11.3. Discard the engine block core hole plugs.



12. Remove the oil filter bypass valve and discard.



Piston Selection

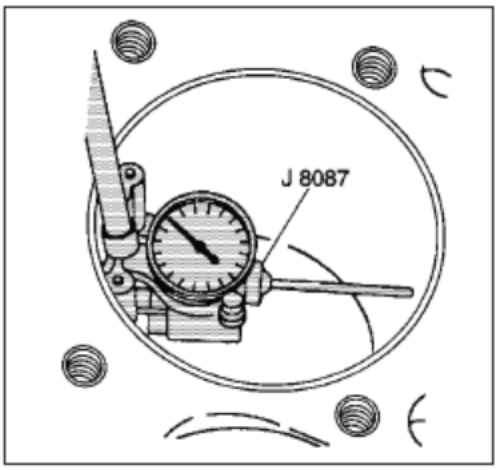
Tools Required

J 8087 Cylinder Bore Gauge

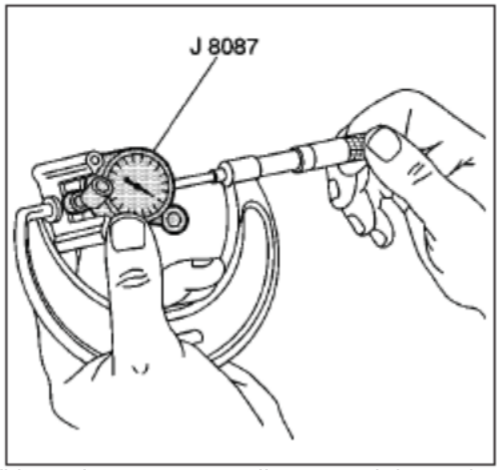
IMPORTANT

Measurements of all components should be taken with the components at normal room temperature. For proper piston fit, the engine block cylinder bores should not have excessive wear or taper. A used piston and piston pin set may be reinstalled if, after cleaning and inspection, the piston and piston pin are within specifications.

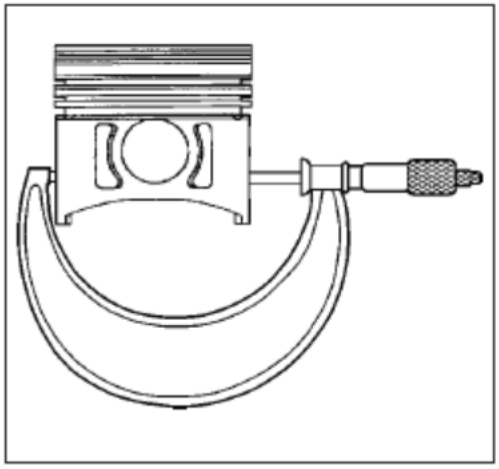
1. Use the J 8087 in order to measure the cylinder bore diameter. Measure at a point 64 mm (2.5 in) from the top of the cylinder bore and 90 degrees to the crankshaft centerline.



2. Measure the J 8087 with a micrometer and record the reading.



3. With a micrometer or caliper at a right angle to the piston pin bore, measure the piston 11 mm (0.433 in) from the bottom of the skirt.
4. Subtract the piston diameter from the cylinder bore diameter in order to determine piston-to-bore clearance. Refer to Engine Mechanical Specifications.
5. If the proper clearance cannot be obtained, then select another piston and measure the clearances. If the proper fit cannot be obtained, the cylinder bore may require honing or boring.
6. When the piston-to-cylinder bore clearance is within specifications, permanently mark the top of the piston for installation into the proper cylinder.

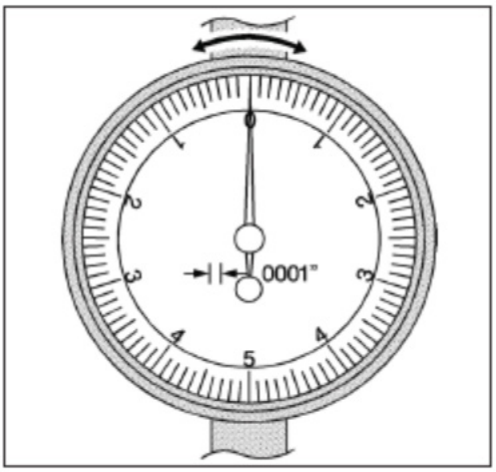


22. Load the handle in the forward position and zero the dial indicator. Load the handle multiple times in both directions and record the reading.

IMPORTANT

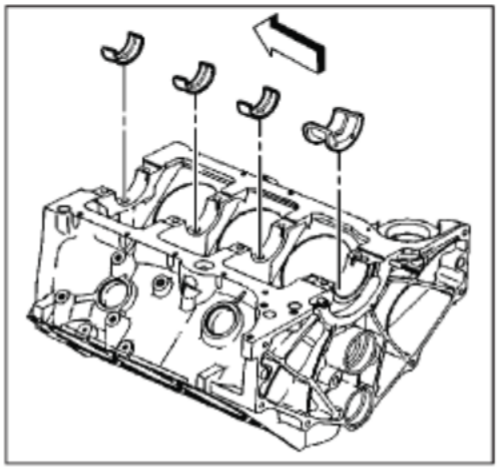
During this procedure, card stock may enter the crankshaft journal oil galleries. Be sure to remove all card stock from the bearing journal and oil galleries prior to reassembly.

23. Remove the bearing cap bolts, cap and paper stock.
24. Replace the bearing halves as required to obtain the proper bearing clearances.
25. Install the bearings, cap and bolts. Refer to Fastener Tightening Specifications.

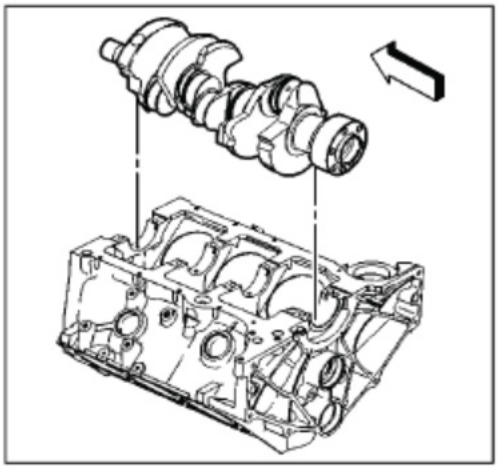


Measuring Crankshaft Bearing Clearances (Plastic Gauge Method)

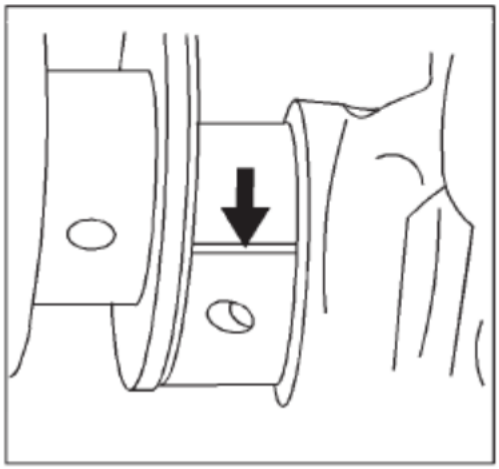
1. Install the crankshaft bearings into the engine block.



2. Install the crankshaft.



3. Install the gauging plastic the full width of the journal.



Balance Shaft Bearing and/or Bushing Removal

Tools Required

J 26941 Bushing/Bearing Remover

J 38834 Balance Shaft Service Kit

CAUTION

Refer to Safety Glasses Caution in Cautions and Notices.

1. Use the J 38834 and the J 26941 in order to remove the balance shaft rear bearing.

1.1. Install the J 26941 legs behind the balance shaft rear bearing and secure.

1.2. Install the J 38834-1 with the short threaded end through the balance shaft bore in the front of the engine block.

1.3. Install the J 38834-1 into the J 26941.

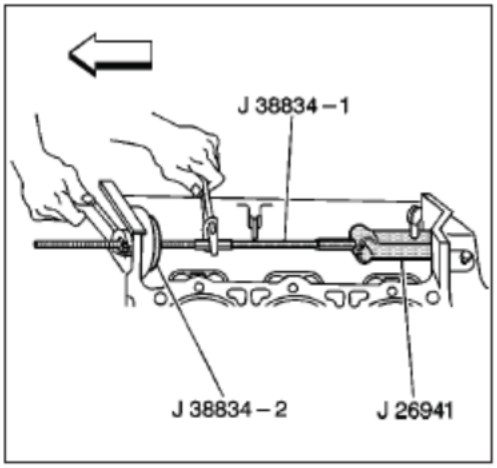
1.4. Slide the J 38834-2 onto the J 38834-1 and into the balance shaft bore of the engine block.

1.5. Install the J 38834 bearing, washer and nut onto the J 38834-1.

1.6. Using a wrench, secure the J 38834-1 and then rotate the J 38834 nut clockwise until the balance shaft rear bearing is removed from the engine block.

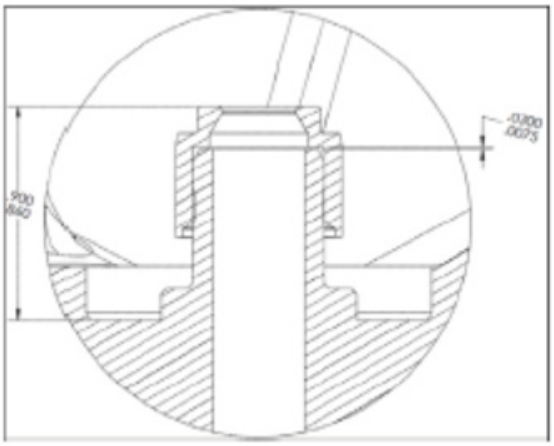
1.7. Remove the J 26941 from the balance shaft rear bearing.

2. Discard the balance shaft rear bearing.

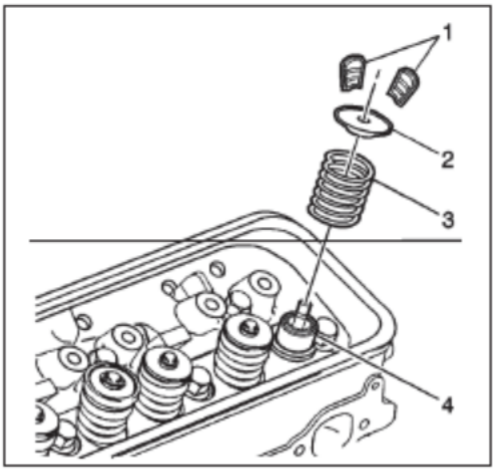


5. Install the valve stem oil seal onto the valve guide using the special tool SK69070.
6. Inspect the valve stem oil seal. The valve stem oil seal should not be bottomed against the valve guide.

The distance measured between the top of the seal and the bottom of the head should be between 0.860”-0.900” as shown on the image.



7. Install the valve spring (3).
8. Install the valve spring cap (2) onto the valve spring (3) and over the valve stem.



CAUTION

Compressed valve springs have high tension against the valve spring compressor. Valve springs that are not properly compressed by or released from the valve spring compressor can be ejected from the valve spring compressor with intense force. Use care when compressing or releasing the valve spring with the valve spring compressor and when removing or installing the valve stem keys. Failing to use care may cause personal injury.

CAUTION

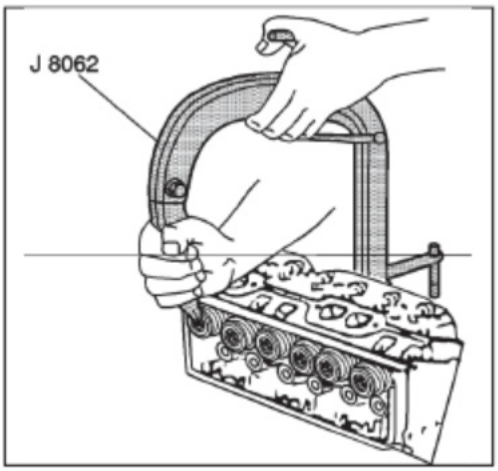
Refer to Safety Glasses Caution in Cautions and Notices.

9. Use the J 8062 in order to compress the valve springs.
10. Install the valve stem keys.

10.1 Use grease in order to hold the valve stem keys in place while disconnecting the J 8062.

10.2. Look to ensure that the valve stem keys seat properly in the upper groove of the valve stem.

10.3. Tap the end of the valve stem with a plastic-faced in order to seat the valve stem keys, if necessary.



Engine Block Plug Installation

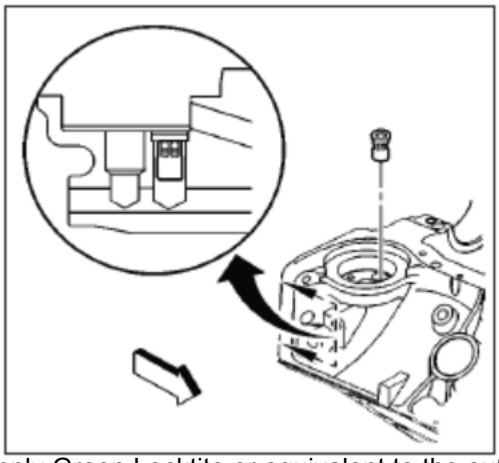
Tools Required

J 41712 Oil Pressure Switch Socket

CAUTION

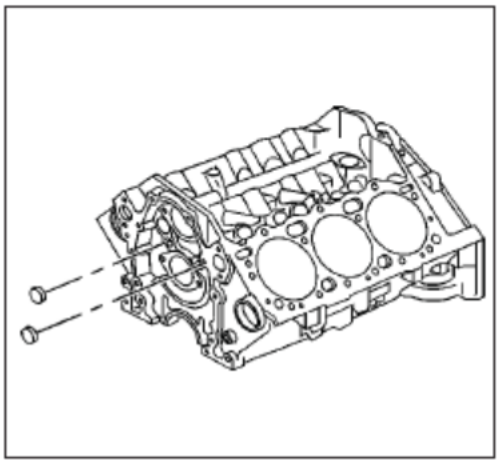
Refer to Safety Glasses Caution in Cautions and Notices.

1. Install a NEW oil filter bypass valve.
- Install the oil filter bypass valve into the oil gallery bore until slightly below flush with the surface of the engine block.
- Using a pointed punch, stake the engine block area around the oil filter bypass valve.



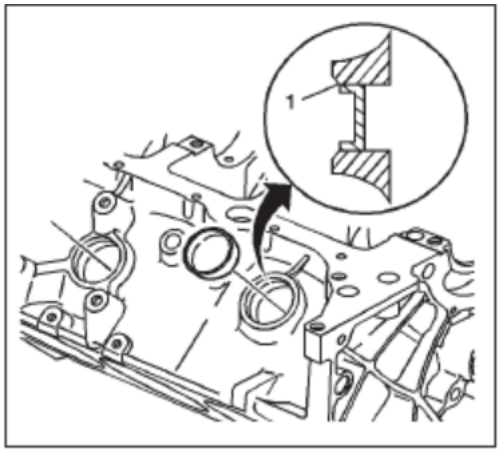
2. Apply Green Locktite or equivalent to the outside diameter of the NEW front engine oil gallery plugs.
3. Install the NEW front engine block oil gallery plugs.

A properly installed front engine oil gallery plug must be installed slightly below flush with the front face of the engine block

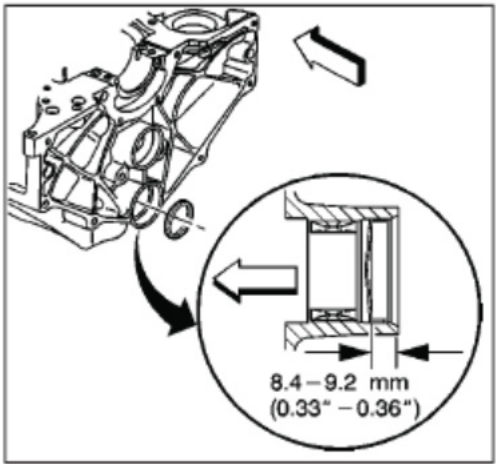


4. Apply Aviation Form-A-Gasket Liquid Sealant or equivalent to the outside diameter of the NEW engine block core hole plugs.
5. Install the NEW engine block core hole plugs.

A properly installed engine block core hole plug must be installed flush with the bottom of the chamfer (1) of the engine block core hole.



6. Apply Green LockTite or equivalent to the outside diameter of the NEW expansion cup plug (balance rear bearing hole).
7. Install the NEW expansion cup plug (balance shaft rear bearing hole).



Balance Shaft Installation

Tools Required

J 8092 Universal Driver Handle

J 36660 Electronic Torque Angle Meter

J 36996 Balance Shaft Installer

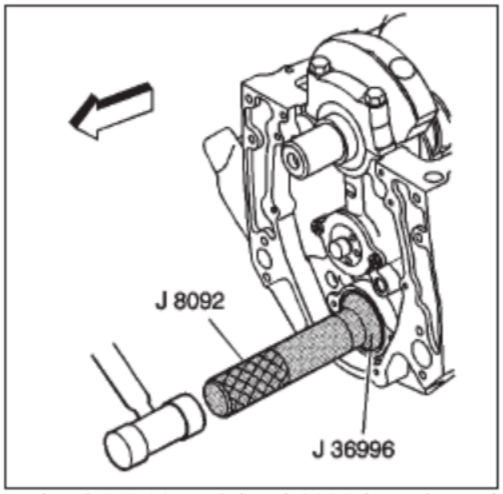
IMPORTANT

The balance shaft and the balance shaft front bearing are serviced only as an assembly. Do not remove the balance shaft front bearing from the balance shaft.

1. Apply clean engine oil GM P/N 12345610 or equivalent to the balance shaft front bearing.

CAUTION

Refer to Safety Glasses Caution in Cautions and Notices.



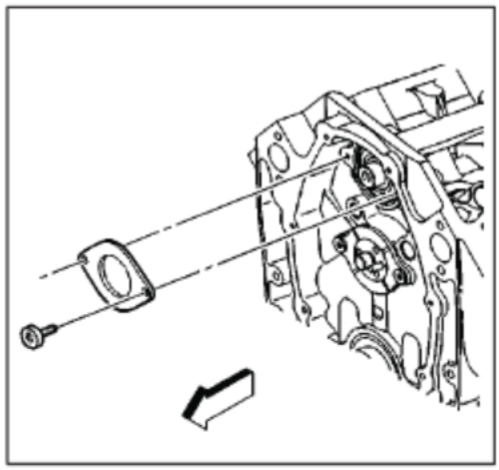
2. Use the J 36996 and the J 8092 in order to install the balance shaft. Apply Clevite Gear Lubricant or equivalent to balance shaft retainer.

Notice: Refer to Fastener Notice in Cautions and Notices.

3. Apply Blue Locktite or Equivalent to balance shaft retainer bolts.
4. Install the balance shaft retainer and bolts.

Tighten

Tighten the balance shaft retainer bolts to 12 N•m (106 lb•in).



Install the balance shaft driven gear onto the balance shaft.

5. If reusing the fastener, apply Blue threadlock or equivalent to the threads of the balance shaft driven gear bolt. Use BLUE Locktite
6. Install the balance shaft driven gear bolt.

6.1. Use a wrench to secure the balance shaft.

Place the wrench onto the balance shaft near to the balance shaft front bearing.

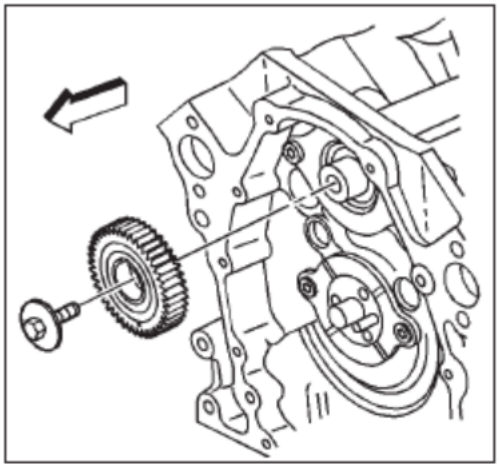
6.2. Install the balance shaft driven gear bolt.

Tighten

6.2.1. Tighten the balance shaft driven gear

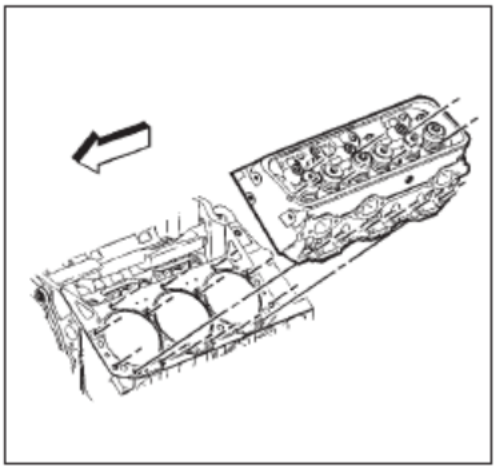
bolt on the first pass to 20 N•m (15 lb•ft.).

6.2.2. Tighten the balance shaft driven gear bolt on the final pass using the J 36660 an additional 35 degrees.



5. Install the cylinder head onto the engine block.

Guide the cylinder head carefully into place over the dowel pins and the cylinder head gasket.



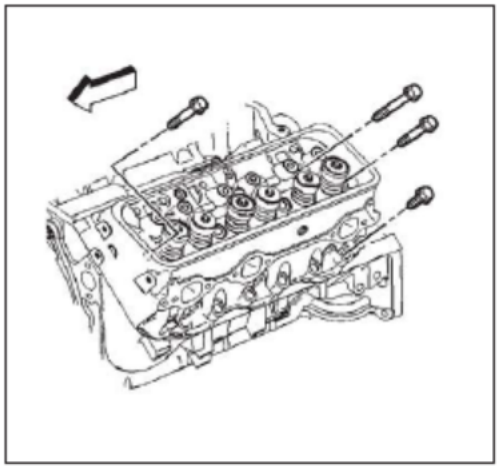
6. Apply PTFE sealant or equivalent to the threads of the cylinder head bolts.

Notice: Refer to Fastener Notice in Cautions and Notices.

7. Install the cylinder head bolts finger tight.

Notice: Bolt number locations refer to torque sequence in steps 12 and 13.

8. Place the (5) long bolts into positions 1, 4,5,8,9.
9. Place the (2) medium bolts into positions 12 and 13.
10. Place the (6) short bolts into positions 2, 3,6,7,10,11.
11. Snug each bolt.



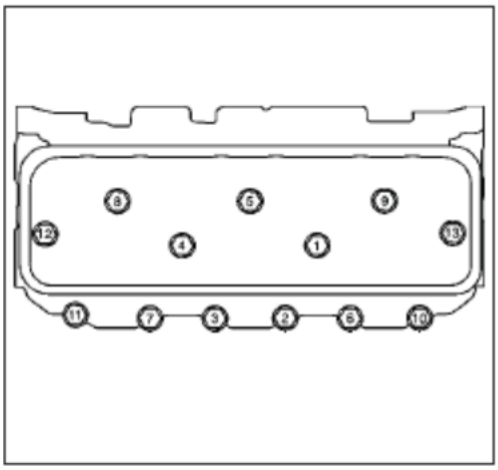
12. Tighten the cylinder head bolts in sequence on the first pass.

Tighten

Tighten the bolts in sequence on the first pass to 30 N•m (22 lb•ft.).

13. Use the J 36660 in order to tighten the cylinder head bolts in sequence on the final pass.

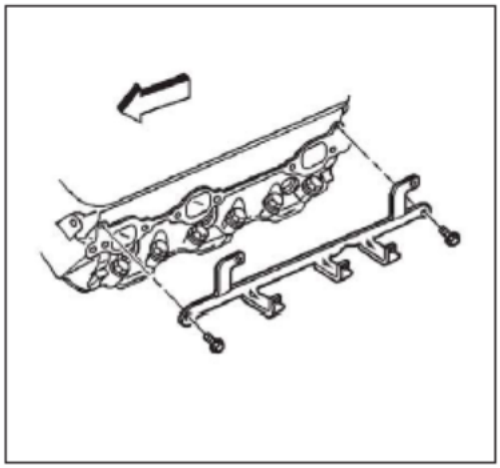
- Tighten the long bolts (1,4,5,8 and 9) on the final pass in sequence to 75 degrees.
- Tighten the medium bolts (12 and 13) on the final pass in sequence to 65 degrees.
- Tighten the short bolts (2,3,6,7,10 and 11) on the final pass in sequence to 55 degrees.



14. Install the spark plug wire support and bolts.

Tighten

Tighten the spark plug wire support bolts to 12 N•m (106 lb•in).

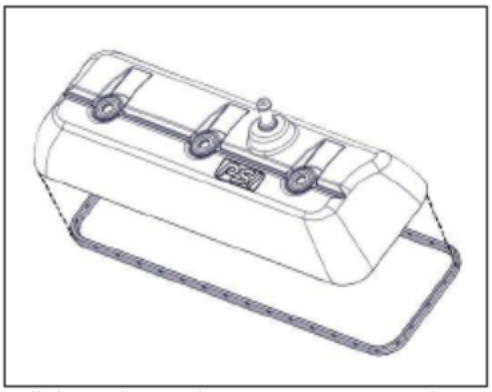


Valve Rocker Arm Cover Installation (Right)

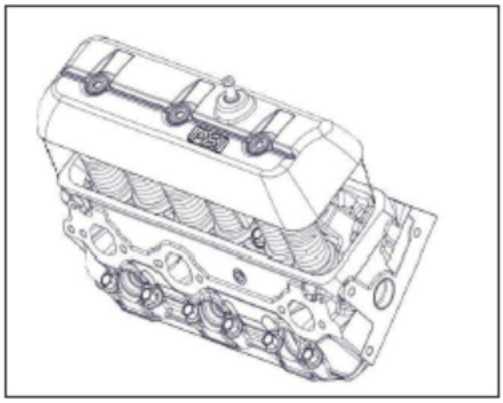
IMPORTANT

Do not reuse the valve rocker arm cover gasket or the valve rocker arm cover bolt grommets.

1. Install the NEW valve rocker arm cover gasket into the groove of the valve rocker arm cover.
2. Install the NEW valve rocker arm cover bolt grommets into the valve rocker arm cover.



3. Install the valve rocker arm cover onto the cylinder head.



4. Install the valve rocker arm cover bolts.

Tighten

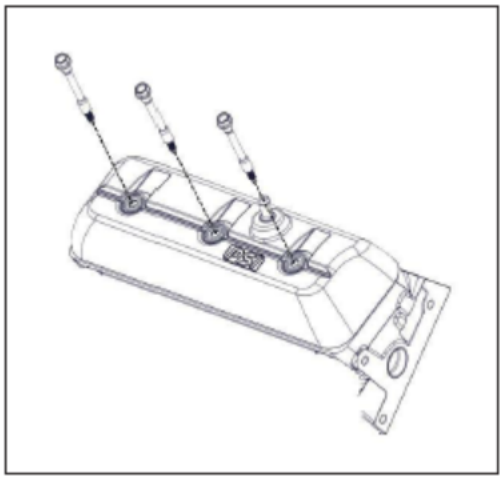
Tighten the valve rocker arm cover bolts to 12 N•m (106 lb•in). Torque from the center out.

Notice: Refer to Fastener Notice in Cautions and Notices.

5. Install the valve rocker arm cover bolts.

Tighten

Tighten the valve rocker arm cover bolts to 12 N•m (106 lb•in). Torque from the center out.



Aerobic Type Room Temperature Vulcanizing (RTV) Sealant

Aerobic type Room Temperature Vulcanizing (RTV) sealant cures when exposed to air. This type of sealant is used where 2 components (such as the intake manifold and the engine block) are assembled together.

Use the following information when using RTV sealant:

- • Do not use RTV sealant in areas where extreme temperatures are expected. These areas include:
  - The exhaust manifold
  - The head gasket
  - Any other surfaces where a different type of sealant is specified in the service procedure
- Always follow all the safety recommendations and the directions that are on the RTV sealant container.
- Use a plastic or wood scraper in order to remove all the RTV sealant from the components.

IMPORTANT

Do not allow the RTV sealant to enter any blind threaded holes, as it may prevent the fasteners from clamping properly or cause damage when the fastener is tightened.

The surfaces to be sealed must be clean and dry.

- Use a RTV sealant bead size as specified in the service procedure.
- Apply the RTV sealant bead to the inside of any bolt hole areas.
- Assemble the components while the RTV sealant is still wet to the touch (within 3 minutes). Do not wait for the RTV sealant to skin over.
- Tighten the fasteners in sequence (if specified) and to the proper torque specifications. DO NOT over tighten the fasteners.
- The threaded surfaces must be clean and dry.
- Apply the threadlock sealant as specified on the threadlock sealant container.

IMPORTANT

Fasteners that are partially torqued and then the threadlock sealant is allowed to cure more than five minutes, may result in incorrect clamp load of assembled components.

IMPORTANT:

The fuel cylinder manual valve contains an “Excess Flow Check Valve” open the manual valve slowly to prevent activating the “Excess Flow Check Valve.”

14. Check for leaks at the inlet and outlet fittings using a soapy solution or an electronic leak detector. If leaks are detected make repairs. Check coolant line connections to ensure no leaks are present.
15. Start engine recheck for leaks at the regulator.
16. Dispose of any drained material in safe and proper manner.

Air Fuel Mixer/Throttle Control Device Maintenance and Inspection

IMPORTANT:

The Air Fuel Mixer components have been specifically designed and calibrated to meet the fuel system requirements of the emission certified engine. The mixer should not be disassembled or rebuilt. If the mixer fails to operate or develops a leak the mixer should be replaced with Crown genuine part.

When inspecting the mixer check for the following items:

- Leaks at the inlet fitting.
- Fuel inlet hose for cracking, splitting or chaffing, replace if any of these condition exist.
- Ensure the mixer is securely mounted and is not leaking vacuum at the mounting gasket or surface.
- Inspect air inlet hose connection and clamp. Also inspect inlet hose for cracking, splitting or chafing. Replace if any of these conditions exist.
- Inspect Air cleaner element according to the Recommended Maintenance Schedule found in this section.
- Check Fuel lines for cracking, splitting or chafing. Replace if any of these conditions exist.
- Check for leaks at the throttle body and intake manifold.

Exhaust System and Catalytic Converter Inspection and Maintenance

IMPORTANT:

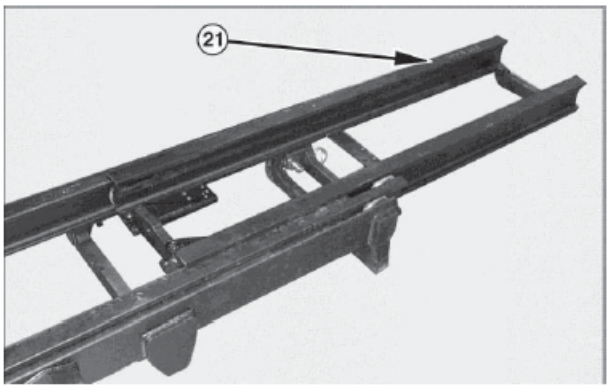
The exhaust system on this emission certified engine contains a Heated Exhaust Gas Oxygen Sensor (HEGO) which provides feed back to the ECM on the amount of oxygen present in the exhaust stream after combustion.The oxygen in the exhaust stream is measured in voltage and sent to the ECM. The ECM then makes corrections to the fuel air ratio to ensure the proper fuel charge and optimum catalytic performance. Therefore, it is important that the exhaust connections remain secured and air tight.

IMPORTANT:

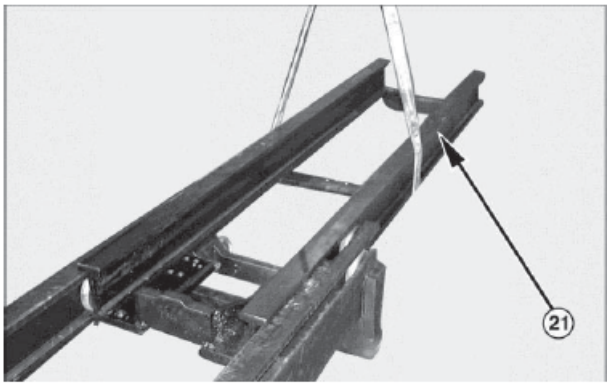
The HEGO sensor is sensitive to silicone based products. Do not use silicone sprays or hoses which are assembled using silicone lubricants. Silicone contamination can cause severe damage to the HEGO.

When inspecting the Exhaust system check the following:

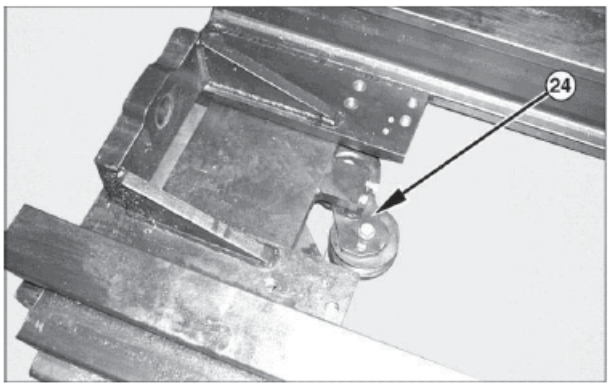
- Exhaust manifold at the cylinder head for leaks and that all retaining bolts and shields (if used) are in place.
- Manifold to exhaust pipe fasteners to ensure they are tight and that there are no exhaust leaks repair if necessary.
- HEGO electrical connector to ensure connector is seated and locked, check wires to ensure there is no cracking, splits chafing or “burn through.” Repair if necessary.
- Exhaust pipe extension connector for leaks tighten if necessary
- If the engine is equipped with a catalytic converter inspect the converter to ensure it is securely mounted.
- Check for any leaks at the inlet and outlet of the converter.



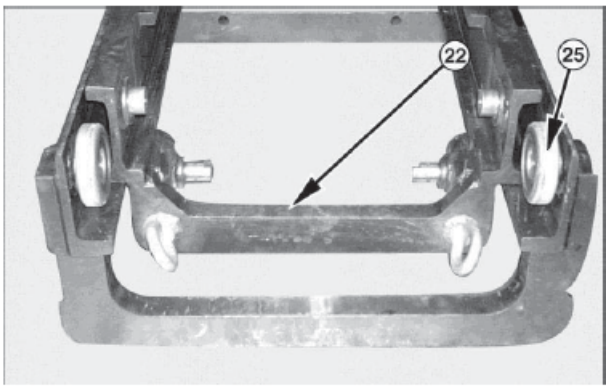
13. Move inner mast channel (21) upward.



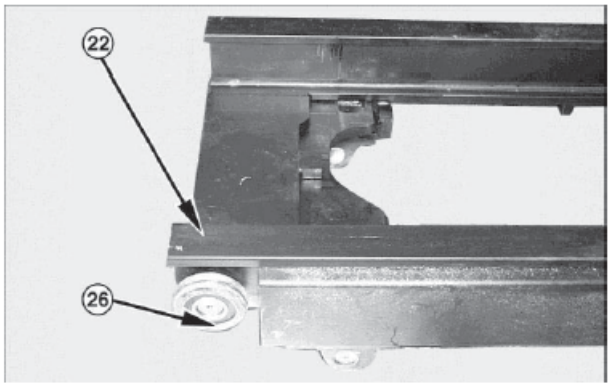
14. Fasten nylon straps and a hoist to inner mast channel (21). Remove inner mast channel. The weight of the inner mast channel is 250 kg (550 lb).



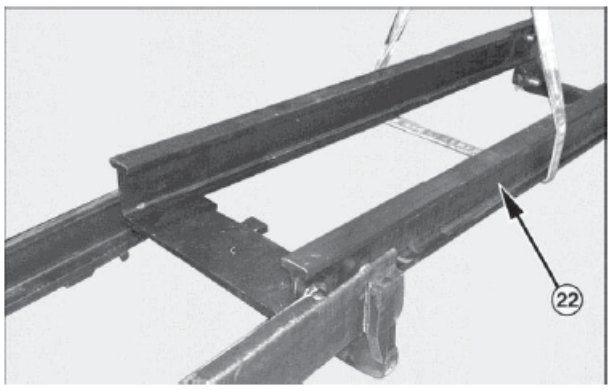
15. Remove bracket (24) with hose sheaves from intermediate mast channel.



16. Move intermediate mast channel (22) downward.
17. Remove bearings (25) and the shims from the stationary mast channel.



18. Remove bearings (26) and the shims from the intermediate mast channel (22).



19. Fasten nylon straps and a hoist to the intermediate mast channel (22). Remove intermediate mast channel. The intermediate mast channel weighs 260 kg (572 lb).

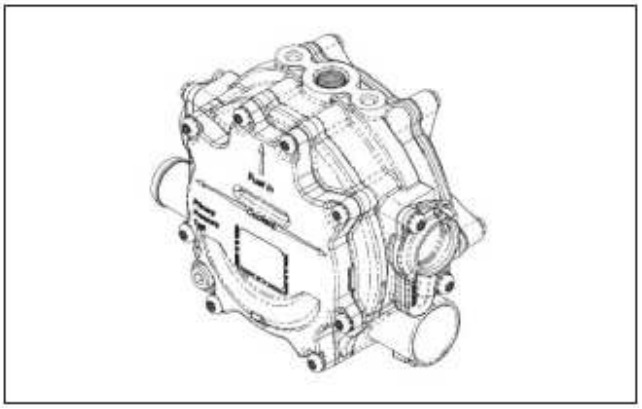
Weight of Each Component by Mast
MFH

	Spec.	FFT						
		4000	4250	4500	4700	5150	5600	6050
Outer mast	Weight (KG)	318	328	334	339	352	364	377
Inner mast		210	220	226	231	244	256	268
Inter mast		256	266	271	275	290	302	314
Primary cylinder		28	29	30	31	33	35	37
Secondary cylinder		41	44	46	48	51	55	59
Mast assembly		1012	1047	1080	1107	1160	1213	1269
Carriage (3.5-4 t)		196.5	196.5	196.5	196.5	196.5	196.5	196.5
Carriage (4.5 t)		231.5	231.5	231.5	231.5	231.5	231.5	231.5
Forks (3.5-4 t, 1200 mm)		91	91	91	91	91	91	91
Forks (4.5 t, 1200 mm)		106	106	106	106	106	106	106
Front end (3.5-4 t) (mast+carriage +forks)		1408.5	1443.5	1476.5	1503.5	1556.5	1609.5	1665.5
Front end (4.5 t) (mast+carriage +forks)		1473.5	1508.5	1541.5	1568.5	1621.5	1674.5	1730.5

* Weight values may contain errors.
* Individual mast components are weighed excluding the cylinders.
* Each of the cylinders and forks is weighed based on one unit.

Light Duty 2-Stage Vaporizer

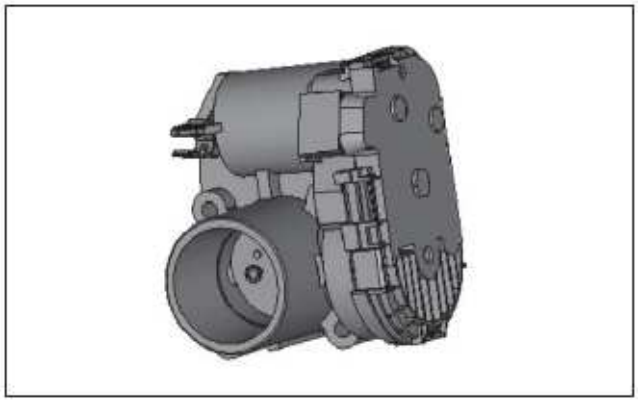
The LP-powered vehicles utilize a 2-stage vaporizer as part of the fuel system. The primary function of this part is to convert liquid LP fuel into a propane vapor. The vapor is then introduced into the DEPR where the pressures are regulated. Converting the fuel from a liquid to a vapor is accomplished by passing the propane through a heat exchanger inside the convertor. Coolant flows through the convertor as part of the heat exchange process.



LD 2-Stage Vaporizer

Electronic Throttle Control Device (ETC)

Engine speed is controlled by the ECM and the Electronic Throttle Control device which is an automotive style throttle. The ECM controls engine speed one of several ways depending on the equipment manufacturer's requirement. Engine speed can be controlled by discrete speed governing. The ECM then targets the preprogrammed speed for that pin. The other two modes are through the use of a foot pedal or a hand throttle controller. In both cases the foot pedal or hand throttle controller will send a 0-5volt signal to the ECM. The ECM is programmed with an idle and high speed and interprets speed in between the two based on voltage. When the engine is running electrical signals are sent from the foot pedal position sensor to the engine ECM when the operator depresses or release the foot pedal. The ECM then sends an electrical signal to the motor on the electronic throttle control to increase or decrease the angle of the throttle blade thus increasing or decreasing the air/fuel charge to the engine. The electronic throttle control device incorporates two internal Throttle Position Sensors (TPS) which provide output signals to the ECM as to the location of the throttle shaft and blade. The TPS information is used by the ECM to correct for speed and load control as well as emission.

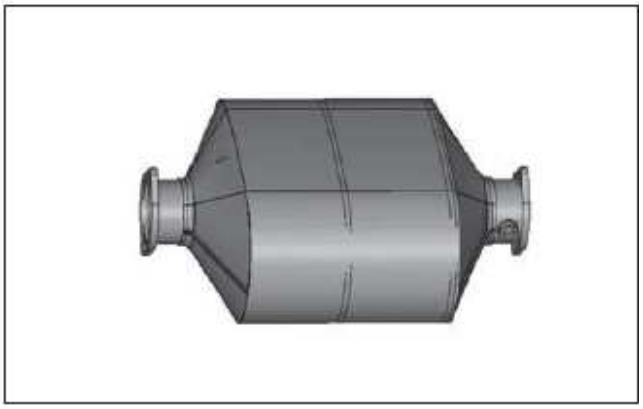


Electronic Throttle Control Device

Three-Way Catalytic Converter

The Catalytic Converter is a component of the emissions system which is designed to meet the emission standards in effect for the Tier 3 mobile certified product.

The exhaust gases pass through the honeycomb catalyst which is coated with a mixture of precious group metals to oxidize and reduce CO, HC and NOX emission gases.



Three Way Catalytic Converter

Hard Start	
Checks	**Action**
Engine Mechanical Checks	**Important:** The LPG Fuel system is more sensitive to intake manifold leakage than the gasoline fuel supply system. Check for the following: • Vacuum leaks • Improper valve timing • Low compression • Improper valve clearance. • Worn rocker arms • Broken or weak valve springs • Worn camshaft lobes. Check the intake and exhaust manifolds for casting ash.
Exhaust System Checks	Check the exhaust system for a possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for signs of heat distress or for possible internal failure. Check for possible plugged catalytic converter. Refer to *Restricted Exhaust System Diagnosis.*

- Go to the START button on the lower left corner and find the 4G Display Program

Password Login

Figure 1 shows the password dialog box, which is displayed when a software session begins. Login can be accomplished in two ways.

1. Enter an "All SIN Password" which is a password applicable to all ECMs of a given original equipment manufacture.

2. Enter a "Single SIN Password" and corresponding ECM serial number for a single ECM. A Single Serial Number password is unique to a specific ECM serial number and permits authorized service personnel to make changes or view information for a specific ECM.

3. In most instances the top "all" serial number boxes should be used for password entry. In this case, do not check the single serial number box. Each password is a 16-character alphanumeric string specific to each Spectrum customer and determines which pages and variables are visible through the software. Passwords are assigned by the support group and may change periodically. Check the "save password" box to automatically retain the password for future use.

NOTE: The password is printed on the CD disk. If it does not have a password or you have questions please contact Crown.

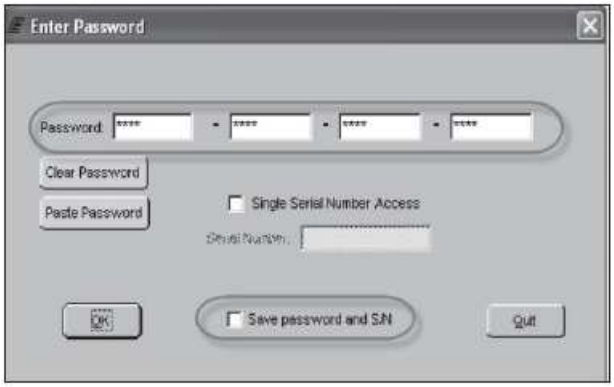


Figure 1. Populated Password Dialog Box

Password Dialog Box Functions

- **Clear Password Button** Erases the current password from the password field.
- **Paste Password Button Allows** the user to copy a 16-character string from any word processor and paste the string in the password field.
- **Single Serial Number Access Checkbox** Tells the software that the password is applicable for single serial number access.
- **Serial Number Field** Only applicable when Single Serial Number Access Checkbox is checked. The entry field must be populated for the 6-digit serial number for which the Single Serial Number Access password applies (NOTE: Leading zeros included in the serial number are not required).
- **Save Password and SIN Checkbox** Retains the password, and serial number (if applicable) for the next software session.

Should an invalid password be entered, the error prompt shown in figure (2) will be displayed and the software will not load. This prompt signifies the following:

- The All S/N password is invalid.
- The Single S/N password is incorrect for the Single Serial Number entered.
- An All S/N password is entered for Single Serial Number use.
- The Single Serial Number password is valid; however, the Single Serial Number Access Checkbox is not checked.

Engine Wire Harness Repair

ON-Vehicle Service Wire Harness Repair

The ECM harness electrically connects the ECM to a various components in both the engine and passenger compartments.

Wire harnesses should be replaced with proper part number harnesses. When wires are spliced into a harness, use wire with high temperature insulation only.

Low current and voltage levels are used in the system, so it is important that the best possible bond at all wire splices be made by soldering the splices.

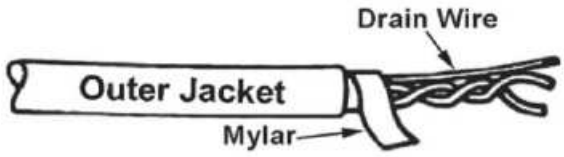
Connectors and Terminals

Use care when probing a connector or replacing terminals in them to prevent shorting opposite terminals and damage certain components. Always use jumper wires between connectors, for circuit checking. Do not probe through the Weather-Pack seals with oversized wire probes. Use tachometer adapter J 35812 (or equivalent) which provides an easy hook up of the tach lead. The connector test adapter kit J 35616 (or equivalent), contains an assortment of flexible connectors used to probe terminals during diagnosis. Fuse remover and test tool BT 8616, or equivalent, is used for removing a fuse and to adapt fuse holder, with a meter, for diagnosis. Do not solder oxygen sensor wire terminals as these wire ends are used for the sensors oxygen reference.

Open circuits are often difficult to locate by sight due to dirt, oxidation, or terminal misalignment. Merely wiggling a connector on a sensor, or in the wiring harness, may correct the open circuit condition. This should always be considered, when an open circuit, or failed sensor is indicated. Intermittent problems may also be caused by oxidized or loose connections.

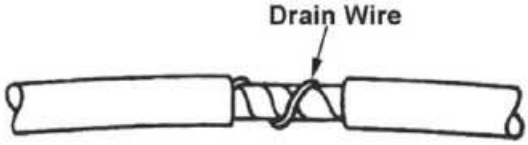
Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar, but are serviced differently.

REPAIRING TWISTED/SHIELDED CABLE



1. Remove outer jacket
2. Unwrap aluminum/Mylar tape. Do not remove Mylar.

3. Untwist conductors, strip insulation as necessary.



4. Splice wire using splice clips and rosin core solder. Wrap each splice to insulate.
5. Wrap with Mylar and drain wire (uninsulated) wire.

6. Tape over entire juncture and secure.

Diagnostic Trouble Code (DTC) Chart – Sorted By SPN:FMI (3 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 304: Cylinder 4 emissions/catalyst damaging m	1326	31	DTC 175: Adaptive-learn gasoline bank2 low	520201	1
DTC 1315: Cylinder 5 misfire detected	1327	11	DTC 1161: Adaptive-learn LPG high	520202	0
DTC 305: Cylinder 5 emissions/catalyst damaging m	1327	31	DTC 1162: Adaptive-learn LPG low	520202	1
DTC 1316: Cylinder 6 misfire detected	1328	11	DTC 1163: Adaptive-learn NG high	520203	0
DTC 306: Cylinder 6 emissions/catalyst damaging m	1328	31	DTC 1164: Adaptive-learn NG low	520203	1
DTC 1317: Cylinder 7 misfire detected	1329	11	DTC 1155: Closed-loop gasoline bank1 high	520204	0
DTC 307: Cylinder 7 emissions/catalyst damaging m	1329	31	DTC 1156: Closed-loop gasoline bank1 low	520204	1
DTC 1318: Cylinder 8 misfire detected	1330	11	DTC 1157: Closed-loop gasoline bank2 high	520205	0
DTC 308: Cylinder 8 emissions/catalyst damaging m	1330	31	DTC 1158: Closed-loop gasoline bank2 low	520205	1
DTC 628: Fuel-pump high-side open or short to ground	1347	5	DTC 1151: Closed-loop LPG high	520206	0
DTC 629: Fuel-pump high-side short to power	1347	6	DTC 1152: Closed-loop LPG low	520206	1
DTC 629: Fuel pump relay coil short to power	1348	3	DTC 1153: Closed-loop NG high	520207	0
DTC 628: Fuel pump relay control ground short	1348	4	DTC 1154: Closed-loop NG low	520207	1
DTC 627: Fuel pump relay coil open	1348	5	DTC 154: EGO2 open / lazy	520208	10
DTC 1625: J1939 shutdown request	1384	31	DTC 140: EGO3 open / lazy	520209	10
DTC 687: Power relay coil short to power	1485	3	DTC 160: EGO4 open / lazy	520210	10
DTC 686: Power relay ground short	1485	4	DTC 420: Catalyst inactive on gasoline (Bank 1)	520211	10
DTC 685: Power relay coil open	1485	5	DTC 430: Catalyst inactive on gasoline (Bank 2)	520212	10
DTC 234: Boost control overboost failure	1692	0	DTC 1165: Catalyst inactive on LPG	520213	10
DTC 299: Boost control underboost failure	1692	1	DTC 1166: Catalyst inactive on NG	520214	10
DTC 236: TIP active	1692	2	DTC 1515: AUX analog Pull-Down 1 high voltage	520215	3
DTC 1666: PWM8 short to power	2646	3	DTC 1516: AUX analog Pull-Down 1 low voltage	520215	4
DTC 1665: PWM8 open / ground short	2646	5	DTC 1511: AUX analog Pull-Up 1 high voltage	520216	3
DTC 1670: PWM9 short to power	2647	3	DTC 1512: AUX analog Pull-Up 1 low voltage	520216	4
DTC 1669: PWM9 open / ground short	2647	5	DTC 1513: AUX analog Pull-Up 2 high voltage	520217	3
DTC 8906: UEGO return voltage shorted high	3056	3	DTC 1514: AUX analog Pull-Up 2 low voltage	520217	4
DTC 8907: UEGO return voltage shorted low	3056	4	DTC 1517: AUX analog Pull-Up 3 high voltage	520218	3
DTC 8910: UEGO sense cell voltage high	3217	3	DTC 1518: AUX analog Pull-Up 3 low voltage	520218	4
DTC 8911: UEGO sense cell voltage low	3217	4	DTC 1541: AUX analog Pull-Up/Down 1 high voltage	520219	3
DTC 8908: UEGO pump voltage shorted high	3218	3	DTC 1542: AUX analog Pull-Up/Down 1 low voltage	520219	4
DTC 8909: UEGO pump voltage shorted low	3218	4	DTC 1543: AUX analog Pull-Up/Down 2 high voltage	520220	3
DTC 8904: UEGO cal resistor voltage high	3221	3	DTC 1544: AUX analog Pull-Up/Down 2 low voltage	520220	4
DTC 8905: UEGO cal resistor voltage low	3221	4	DTC 1545: AUX analog Pull-Up/Down 3 high voltage	520221	3
DTC 8901: UEGO microprocessor internal fault	3221	31	DTC 1546: AUX analog Pull-Up/Down 3 low voltage	520221	4
DTC 8916: UEGO sense cell impedance high	3222	0	DTC 1551: AUX digital 1 high voltage	520222	3
DTC 8902: UEGO heater supply high voltage	3222	3	DTC 1552: AUX digital 1 low voltage	520222	4
DTC 8903: UEGO heater supply low voltage	3222	4	DTC 1553: AUX digital 2 high voltage	520223	3
DTC 8914: UEGO sense cell slow to warm up	3222	10	DTC 1554: AUX digital 2 low voltage	520223	4
DTC 8917: UEGO pump cell impedance high	3225	0	DTC 1555: AUX digital 3 high voltage	520224	3
DTC 8918: UEGO pump cell impedance low	3225	1	DTC 1555: Water Intrusion Detection	520224	3
DTC 8912: UEGO pump voltage at high drive limit	3225	3	DTC 1556: AUX digital 3 low voltage	520224	4
DTC 8913: UEGO pump voltage at low drive limit	3225	4	DTC 916: Shift actuator feedback out-of-range	520226	3
DTC 8915: UEGO pump cell slow to warm up	3225	10	DTC 919: Shift unable to reach desired gear	520226	7
DTC 171: Adaptive-learn gasoline bank1 high	520200	0	DTC 920: Shift actuator or drive circuit failed	520226	31
DTC 172: Adaptive-learn gasoline bank1 low	520200	1	DTC 1639: PWM5 open / ground short	520230	5
DTC 174: Adaptive-learn gasoline bank2 high	520201	0	DTC 1640: PWM5 short to power	520230	6

DTC 107-MAP Low Voltage

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON, Engine running. • DSC (Diagnostic Scan Tool) connected in System Data Mode Does DST display MAP voltage of 0.050 or less with the engine running below 3000 rpm and TPS above 2.0 %?		Go to Step (3)	Intermittent problem Go to Intermittent section
3	• Key OFF • Disconnect the MAP sensor connector C006 from the wiring harness • Jump the 5 volt reference pin 3 and MAP signal circuit pin 4 together • Key ON Does the DST display MAP voltage of 4.5 volts or greater?		Go to Step (4)	Go to Step (8)
4	• Inspect MAP connector and pins for corrosion, contamination or mechanical damage Any problems found?		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (5)
5	• Key OFF • Disconnect ECM connector C001 • Check for continuity between MAP sensor connector signal pin 4 and ECM MAP signal pin 7. Do you have continuity between them?		Go to Step (6)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
6	• Check for continuity between MAP sensor connector 5 volt supply signal pin 3 and ECM 5 volt supply pin 19 Do you have continuity between them?		Go to Step (7)	Rep air the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
7	• Check for continuity between MAP sensor connector ground pin 1 and ECM sensor ground pin 20 Do you have continuity between them?		Go to Step (17)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
8	• Probe MAP connector signal circuit pin 4 with a test light connected to battery voltage. Does the DST display MAP voltage of 4.0 or greater?		Go to Step (9)	Go to Step (13)

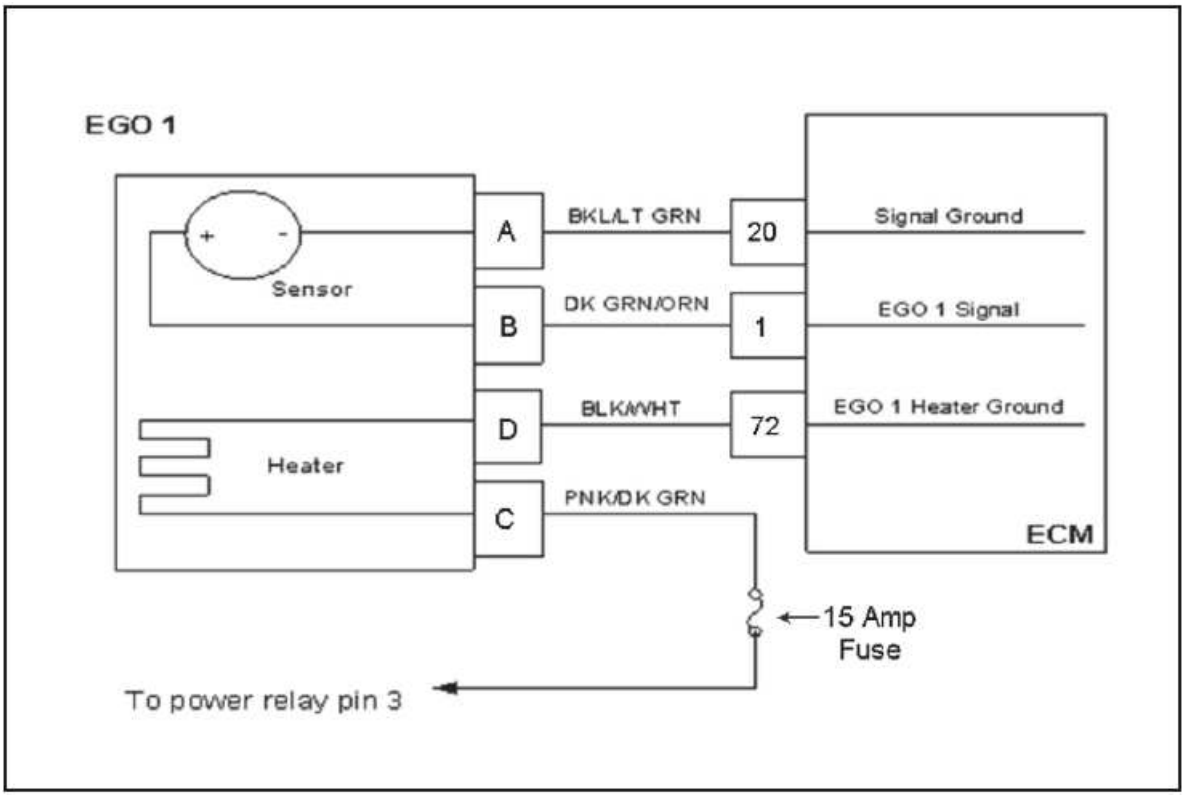
Step	Action	Value(s)	Yes	No
8	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-112 check for any stored codes. Does the engine operate normally with no stored codes?	-	System OK	Go to OBD System Check

DTC 118-ECT/CHT Voltage High

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON • DST (Diagnostic Scan Tool) connected in System Data Mode Does DST display ECT voltage of 4.95 or greater?		Go to Step (3)	Intermittent problem Go to Intermittent section
3	• Key OFF • Disconnect the ECT sensor connector C007 and Jump terminals A and B together • Key ON Does the DST display ECT voltage of 0.05 volts or less?		Go to Step (4)	Go to Step (8)
4	• Using a DVOM check the resistance between the two terminals of the ECT sensor and compare the resistance reading to the chart Is the resistance value correct?		Go to Step (6)	Go to Step (5)
5	Replace ECT sensor Is the replacement complete?		Go to Step (14)	-
6	• Inspect the ECT wire harness connector terminals A and B for damage, corrosion or contamination Did you find a problem?		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (7)
7	• Key OFF • Disconnect ECM wire harness connector C001 • Inspect ECM connector pins 10 and 20 for damage corrosion or contamination Did you find a problem?		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Intermittent problem Go to Intermittent section
8	• Jump the ECT signal pin A at the ECT connector to engine ground Does DST display ECT voltage of 0.05 or less?		Go to Step (9)	Go to Step (12)
9	• Key OFF • Disconnect ECM wire harness connector • Using a DVOM check for continuity between ECT sensor ground pin B and ECM connector pin 20 Do you have continuity between them?		Go to Step (10)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.

Step	Action	Value(s)	Yes	No
10	• Key OFF • Disconnect ECM connector C001 • Using a DVOM check for continuity between the electronic throttle connector sensor ground pin 2 and ECM connector TPS 1 sensor ground pin 20 Do have continuity between them?		Go to Step (6)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
11	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-123 check for any stored codes. Does the engine operate normally with no stored codes?		System OK	Go to OBD System Check

DTC 154-EGO 2 Pre Cat Open/Lazy (TPS 520208:FMI 10)



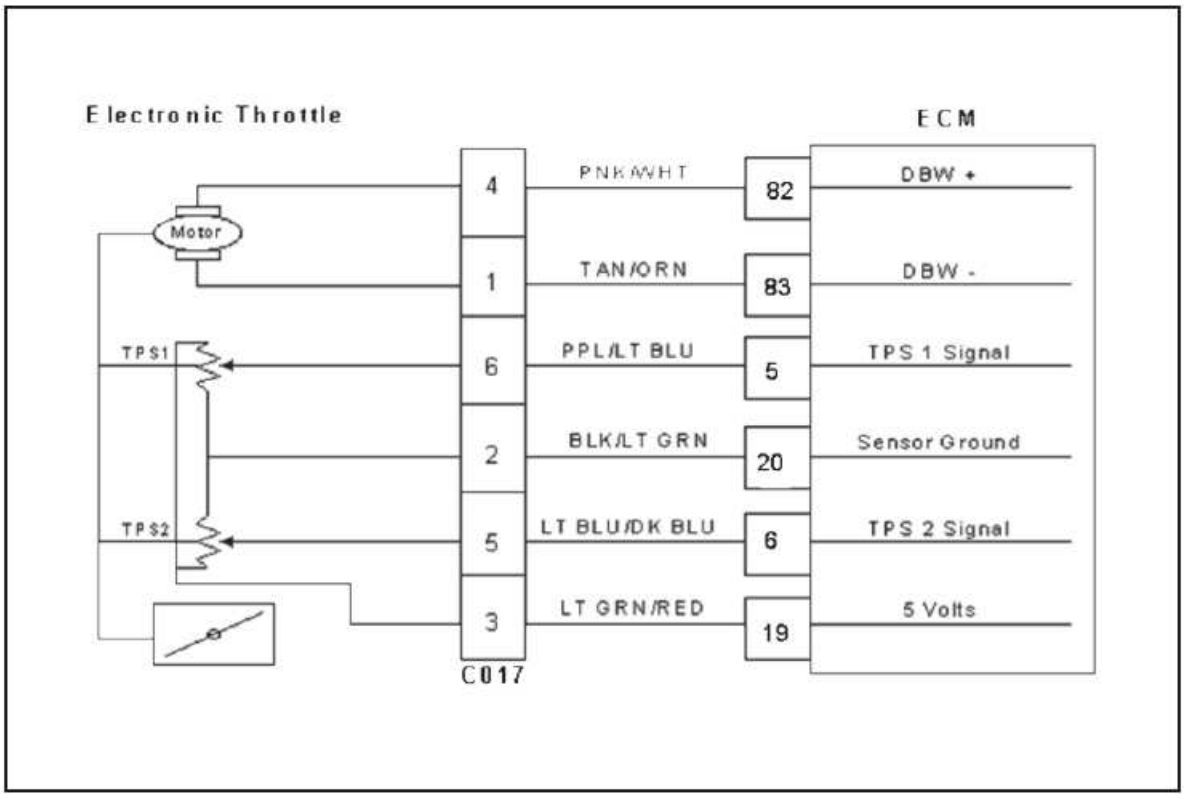
Conditions for Setting the DTC

- Heated Oxygen Sensor
- Check condition - Engine running
- Fault condition - EGO 2 cold persistently more than 120 seconds
- MIL - On during active fault and for 1 second after active fault
- Adaptive - Disabled during active fault
- Closed Loop - Disabled during active fault

Circuit Description

The EGO 2 sensor is used to monitor the efficiency of the catalytic converter. The ECM compares the EGO 1 and EGO 2 voltage signals to determine this. This fault will set if EGO 2 is cold, non-responsive, or inactive for more than 120 seconds.

DTC 222-TPS 2 Signal Voltage Low (TPS 520251:FMI 4)



Conditions for Setting the DTC

- Throttle Position Sensor 2
- Check Condition-Cranking or Running
- Fault Condition-TPS 2 sensor voltage less than 0.200 volts
- MIL-ON during active fault
- Engine will Shutdown

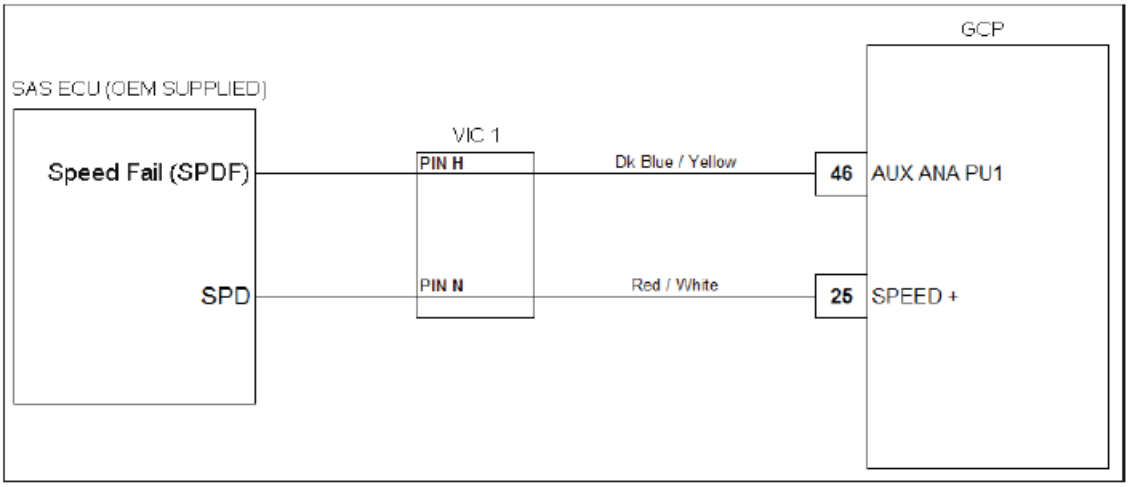
Circuit Description

Dual throttle Position Sensors are used within the throttle that use variable resistors to determine signal voltage based on throttle plate position. TPS1 will read lower voltage when closed and TPS2 will read higher voltage when closed. The TPS1 and TPS2 percentages are calculated from these voltages. Although the voltages are different, the calculated values for the throttle position percentages should be very close to the same. The TPS values are used by the ECM to determine if the throttle is opening as commanded. The TPS is not serviceable and in the event of a failure the electronic throttle assembly must be replaced. This fault will set if the TPS 2 voltage is less than 0.200 volts. The MIL command is ON and engine will shutdown.

DTC 337-Crank Loss

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Check that the ECM ground terminals C010, C022 and C023 are clean and tight Are the ground terminals clean and tight?		Go to Step (3)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
3	• Key OFF • Disconnect the CKP (Crankshaft Position) • Sensor connector C015 • Using A DVOM check for voltage at the CKP sensor connector pin 1 and engine ground **(CHECK THIS BEFORE THE POWER RELAY SHUTS OFF)** Do you have voltage?	5.0 Volts	Go to Step (4	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
4	• Key OFF • Disconnect ECM connector C001 • Using a DVOM check for continuity between CKP connector pin 2 and ECM connector pin 22 Do you have continuity between them?		Go to Step (5)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
5	• Using a DVOM check for continuity between CKP connector pin 3 and ECM connector pin 21 Do you have continuity between them?		Go to Step (6)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
6	Inspect the CKP connector C015 terminals for damage, corrosion or contamination Did you find a problem?		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (7)
7	• Inspect the ECM connector C001 terminals 19, 22, and 21 for damage, corrosion or contamination Did you find a problem		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to step (8)
8	• Replace the CKP sensor Is the replacement complete?		Go to Step (10)	-
9	• Replace ECM Is the replacement complete?		Go to Step (11)	-

DTC 502 – Loss of Road Speed (SPN 84:FMI 1)



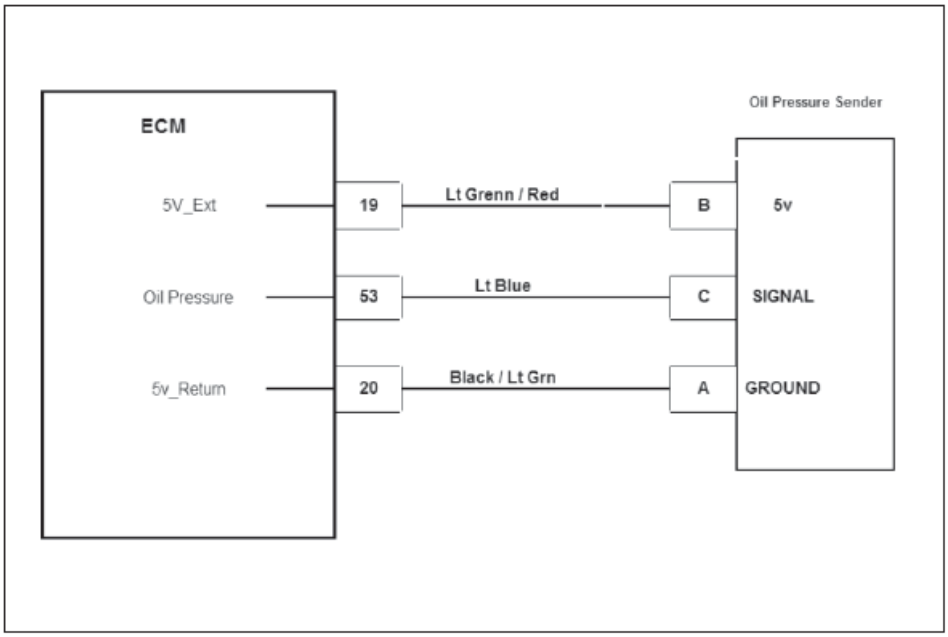
Conditions for Setting the DTC

- Road speed input is less than 0.1 km/hr
- Fault must be active for 5.0 seconds to activate DTC
- Engine speed is greater than 1,500 rpms
- MAP pressure is greater than 10.00 PSIA
- SPDF signal indicates vehicle is moving
- MIL light on during fault
- Power Derate 2 enabled

Circuit Description

The ECM is provided a pulse width modulation (PWM) signal from the OEM vehicle controller to determine the road speed of the vehicle. The PWM signal is supplied to the engine VIC1 Pin N and finally to pin 25 at the 4G connector. The DTC will set when the PWM signal is lost and the engine speed is greater than 1,500 rpms, MAP pressure is greater than 10.0 psia and the SPDF signal indicates the vehicle is moving. The technician should check the OEM system including vehicle speed controller along with circuit between the vehicle speed controller and the engine ECM.

DTC 524-Oil Pressure Low Stage 2 (TPS 100:FMI 1)

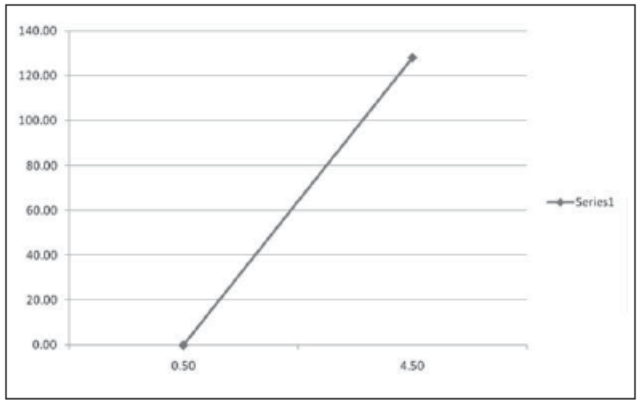


Conditions for Setting the DTC

- Engine Oil Pressure low.
- Fault Condition- Oil pressure less than 8 psi for 1 or more seconds
- Engine Shut Down will occur 30 seconds after MIL is ON

Circuit Description

The Oil Pressure Sender is used to communicate the oil pressure condition to the ECM. Engine damage can occur if the engine is operated with low oil pressure. The ECM sends a 5v signal to the oil pressure sender. The sender will report a signal back to the ECM on the signal wire depending on the pressure that is applied on its diaphragm. The voltage is linear in comparison to the pressure applied (see chart below). The MIL command is ON and the engine will shut down in the event of this fault to help prevent possible engine damage.

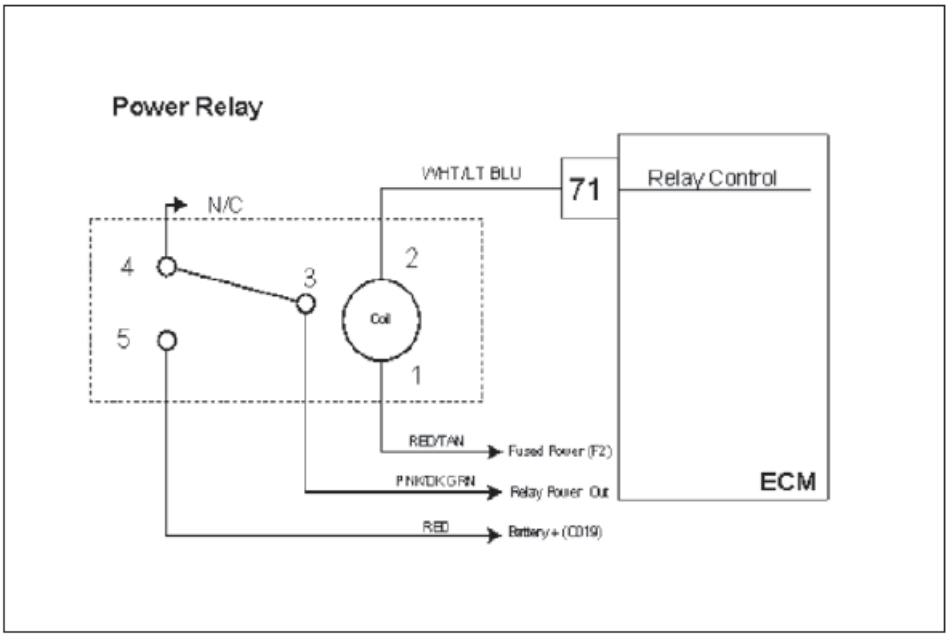


DTC 604-RAM Failure

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON, Engine Running • DST (Diagnostic Scan Tool) connected in System Data Mode • Clear system fault code Does DTC 604 reset with the engine idling?		Go to Step (3)	Intermittent problem Go to Intermittent section
3	• Check ECM power and ground circuits Did the power and ground circuits check OK?		Go to Step (4)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
4	• Replace ECM Is the replacement complete?		Go to Step (5)	-
5	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-604 check for any stored codes. Does the engine operate normally with no stored codes?		System OK	Go to OBD System Check

Step	Action	Value(s)	Yes	No
8	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-650 check for any stored codes. Does the engine operate normally with no stored codes?		System OK	Go to OBD System check

DTC 687-Relay Coil Short to Power (SPN 1485:FMI 3)



Conditions for Setting the DTC

- Power relay check
- Check Condition-Key ON
- Fault Condition-Relay coil shorted to power

Circuit Description

The power relay switches power out to various sensors, actuators and solenoids in the fuel system. This fault will set if the ECM detects a short circuit to power on the relay control output.

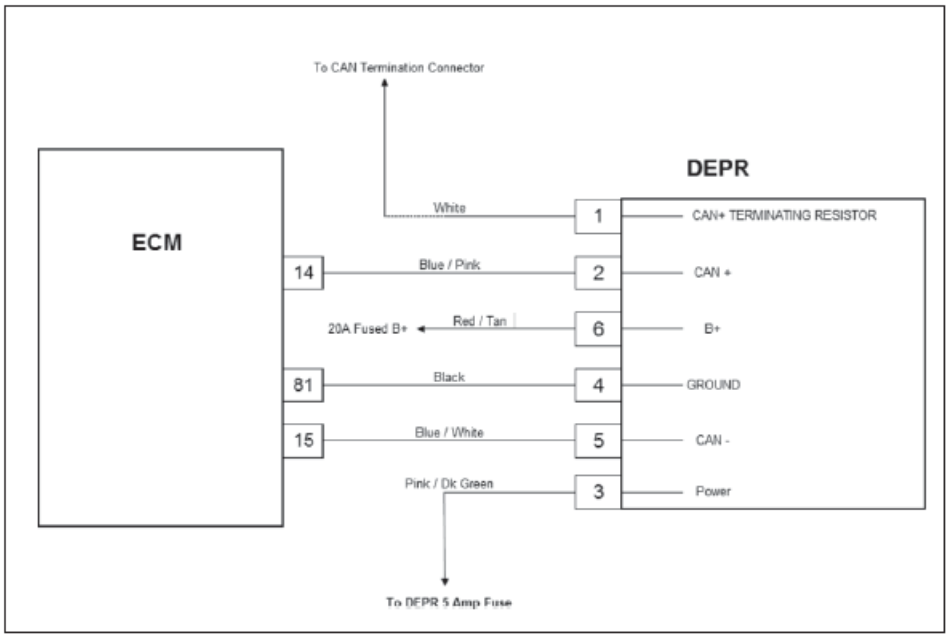
Diagnostic Aid

Relay coil resistance changes with temperature. The following diagnostic charts have steps to measure relay coil resistance values. When checking the resistance values be sure the relay is at a reasonable temperature, between +20 and +100 degrees F.

DTC 1151-Closed Loop High LPG

Step	Action	Value(s)	Yes	No
1	• Perform the On-Board (OBD) System Check? Are any other DTCs present?		Go to Step (3)	Go to Step (2)
2	Visually and physically check the following items: • The air intake duct for being collapsed or restricted • The air filter for being plugged • System power fuses are good and in the proper location • The EGO 1 sensor installed securely and the wire leads not contacting the exhaust manifold or ignition wires • ECM grounds must be clean and tight. Refer to Engine Electrical Power and Ground Distribution • Fuel System Diagnostics. Refer to Fuel System Diagnostics Was a repair made?		Go to Step (9)	Go to Step (4)
3	• Diagnose any other DTC codes before proceeding with this chart. Always repair existing codes starting with the lowest numerical code set first. Have any other DTC codes been detected, diagnosed and repaired?		Go to Step (9)	Go to step (4)
4	• Disconnect EGO1 connector C005 • Using a DVOM check for voltage between EGO 1 connector pin B and engine ground • Key ON **(CHECK MUST BE MADE WITHIN 30 SECONDS OR BEFORE POWER RELAY SHUTS DOWN)** Do you have voltage?	System voltage	Go to Step (5)	Repair the open EGO power circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
5	• Key OFF • Disconnect EGO 1 sensor wire harness connector C005 • Disconnect ECM wire harness connector C001 • Key ON • Using a high impedance DVOM check for continuity between EGO 1 connector signal pin A and engine ground Do you have continuity?		Repair the shorted circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (6)
6	• Using a high impedance DVOM check for continuity between EGO 1 connector signal ground pin C and EGO 1 signal pin A Do you have continuity?		Repair the shorted circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (7)

DTC 1171-EPR Pressure Higher Than Expected (SPN 520260:FMI 0)



Conditions for Setting the DTC

- EPR delivery pressure
- Check condition-Engine running or cranking
- MIL-ON during active fault
- Fault condition-EPR actual pressure greater than 1.5 inches above commanded pressure
- Adaptive disabled
- Closed loop disabled

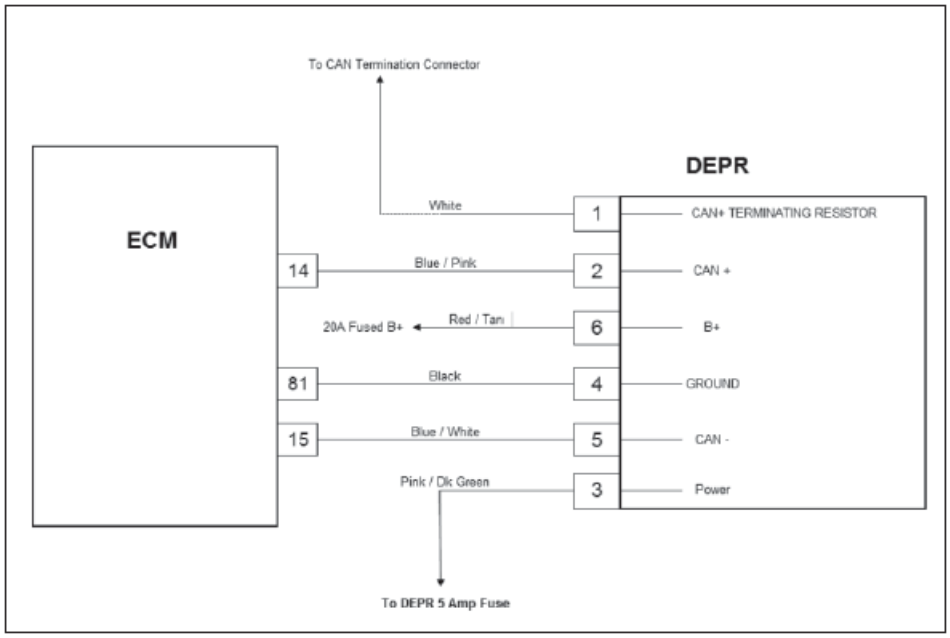
Circuit Description

The EPR (Electronic Pressure Regulator) unit measures and controls the amount of fuel that is able to pass to the fuel mixer. This code will set in the event the actual pressure is 1.5 inches water pressure higher than the actual commanded pressure. Adaptive learn is disabled and the MIL command is ON during this fault.

Diagnostic Aid

Always run the fuel system diagnostic pressure check before proceeding with the following diagnostic chart. High secondary fuel pressure due to a worn or damaged primary or secondary seat may cause this fault to set

DTC 1175-EPR Supply Voltage Low (SPN 520260:FMI 4)



Conditions for Setting the DTC

- EPR supply voltage
- Check condition-Engine running or cranking
- MIL-ON during active fault
- Fault condition-EPR internal supply voltage low
- Adaptive disabled

Circuit Description

The EPR (Electronic Pressure Regulator) unit measures and controls the amount of fuel that is able to pass to the fuel mixer. Pressure readings are sent over the CAN to the ECM and in return the ECM sends back a control signal to the EPR to increase or decrease pressure for precise mixture control. This code will set if the internal EPR supply voltage is low. Adaptive is disabled and the MIL command is ON.

Diagnostic Aid

This DTC indicates abnormal EPR internal voltages that are not measurable externally. Check the system charging voltage to be sure this DTC and other low voltage DTCs are not present. Repair the charging system if it is found to be out of specification for low charge voltage. In the event of multiple code sets, always start the diagnostic repair with the lowest numerical value DTC first.

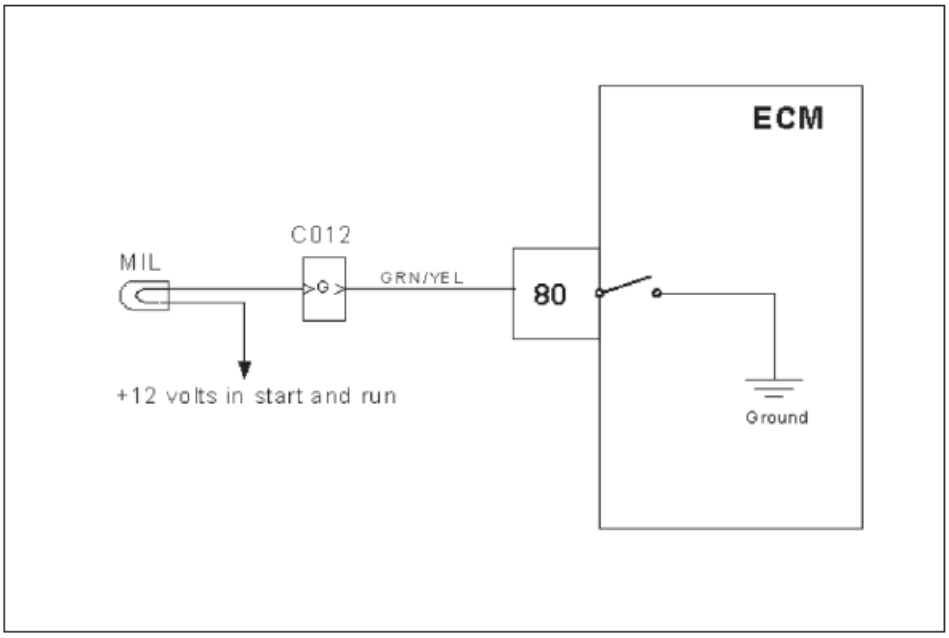
DTC 1511 – Auxiliary Analog PU 1 High Voltage

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON, Engine Running • DST (Diagnostic Scan Tool) connected On the Raw Volts page, check the value for Aux_ana_PU1 Does the DST display 4.9v or greater?	4.9v or Greater	Go to Step (3)	Intermittent problem Go to Intermittent section Check for bad wiring in the circuit
3	• Key off and battery disconnected • Provide a good ground circuit to pin H at VIC 1 Reconnect battery and turn the key on, does the page still indicate 4.9v or greater?	4.9v or Greater	Go to Step (4)	Repair circuit issue between OEM supplied speed computer and Pin H at the VIC 1
4	• Key off and battery disconnected • Remove ground circuit installed in step 3, reinstall OEM wiring • Provide a good ground circuit to Pin 46 at the 4G Connector Reconnect battery and turn the the key on, does the raw volts page still indicate 4.9v or greater?	4.9v or Greater	Refer to OEM for diagnosis of speed control system	Repair wire circuit issue between VIC 1 and 4G pin 46

DTC 1615-A/D Loss

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON, Engine Running • DST (Diagnostic Scan Tool) connected in System Data Mode • Clear system fault code Does DTC 1615 reset with the engine idling?		Go to Step (3)	Intermittent problem Go to Intermittent section
3	• Check ECM power and ground circuits Did the power and ground circuits check OK?		Go to Step (4)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
4	• Replace ECM Is the replacement complete?		Go to Step (5)	-
5	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-1615 check for any stored codes. Does the engine operate normally with no stored codes?		System OK	Go to OBD System Check

DTC 1644-MIL Control Ground Short (SPN 1213:FMI 4)



Conditions for setting the DTC

- MIL
- Check Condition-Key ON engine OFF
- Fault Condition-ECM MIL output shorted to ground
- MIL Command-ON

Circuit Description

The Spectrum Fuel system is equipped with OBD (On-Board Diagnostics). The system has a dash mounted MIL (Malfunction Indicator Lamp). The MIL serves as notification of an emissions related problem. The MIL also has the ability to flash DTC codes in what is referred to as the blink code mode. It will display DTCs that have been stored due to a possible system malfunction. The following DTC charts in this manual will instruct the technician to perform the OBD system check. This simply means to verify the operation of the MIL. The lamp should illuminate when the key is in the ON position, and the engine is not running. This feature verifies that the lamp is in proper working order. If the lamp does not illuminate with the vehicle key ON and engine OFF, repair it as soon as possible. Once the engine is in start or run mode, the lamp should go off. If the lamp stays on while the engine is in the start or run mode, a current diagnostic trouble code may be set

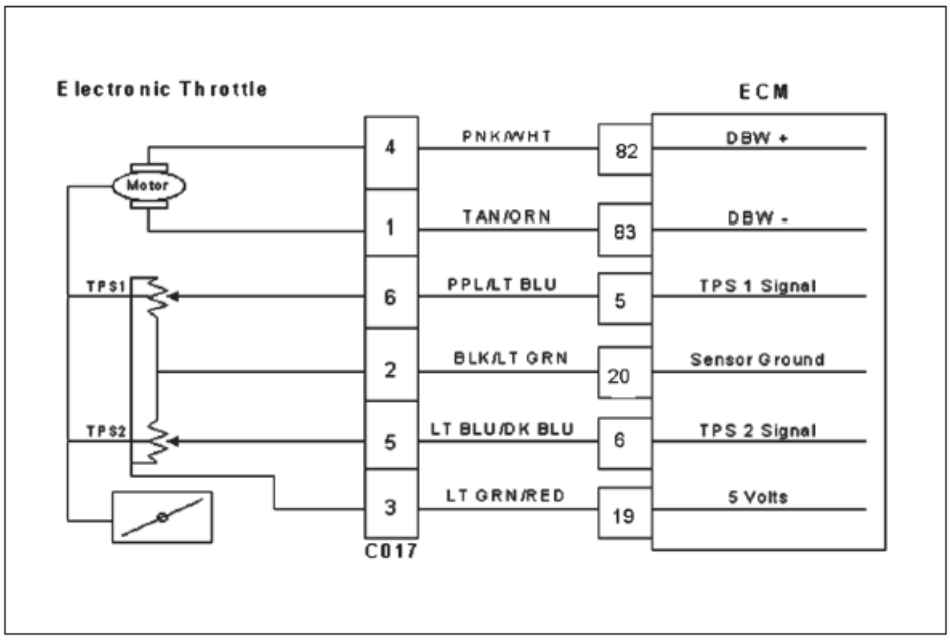
or a problem may exist with the MIL electrical wiring. The electrical schematic above shows the MIL power source supplied to the lamp. The ECM completes the circuit to ground to turn the lamp ON. This fault will set if the ECM MIL control is shorted to ground.

DTC 2112-Unable To Reach Higher TPS

Step	Action	Value(s)	Yes	No
1	Did you perform the On-Board (OBD) System Check?	-	Go to Step (2)	Go to OBD System Check Section
2	• Key ON, Engine OFF • DST (Diagnostic Scan Tool) connected in DBW (Drive By Wire) test mode • Depress foot pedal until the throttle command is 63%~68% Is the TPS voltage less than 2.0 volts?		Go to Step (3)	Intermittent problem Go to Intermittent section
3	• Key OFF • Disconnect electronic throttle connector C017 • Probe TPS 1 signal circuit pin 6 with test light connected to battery voltage • Key ON Is TPS voltage 4.0 volts or greater?		Go to Step (4)	Go to Step (8)
4	• Check throttle bore for foreign object Did you find a problem?		(Go to Step (5)	Go to Step (6)
5	• Remove the foreign object Has the object been removed?		Go to Step (11)	-
6	• Check the electronic throttle connector terminals for damage corrosion or contamination Did you find a problem?		Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.	Go to Step (7)
7	• Replace throttle Is the replacement complete?		Go to Step (11)	-
8	• Key OFF • Disconnect ECM wire harness connector C001 • Using a DVOM check for continuity between throttle connector TPS 1 signal pin 6 and ECM TPS 1 signal pin 5 . Do you have continuity between them?		Go to Step (9)	Repair the circuit as necessary. Refer to Wiring Repairs in Engine Electrical.
9	• Using a DVOM check for continuity between throttle connector TPS 1 signal pin 6 and engine ground Do you have continuity between them?			Go to Step (10)
10	• Replace ECM Is the replacement complete?		Go to Step (11)	-

Step	Action	Value(s)	Yes	No
10	• Inspect FPP1, C012 and ECM connectors for damage corrosion or contamination Did you find a problem?		Repair the circuit as required. See wiring harness repair section	Go to step (11)
11	• Replace ECM Is the replacement complete?		Go to step (12)	-
12	• Remove all test equipment except the DST. • Connect any disconnected components, fuses, etc. • Using the DST clear DTC information from the ECM. • Turn the ignition OFF and wait 30 seconds. • Start the engine and operate the vehicle to full operating temperature • Observe the MIL • Observe engine performance and drivability • After operating the engine within the test parameters of DTC-2123 check for any stored codes. Does the engine operate normally with no stored codes?		System OK	Go to OBD System Check

DTC 2135: TPS1/2 Simultaneous Voltages Out-of-range (SPN 51:FMI 31)



Conditions for Setting the DTC

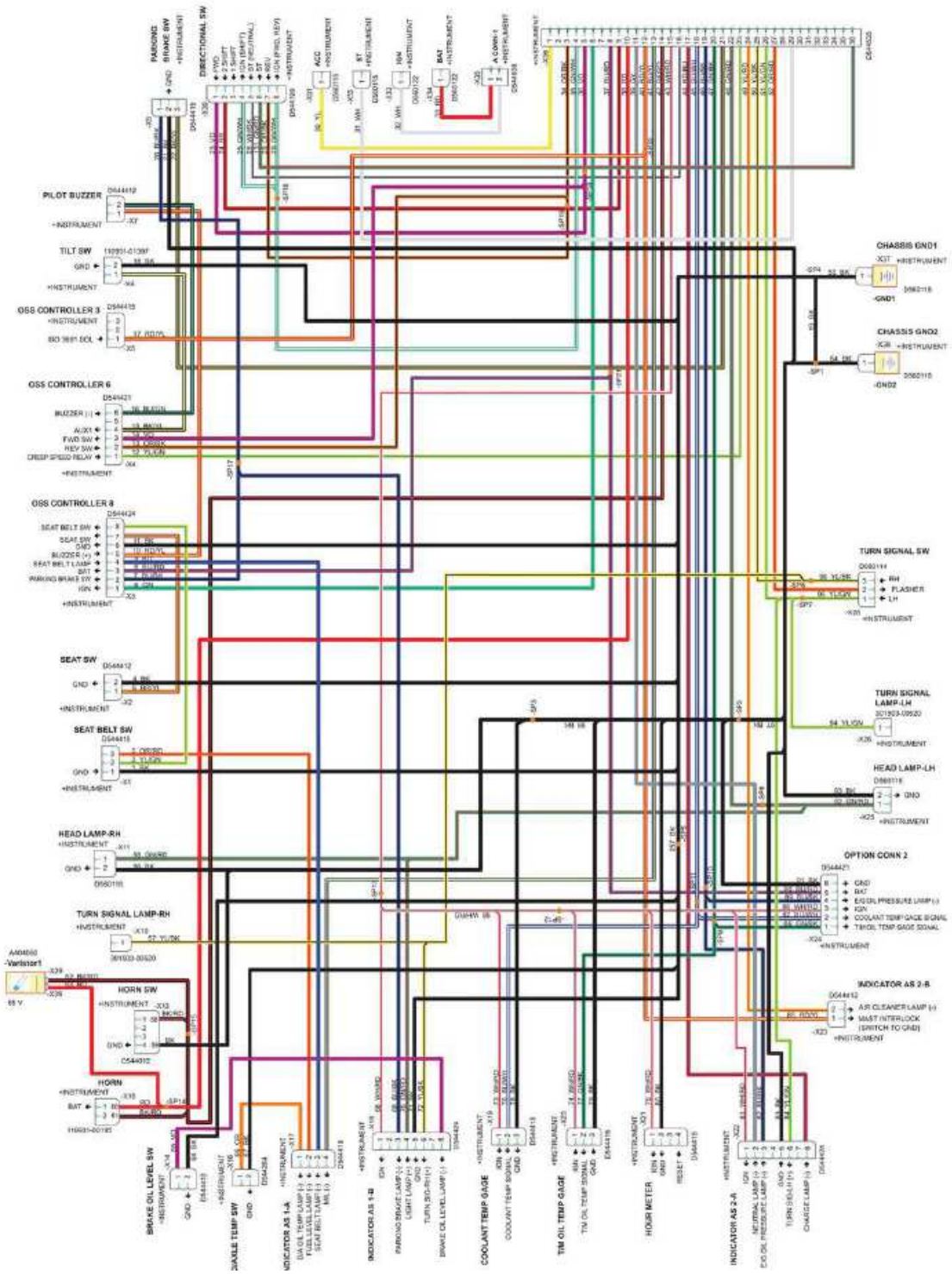
- Throttle Position Sensor 1 & 2
- Check Condition-Key ON
- Fault Condition-TPS 1 20% higher than TPS2
- MIL-ON for remainder of key on cycle
- Engine shutdown

Circuit Description

Dual throttle Position Sensors are used within the throttle that use variable resistors to determine signal voltage based on throttle plate position. TPS 1 will read lower voltage when closed and TPS 2 will read higher voltage when closed. The TPS 1 and TPS 2 percentages are calculated from these voltages. Although the voltages are different, the calculated values for the throttle position percentages should be very close to the same. The TPS values are used by the ECM to determine if the throttle is opening as commanded. The TPS is not serviceable and in the event of a failure the electronic throttle assembly must be replaced. This fault will set if TPS 1 is 20% (or more) higher than TPS 2. At this point the throttle is considered to be out of specification, or there is a problem with the TPS signal circuit. The MIL command is ON and the engine will shutdown.

ELECTRIC SCHEMATICS

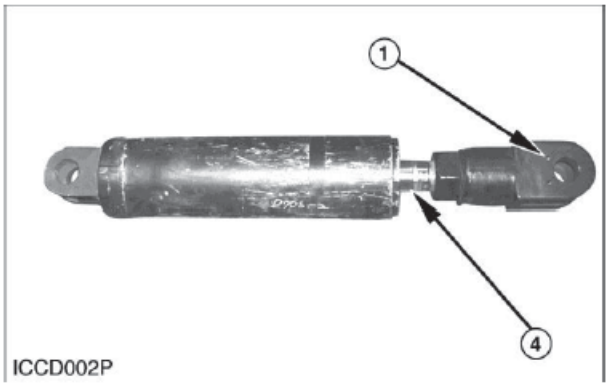
ELECTRIC SCHEMATICS - 1 of 2



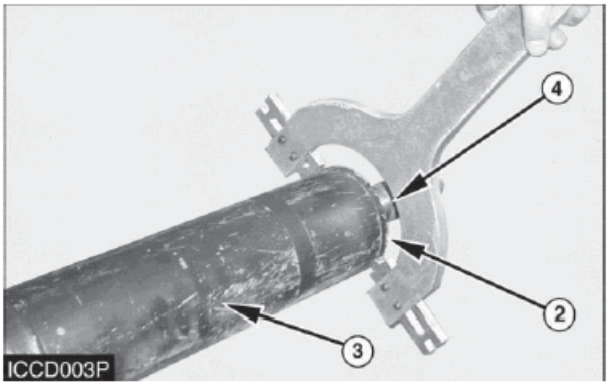
Disassemble & Assemble Tilt Cylinders

Start By:

a. Remove tilt cylinder.



1. Remove eye (1) from the rod assembly (4).

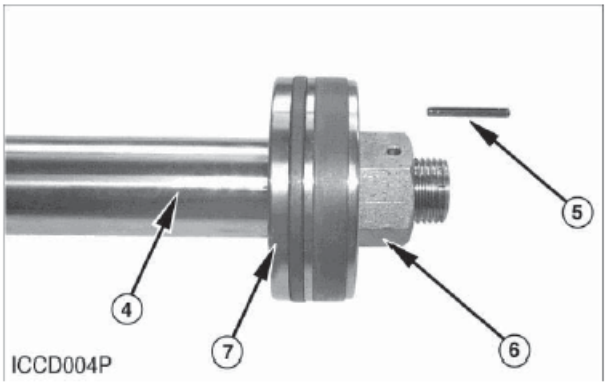


2. Remove rod cover (2) from the cylinder tube (3) using a spanner wrench.

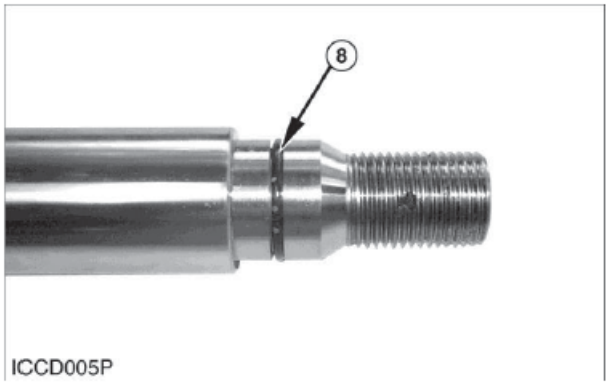
NOTICE

Use extra care not to damage the highly finished surface of the cylinder rod and the bore of the cylinder tube during disassembly and assembly of the tilt cylinder.

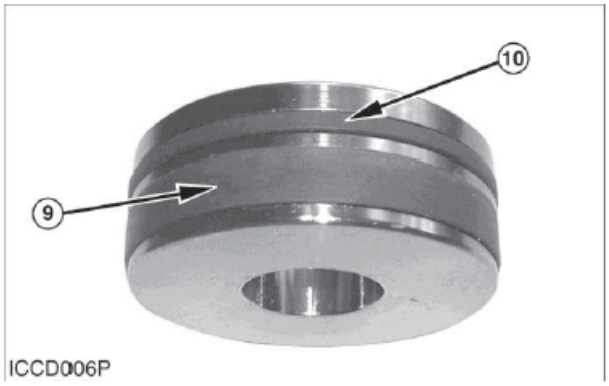
3. Remove rod assembly (4) from the cylinder body.



4. Remove pin (5) inside hole and nut (6) from the cylinder rod (4).
5. Remove piston (7) from the cylinder rod.



6. Remove O-ring seal (8) from the cylinder rod.

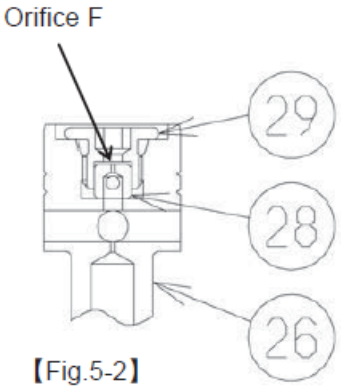


7. Remove wear ring (9) and slipper seal (10) from the piston.

Assembling Inlet Section Assembly

Combination number shall be in accordance with the attached Part List (P/N: C0213-41001).

Tightening torque of each part shall be in compliance with the Parts List.



【Fig.5-2】

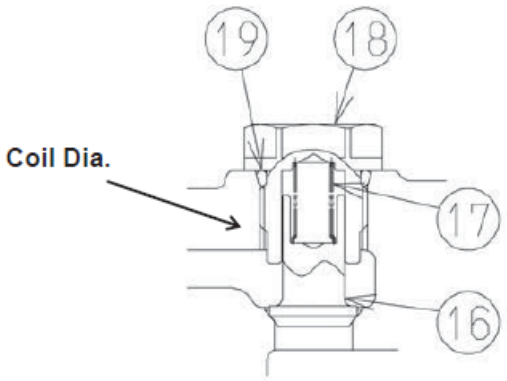
1. Mount O-rings and wipers on each plug.
2. If the two plugs (42) and (59) were removed, tighten them at the original position.
3. Insert the main poppet into the poppet (unload valve) to make the poppet assembly(32), and insert it into the inlet housing(1). Then, insert the spring(33) into the main poppet, and tighten the plug(34) making sure that its end is inserted in the inside of the spring(33).
4. Take care when assembling the spool(26) because the valve(28) is directional. As shown in (Fig.5-2), assemble with the orifice F inside the plug(29), and insert the plug(29) into the spool(26).

Then, while holding the spool(26) in a vise with rigid wood pieces(Fig. 2-1) to prevent damage, tighten the plug(26).

Finally, insert the spring(27) into the subassembled spool(26), insert it into the inlet housing(1) and tighten the plug(30).

5. Insert spring(51) into the spool(50), tighten plug(52).
6. Assemble two relief valve assemblies (41) in the original mounting ports. Take care not to confuse the position.
7. Insert shuttle(36) into spring(37) and insert them into inlet hosing(1).

At this time, the shuttle(36) may be ejected out by spring(37) force. Place the solenoid(38) on the end of the shuttle, slowly insert them into the position where they will not come out by the friction of the O-ring in the in-low part, and tighten with socket head bolt.



8. Insert poppet into the main body of the shut-off valve (20), mount them on the inlet housing(1). And then tighten with set screw. Finally, join lock nut onto the set screw.
9. Insert spring(17) into poppet(16). Make sure to insert the larger diameter part of the spring(17) into the poppet as shown in.

If assembled in opposite, the spring may be broken.

Insert the poppet(16) inserted with spring(17) Into plug(18), tighten to the inlet housing(1) so that the Poppet(16).

10. Insert poppet(21) and spring(22) into inlet housing(1). Tighten by turning the solenoid valve.
11. Assemble O-ring(3) and wiper(4) in the seal hole on the spool head side of inlet housing(1). Fix the seal plate(5) with screw(15).
12. Finally, insert the sub-assembled spool(2) from the opposite side of the inlet housing(1), cover with cap(13), and tighten with screw(15).

(Cautions For Inserting Spool)

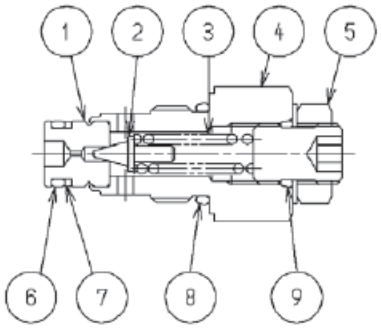
Insert the spool slowly, vertically to the axis of the hole. Reciprocate the spool with hands to check if there is any resistive or uneven feeling which may cause malfunction of the spool.

Disassembly & Assembly

Ref.No. GZ-MS-V0030

07.2.9

訂正	年 月 日	記 事	訂正番号	実施記事	担当	検討	照査	承認

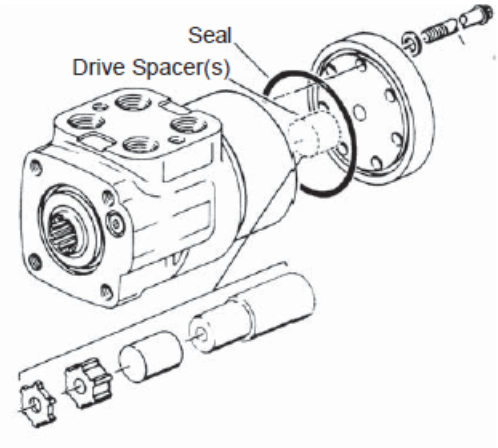


CLASS	DESCRIPTION
A	PARTS WHICH SHOULD BE REPLACED AT DISASSEMBLY, AND THOSE WHICH WILL BE SUPPLIED AS REPAIR KIT.
B	PARTS WHICH WILL BE SUPPLIED AS ONLY MATCHING PAIRS DUE TO QUARITY ASSURANCE REASON AND FOR THE CONVENIENCE OF ASSEMBLY.
C	PARTS WHICH WILL BE SUPPLIED ON A SINGLE PART BASE.
D	PARTS WHICH ARE NOT REGARDED AS REPAIR PARTS.

区分	照合番号	品番	名称	員数	備考
	9	95113-01000	O-RING	1	
	8	21001-00035	O-RING	1	
	7	95712-01000	BACKUP RING	1	
	6	21001-01136	O-RING	1	
	5	21003-00182	ADJUST KIT	1	
	4	21011-32934	PLUG	1	
	3	21111-42316	PILOT SPRING	1	
	2	21111-43110	PILOT POPPET	1	
	1	21011-35401	PILOT SEAT	1	

普通許容差	削り加工はKES2218による	尺度 1/1	表面あらさ	形式	KVMF-120
等級指示のないメートルおじは6gまたは6Hとする					三角法
承認		材質		組立品名称	
照査	藤井	寸度		名称	リリーフバルブ
検討	大嶋	熱処理			
担当	大嶋	引張強さ			
共通使用	製図 K.O 07.02.07	硬さ		品番	C0003-30020 -0
		表面処理			

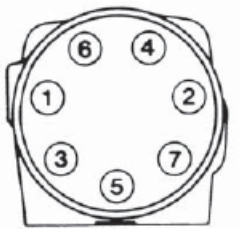
A4NJS CAD サービス用 KYB 株式会社



IDCD301P

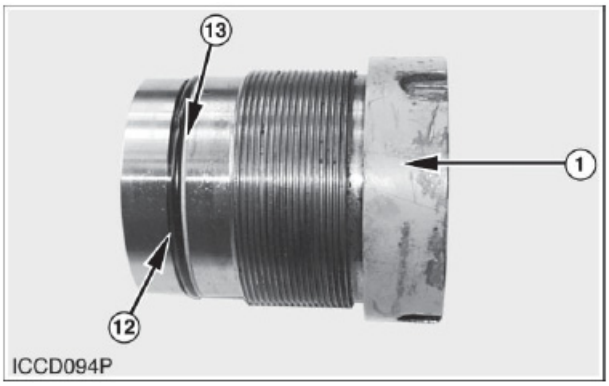
Actual Displacement cm³/r(in/r)	Spacer Length mm [in.]
45 [2.8]	None
60 [3.6]	None
75 [4.5]	None
95 [5.9]	3.56 [.140]
120 [7.3]	6.10 [.240]
145 [8.9]	10.29 [.405]
160 [9.7]	12.19 [.480]
185 [11.3]	15.62 [.615]
230 [14.1]	21.97 [.865]
295 [17.9]	28.45 [1.120]
370 [22.6]	41.15 [1.620]
460 [28.2]	53.67 [2.113]
590 [35.9]	66.37 [2.613]
740 [45.1]	91.77 [3.613]

24. Install drive spacer (s) when used, in meter.
25. Install 73.5 mm [2.89 in.] ID seal in gerotor (meter) or end cap, see notes.
26. Install end cap on gerotor, align holes.

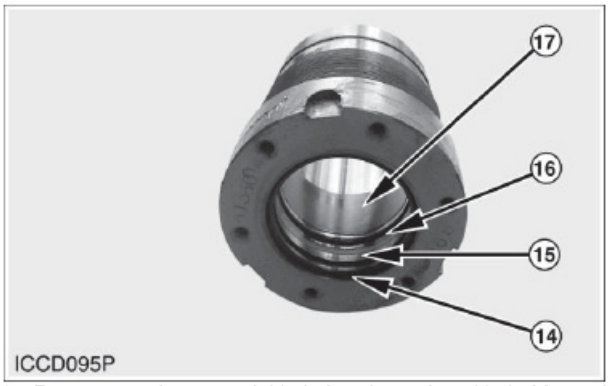


IDCD302P

27. Install 7 dry cap screws in end cap. Pretighten screws to 11-17 N•m [100-150 lb•in] then torque screws to specifications.



9. Remove O-ring seal (12) and backup ring (13) from each head (1).



10. Remove wiper seal (14), backup ring (15), U-packing (16) and DU-bush (17) from the bore of each head.

NOTE : Assemble the steering cylinder in the reverse order of disassembly.

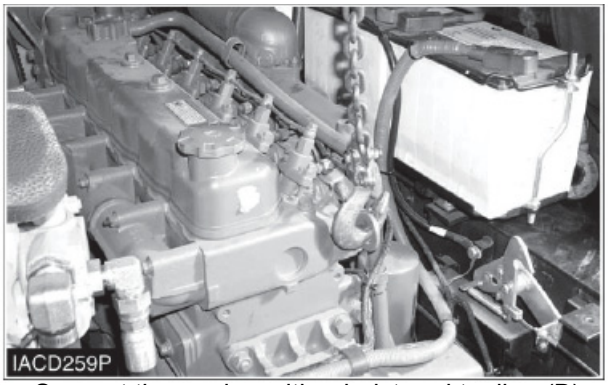
Tires And Rims (Steer)

Remove And Install Tires And Rims (Steer)

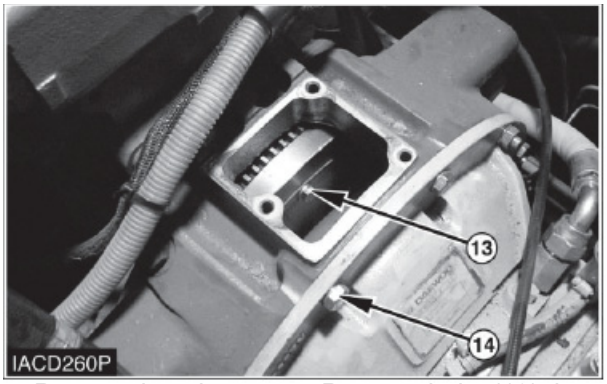
1. Put a hydraulic jack in position under the steer axle.
2. Loosen nuts (1) that hold the tire and rim in place.
3. Lift the steer axle until the tire is clear of the ground. Remove nuts (1). Remove the tire and rim.

NOTE : The following steps are for installation of the tires and rims (steer).

4. Put the tire and rim in position on the hub.
5. Install nuts (1) that hold the tire and rim in place. Tighten the nuts to a torque of 430 ± 35 Nm (318 ± 25 lb ft).
6. Lower the steer axle and remove the hydraulic jack.



7. Support the engine with a hoist and tooling (B).
8. Support transaxle assembly with a floor jack and wood block.



9. Remove housing cover. Remove bolts (13) that hold the converter to the flywheel.

NOTE: At this point, make a final check to be sure all removals and disconnections have been made from the transaxle.

10. Remove bolts (14) and nuts from the converter housing.
11. Use the floor jack to move transaxle assembly from beneath the machine.
12. Install transaxle in the reverse order of removal.
13. Bleed the brake system. Refer to the topic “Brake System Air removal” in the Testing and Adjusting section of Vehicle Systems.
14. Fill all fluids to their correct levels.

End By :

a. Install floor plate.

b. Install mast *

* Refer to the Mast System Disassembly & Assembly Section for further information.

Engine

Remove & Install Engine

Tools Needed	A
Link Bracket	1

NOTE: Procedures for LP gas and diesel engines are all similar. The engine shown in the following illustrations is for diesel engine.

Start By :

a. Remove overhead guard *

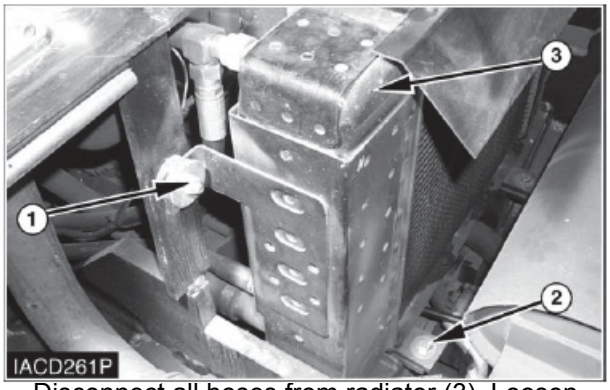
b. Remove hood (with seat) assembly *

c. Remove counterweight *

d. Remove floor plate.

e. Remove hydraulic control valve *

* Refer to the topics “Overhead Guard”, “Hood (with seat) Assembly”, “Counterweight” and “Hydraulic Control Valve” in this module.



1. Disconnect all hoses from radiator (3). Loosen bolts (1) and (2) and remove radiator (3).

Overhead Guard Must Be In Place Warning

WARNING

Operation without this device in place may be hazardous. This guard conforms to A.N.S.I.B56.1 and F.E.M. Section IV. This design has been tested with an impact of (appropriate value).

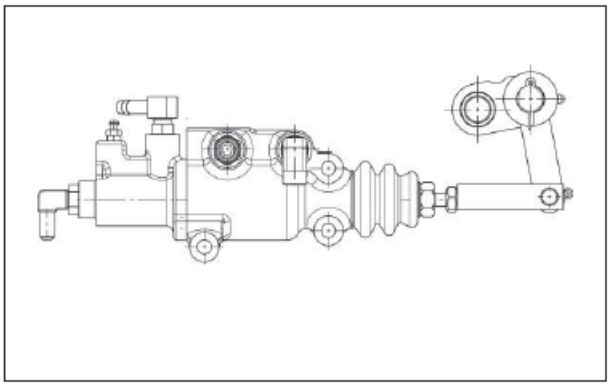
Located on the Overhead Guard.

Brake Pedal Adjustment Warning

WARNING

Improper adjustment could result in injury or death. It has to be adjusted by drawing dimension on free condition. For safe, don't unfasten clevis and nut. It has to be adjusted by trained personnel.

(OCDB Type Only)



Located inside Brake pedal box.

If Optional Suspension Seat (weight adjusting type) Equipped

Forward and Backward Adjustment

The seat can be adjusted by pushing the lever on the right side of seat.

Adjust the seat before operating the lift truck. After adjusting, set the seat to make sure it is properly locked. Do not adjust the seat while the truck is in motion.

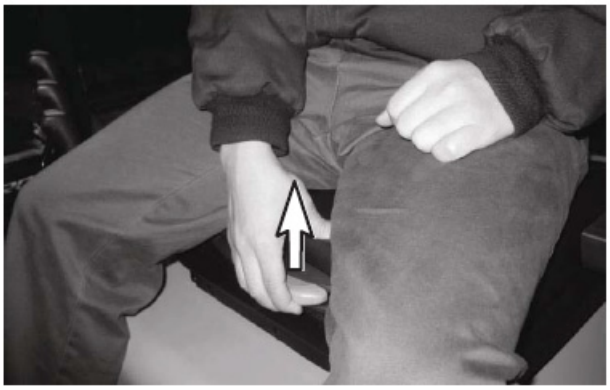
Weight adjustment

Pull the weight adjustment lever upwards and move right or left side.

Adjust to driver's weight in 7 steps (50 ~ 110 kg)

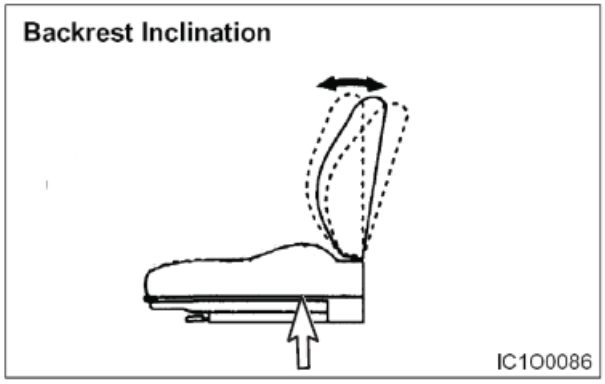
NOTICE

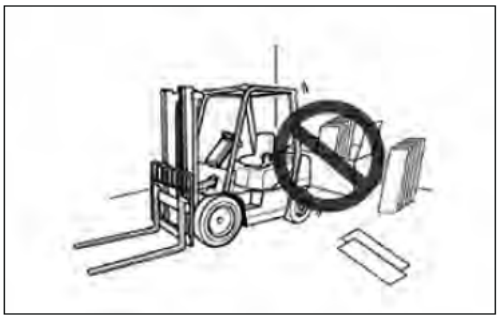
Do not place your hand or fingers under the seat. Injury may occur as the seat moves up and down.



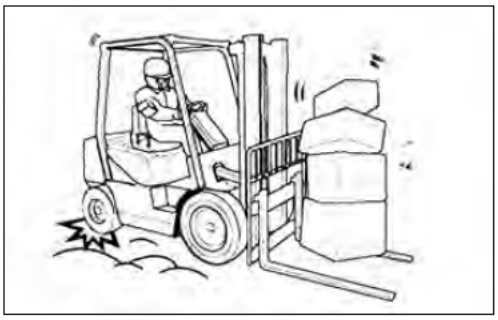
Backrest Inclination

The backrest angle can be adjusted by using the lever on the left side of seat.





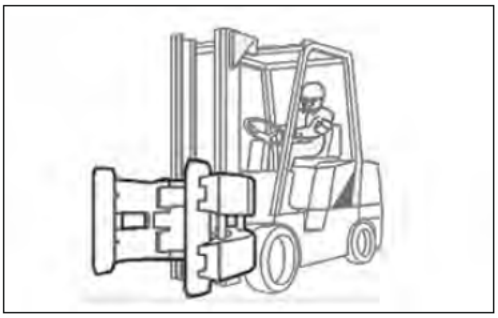
Do not operate forklifts near flammable or combustible materials.
To avoid the discoloration, deformation or combustion of materials (such as lumber, veneer board, paper products and other similar items), always park at least 30 cm (12 inches) away from them.



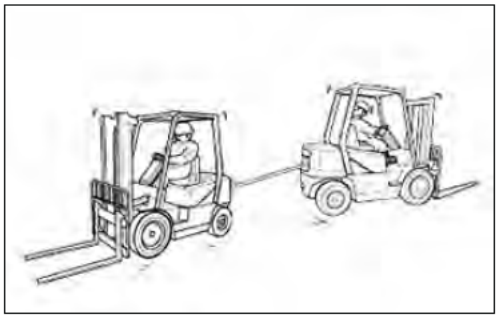
Forklifts are not cars. They often have small tyres, no suspension, and are very heavy.
The forklift's centre of gravity will also change when carrying loads.
Avoid uneven bumps, pot holes and other hazards whenever possible.

Carrying a load suspended on a chain or a cable may unbalance a truck.
Take extra care around pedestrians with a suspended load as it may say or even strike them.

An unloaded forklift may be easier to tip over than a loaded truck.
When traveling without a load, the risk of lateral overturn is greater.



There are many special attachments available to replace the forks on a lift truck.
All carry safety implications and special training in their operation is highly recommended.



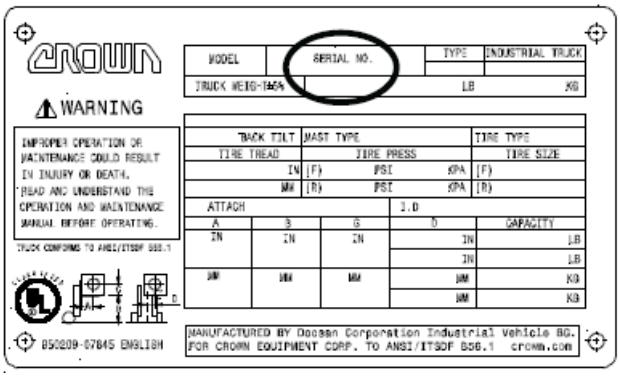
The counterweight draw bar should not be used for towing the forklift or for towing another forklift.
Towing is only advised in emergencies, by trained operators and at low speed, no faster than 2 km/h, to a convenient location for repair.

Serial Number

Serial Number Locations

For quick reference, record your lift truck's serial numbers in the spaces provided below the photographs.

Located on the front side of the FCU.



Lift Truck Serial Number

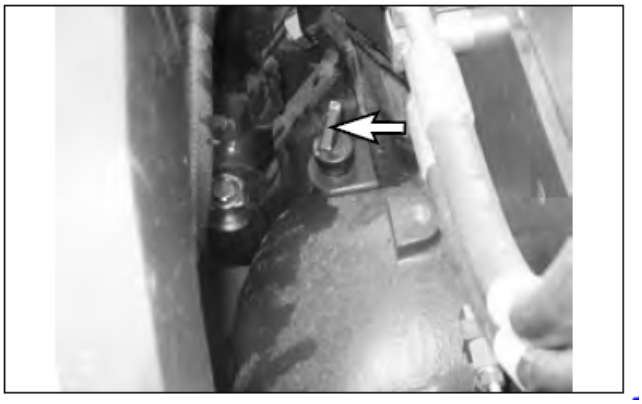
•

4.3 liter PSI Engine Serial Number(PSI)

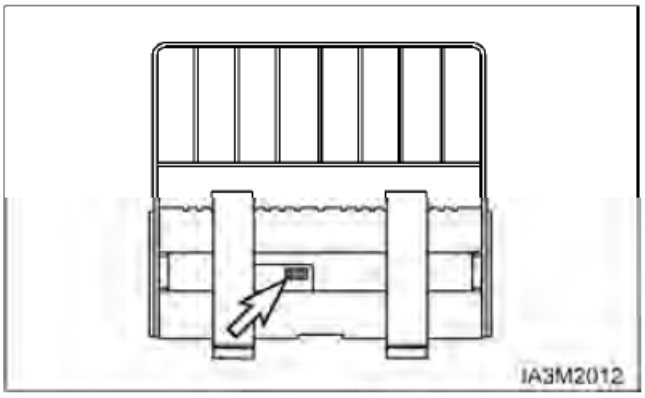
•

Transmission Serial Number

•



DRIVE AXLE Serial Number



Side Shifter Serial Number(If Equipped)

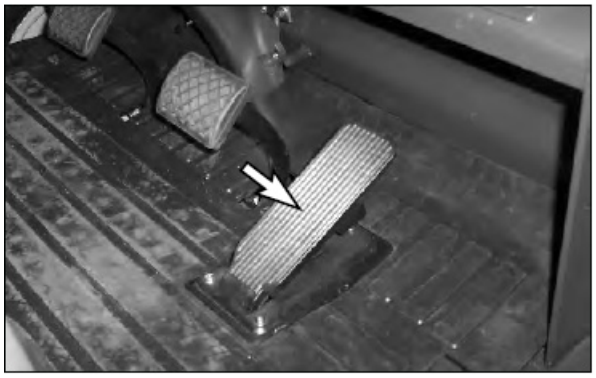
•

Service Brake Pedal

Push DOWN on the brake pedal to slow or stop the lift truck.

RELEASE the brake pedal to allow the lift truck to move.

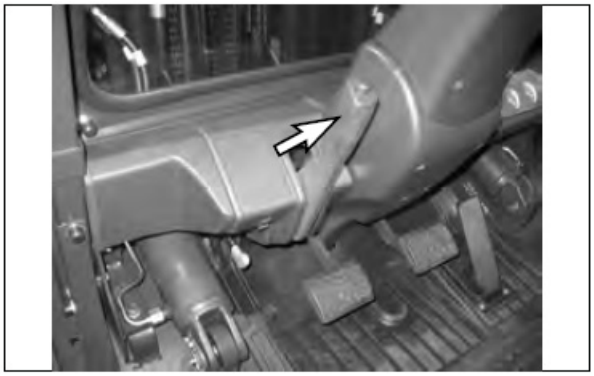
Accelerator Pedal



Push DOWN on the pedal to increase engine rpm (speed).

RELEASE the pedal to decrease engine rpm (speed).

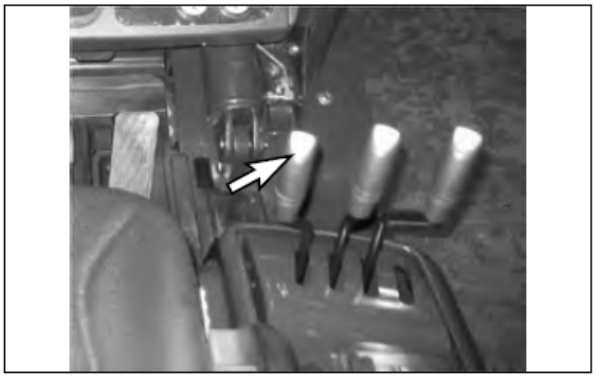
Parking Brake Lever



Pull the lever BACK to engage the parking brake.

Push the lever FORWARD to release the parking brake.

Lift Control



NOTE: To prevent a sudden change of position of the load, operate all lift, tilt and attachment controls smoothly.

1. **Lower Position** - Push the lever FORWARD smoothly to lower the load.

2. **Hold Position** - When the lever is released it will return to the HOLD or centre position. Lifting or lowering action will stop.

3. **Lift Position** - Pull the lever BACK smoothly to lift the load.

Basic Troubleshooting(LP)

The PSI 4.3L fuel systems are equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) and are covered in the Advanced Diagnostics section. Items such as fuel level, plugged fuel lines, clogged fuel filters and malfunctioning pressure regulations may not set a fault code by the Engine Control Module (ECM).

Below are basic checks that should be made before referring to the Advanced Diagnostics section, if engine or drivability problems are encountered.

Locating a problem in a propane engine is done exactly the same way as with a gasoline engine. Consider all parts of the ignition and mechanical systems as well as fuel system.

FUEL SYSTEM SYMPTOM DIAGNOSTICS

Checks	Action
Before Using This Section	Before using this section, you should have performed On Board Diagnostic (OBD) Check and determined that: 1. The ECM and MIL are operating correctly. 2. There are no Diagnostic Trouble Codes (DTCs) stored, or a DTC exists but without a MIL. Several of the following symptom procedures call for a careful visual and physical check. These checks are very important as they can lead to prompt diagnosis and correction of a problem.
Fuel System Check	1. Verify the customer complaint. 2. Locate the correct symptom table. 3. Check the items indicated under that symptom. 4. Operate the equipment under the conditions the symptom occurs. Verify HEGO switching between lean and rich. **IMPORTANT! Normal HEGO switching indicates the fuel system is in closed loop and operating correctly at that time.** 5. Take a data snapshot using the DST under the condition that the symptom occurs to review at a later time.
Visual and Physical Checks	• Check all ECM system fuses and circuit breakers. • Check the ECM ground for being clean, tight and in its proper location. • Check the vacuum hoses for splits, kinks and proper connections. • Check thoroughly for any type of leak or restriction. • Check for air leaks at all the mounting areas of the intake manifold sealing surfaces. • Check for proper installation of the mixer assembly. • Check for air leaks at the mixer assembly. Check the ignition wires for the following conditions: • Cracking • Hardening • Proper routing • Carbon tracking. Check the wiring for the following items: proper connections, pinches or cuts. The following symptom tables contain groups of possible causes for each symptom. The order of these procedures is not important. If the DST readings do not indicate a problem, then proceed in a logical order, easiest to check or most likely to cause the problem.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Checks	Action
DEFINITION: *The engine runs unevenly at idle. If severe enough, the engine may shake.*	
Preliminary Checks	None.
Sensor Checks	Check the Heated Exhaust Gas Oxygen Sensors (HEGO) performance: • Check for silicone contamination from fuel or improperly used sealant. If contaminated, the sensor may have a white powdery coating result in a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine causing a severe driveability problem. Check the Temperature Manifold Absolute Pressure (TMAP) sensor response and accuracy.
Fuel System Checks	• Check for rich or lean symptom that causes the condition. • Drive the vehicle at the speed of the complaint. • Monitoring the oxygen sensors will help identify the problem. • Check for a sticking mixer air valve. • Verify proper operation of the EPR. • Perform a cylinder compression test. Refer to Engine Mechanical in the Service Manual. • Check the EPR fuel pressure. Refer to the LPG Fuel System Diagnosis. • Check mixer assembly for proper installation and connection.
Ignition System Checks	• Check for the proper ignition output voltage using the spark tester J26792 or the equivalent. • Verify that the spark plugs are the correct type and properly gapped. Remove the plugs and inspect them for the following conditions: • Wet plugs. • Cracks. • Wear. • Improper gap. • Burned electrodes. • Blistered insulators. • Heavy deposits. Check the spark plug wires by connecting an ohmmeter to the ends of each wire in question. If the meter reads over 30,000 ohms, replace the wires.
Additional Checks	**Important:** The LPG Fuel system is more sensitive to intake manifold leakage than the gasoline fuel supply system. • Check for vacuum leaks. Vacuum leaks can cause a higher than normal idle and low throttle angle control command. • Check the ECM grounds for being clean, tight, and in their proper locations. Check the battery cables and ground straps. They should be clean and secure. Erratic voltage may cause all sensor readings to be skewed resulting in poor idle quality.

Table 2. MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
541 (54)	**SysVoltRangeHigh** System voltage too high	TurnOnMil	Check battery and charging system voltage Check battery voltage during starting and with the engine running Check voltage regulator, alternator, and charging system Check battery and wiring for overheating and damage Measure battery power at SECM with a multimeter (with key on) SECM Pin A23 (DRVP) to SECM Pin A16 (DRVG) SECM Pin A23 (DRVP) to SECM Pin B17 (DRVG)
551 (55)	**SensVoltRangeLow** Sensor reference voltage XDRP too low	(1) TurnOnMil (2) EngineShutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin B24 +5 Vdc to SECM Pin B1 XDRG GND Verify transducer power at ETC with a multimeter ETC Pin 3 XDRP PWR to ETC Pin 2 XDRG GND Verify transducer power to the foot pedal with a multimeter.
561 (56)	**SensVoltRangeHigh** Sensor reference voltage XDRP too high	(1) TurnOnMil (2) EngineShutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin B24 +5 Vdc to SECM Pin B1 XDRG GND Verify transducer power at ETC with a multimeter ETC Pin 3 XDRP PWR to ETC Pin 2 XDRG GND Verify transducer power to the foot pedal with a multimeter.
571 (57)	**HardOverspeed** Engine speed has exceeded the third level (3 of 3) of overspeed protection	(1) TurnOnMil (2) HardRevLimit	Usually associated with additional ETC faults Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade

(*) Fault actions shown are default values specified by the OEM.

Auto Shift Controller ASC - 206 (If Equipped)

Product Description

The Autoshift controller is an electrical control system, specially designed for use on forklift trucks with internal combustion engines.

Its primary purpose is to prevent the operator from operating the truck outside of the design parameters, e.g. selecting the reverse gear when traveling in excess of 6.0 km/h (3.73 mph) in a forward direction, and vice versa.

The Autoshift controller is mounted on a convenient position away from excessive heat sources and retrofits into the truck's electrical system. An inductive speed sensor is mounted on the transmission case where it will pick up a pulse from a gear tooth pattern. This pulse is used to monitor the truck in motion and its travel speed. To enable the system to change gears smoothly, the shift points for offset speed are adjustable.

An operator no longer has to change gears with his hands, therefore he can be more productive.

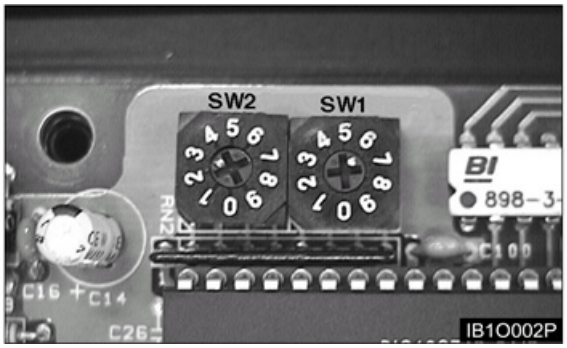
The Autoshift controller prevents strain and abuse to the transmission by changing gears up and down automatically. It also prevents damage to the half shaft, excessive tyre wear and heat to the transmission.

Features

1. 2 - speed auto shift control
2. Prevent downshifting at high speed
3. Inhibit selecting direction at high speed outside of the design parameters.

Adjustments

SW1 (Low-High Shift Point)		SW2 (Direction Inhibit Point)	
NOTCH	Vehicle Speed	NOTCH	Vehicle Speed
0	2.5 km/h (1.55 mph)	0	3.3 km/h (2.05 mph)
1	3.0 km/h (1.86 mph)	1	3.6 km/h (2.24 mph)
2	3.5 km/h (2.17 mph)	2	3.9 km/h (2.42 mph)
3	4.0 km/h (2.49 mph)	3	4.2 km/h (2.61 mph)
4	4.5 km/h (2.80 mph)	4	4.5 km/h (2.80 mph)
5	5.0 km/h (3.11 mph)	5	4.8 km/h (2.98 mph)
6	5.5 km/h (3.42 mph)	6	5.1 km/h (3.17 mph)
7	6.0 km/h (3.73 mph)	7	5.4 km/h (3.36 mph)
8	6.5 km/h (4.04 mph)	8	5.7 km/h (3.54 mph)
9	7.0 km/h (4.35 mph)	9	6.0 km/h (3.73 mph)



Adjustment Switch

Low-High Shift Point (SW1)

ASC-206 allows you to set the 2 speed Auto Gear Shift Point, the maximum travel speed at which the Auto Shift Controller up-shift or down-shift the transmission automatically according to the vehicle speed. For adjustment of 2 speed Auto Gear Shift speed, the SW1 switch is used on the printed circuit board.

For example if SW1 put to 5th notch, the 2 Speed Auto Gear Shift speed will be 5.0 km/h(3.11 mph), which is factory setting value as a default.

Direction Inhibit Point (SW2)

Auto Shift allows you to set the Direction Inhibit Speed, the maximum travel speed at which the transmission can be reversed. For adjustment of direction inhibit speed, the SW2 switch is used on the printed circuit board.

For example SW2 is put to 7rd notch, the Direction Inhibit Speed will be 5.4 km/h (3.36 mph), which is factory setting value as a default.

Transportation Hints

Lift Truck Shipping

Check travel route for overpass clearances. Make sure there is adequate clearance if the lift truck being transported is equipped with a high mast, overhead guard or cab.

To prevent the lift truck from slipping while loading, or shifting in transit, remove ice, snow or other slippery material from the loading dock and the truck bed before loading.

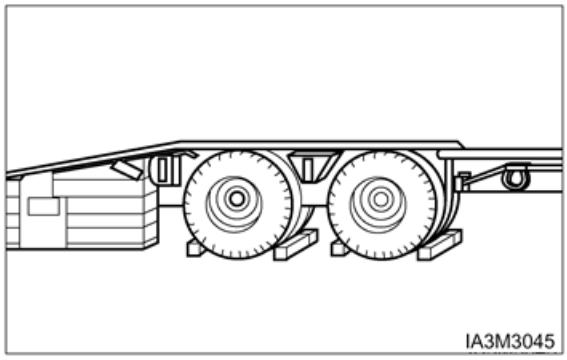
NOTICE

Obey all state and local laws governing the height, weight, width and length of a load.

Observe all regulations governing wide loads.

NOTICE

Remove ice, snow or other slippery material from the shipping vehicle and the loading dock



Always block the trailer or the rail car wheels before loading the lift truck.

Position the lift truck on the truck bed or the rail car.

Apply the parking brake and place the transmission control in NEUTRAL.

Turn the ignition switch to the OFF position and remove the key. If LP equipped, shut off the LP fuel tank.

Block the wheels and secure the lift truck with tiedowns.

Machine Lifting and Tiedown Information

NOTICE

Improper lifting or tiedowns can allow load to shift and cause injury and/or damage.

1. Weight and instructions given herein apply to lift trucks as manufactured by CROWN.
2. Use proper rated cables and slings for lifting. Position the crane for level lift truck lift.
3. Spreader bar widths should be sufficient to prevent contact with the lift truck.
4. Use the tiedown locations provided for lift truck tiedown.

Check the state and local laws governing weight, width and length of a load.

Contact your CROWN Lift Truck dealer for shipping instructions for your lift truck.

Torques for Taperlock Studs

Thread Size Inch	Standard Nut and Bolt Torque	
	N·m[1]	lb·ft
1/4	12 ± 4	9 ± 3
5/16	25 ± 7	18 ± 5
3/8	45 ± 7	33 ± 5
7/16	70 ± 15	50 ± 11
1/2	100 ± 15	75 ± 11
9/16	150 ± 20	110 ± 15
5/8	200 ± 25	150 ± 18
3/4	360 ± 50	270 ± 37
7/8	570 ± 80	420 ± 60
1	875 ± 100	640 ± 75
1 1/8	1100 ± 150	820 ± 110
1 1/4	1350 ± 175	1000 ± 130
1 3/8	1600 ± 200	1180 ± 150
1 1/2	2000 ± 275	1480 ± 200

[1] 1 Newton meter (N•m) is approximately the same as 0.1 kg•m.

Torque for Metric Fasteners

NOTICE

Be very careful never to mix metric with U.S. customary (standard) fasteners. Mismatched or incorrect fasteners will cause lift truck damage or malfunction and may even result in personal injury.

Original fasteners removed from the lift truck should be checked for any damages and kept for reassembly whenever possible. If new fasteners are needed, they must be of the same size and grade as the ones that are being replaced.

The material strength identification is usually shown on the bolt head by numbers (8.8, 10.9, etc.). This chart gives standard torques for bolts and nuts with Grade 8.8.

For mounting torques of main parts, Please refer to Service manual for detail.

NOTE: Metric hardware must be replaced with metric hardware. Check parts book.

Metric ISO[2] Thread

Thread Size Metric	Standard Torque	
	N·m[1]	lb·ft
M6	12 ± 4	9 ± 3
M8	25 ± 7	18 ± 5
M10	55 ± 10	41 ± 7
M12	95 ± 15	70 ± 11
M14	150 ± 20	110 ± 15
M16	220 ± 30	160 ± 22
M20	450 ± 70	330 ± 50
M24	775 ± 100	570 ± 75
M30	1600 ± 200	1180 ± 150
M36	2700 ± 400	2000 ± 300

[1] 1 Newton meter (N•m) is approximately the same as 0.1 kg•m.

[2] ISO - International Standards Organization.

Quick Reference to Maintenance Schedule				FIRST	EVERY						
ITEMS	SERVICES	PAGE	When Required	50-100 Service Hours or a Week	10 Service Hours or Daily	250 Service Hours or Monthly	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	1500 Service Hours or 9 Months	2000 Service Hours or Yearly	2500 Service Hours or 15 Months
Air Breather	Change	144						o			
Air Cleaner Indicator	Check	123			o						
Air Intake System	Change	143						o			
Air Intake System	Check, Clean	134					o				
Battery Terminal	Clean, Inspect	121	o								
Brake Oil Level	Check	126			o						
Carriage Roller Extrusion	Check, Adjust	121	o								
Carriage Side Rollers	Lubricate	138					o				
Carriage Side Rollers Thrust (If Equipped)	Lubricate	137					o				
Carriage Sideshifter (If Equipped)	Lubricate	137					o				
Checking the TMAP Sensor (LP Engine Only)		156									o
Circuit Breaker		120	o								
Circulation Pump Belt (OCDB & LP Engine Only. If Equipped)	Check, Adjust	139					o				
Coolant Level	Check, Clean	122			o						
Cooling System	Clean, Change	152								o	
Crosshead Rollers	Inspect	137					o				
Drive Axle Oil	Check, Clean, Change	130		o							
Drive Axle Oil & Strainer (OCDB Only)	Check, Clean, Change	139					o				
Drive Axle Oil (Shoe Brake Only)	Check, Clean, Change	148							o		
Drive Axle Oil Level	Check	126			o						
Engine Oil & Filter	Change	133				o					
Engine Oil Level	Check	122			o						
Fork	Inspect	153								o	
Fuel Filter (LP Engine Only)		149							o		
Fuel Lines & Fittings	Check	144						o			
Fuel Trim Valve(FTV) Inspection (PSI Engine only)		141					o				
Fuse & Relay (LP Engine Only)		120	o								
Fuses, Bulbs & Circuit Breaker	Change, Reset	119	o								
Horn & Lights (If Equipped)	Check	140					o				
Hydraulic Oil	Check, Clean, Change	155									o
Hydraulic Oil Level	Check	126			o						
Hydraulic Return Filter	Change	144						o			
Inspect Battery System		155									o
Inspect Coolant Hoses (LP Engines Only)		143						o			

Hydraulic Oil Level - Check

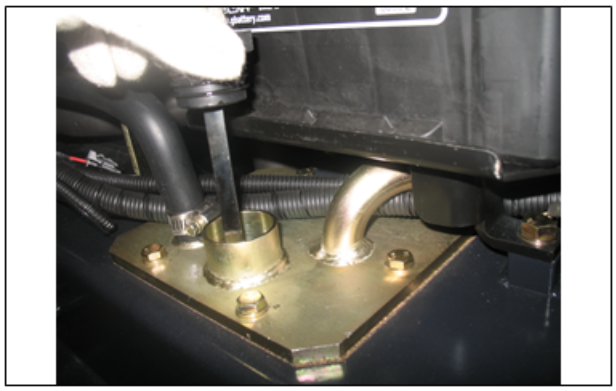
WARNING

At operating temperature, the hydraulic tank is hot and under pressure.

Hot oil can cause burns.

Remove the filter cap only when the engine is stopped, and the cap is cool enough to touch with your bare hand. Remove the filter cap slowly to relieve pressure.

1. Operate the lift truck for a few minutes to warm the oil. Park the lift truck on a level surface, with the forks lowered, mast tilted back, parking brake engaged, transmission in NEUTRAL and the engine stopped.
2. Raise the hood and seat assembly. Make sure the air lift cylinder securely holds the hood open.



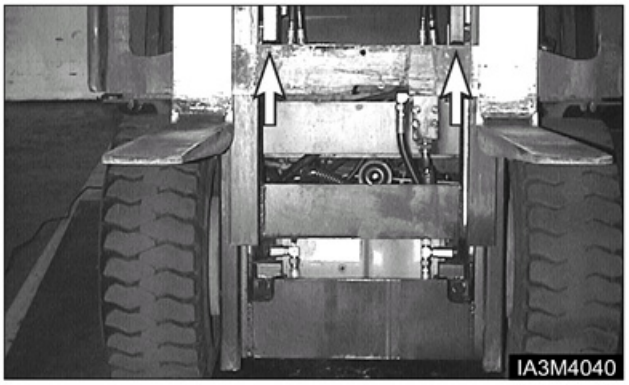
3. Remove the dipstick/ filter cap. Maintain the oil level to the FULL mark on the breather/dip stick.

Drive Axle Oil Level - Check

WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Park the lift truck on a level surface. Apply the parking brake. The engine is at the low idle. Place the directional control level in NEUTRAL.



1. Lift the carriage high enough to access the drive axle housing oil level plug and fill plug.
2. Put blocks under the carriage.

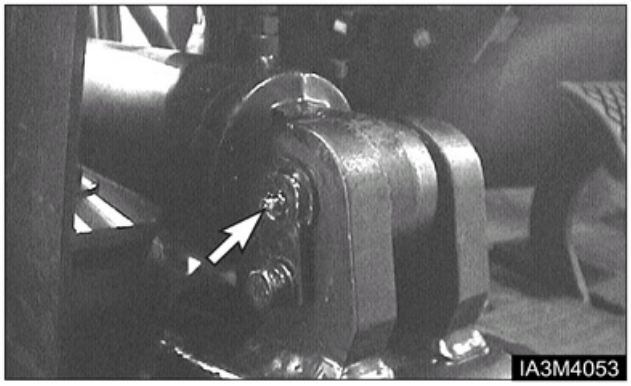
Brake Oil Level - Check

The brake reservoir is located on the left side of the steering column.

1. Remove the filler cap.
2. Maintain the brake fluid level to the fluid level mark on the brake system reservoir.
3. Clean and install the filler cap

Tilt Cylinders - Check, Adjust, Lubricate

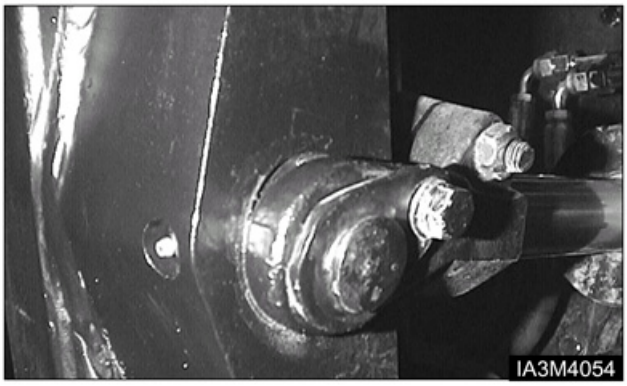
Chassis Pivot Eyebolts



Typical Example

1. Lubricate two fittings for the pivot eyebolts, one on each tilt cylinder.
2. Check the pivot eye pins for loose retainer bolts and wear.

Mast Pivot Eyes

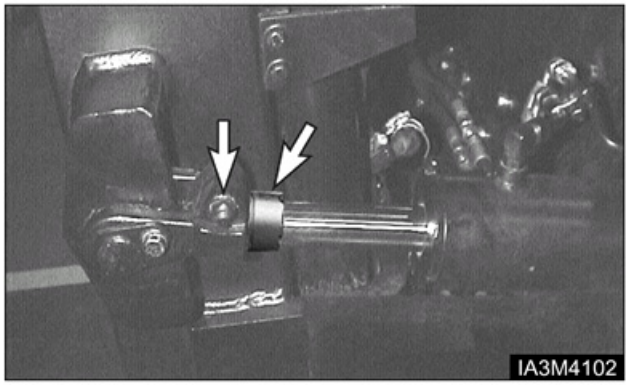


Typical Example

3. Lubricate two fittings for the mast pivot eyes, one on each side of the mast.
4. Check the pivot eye pins for loose retainer bolts and wear.

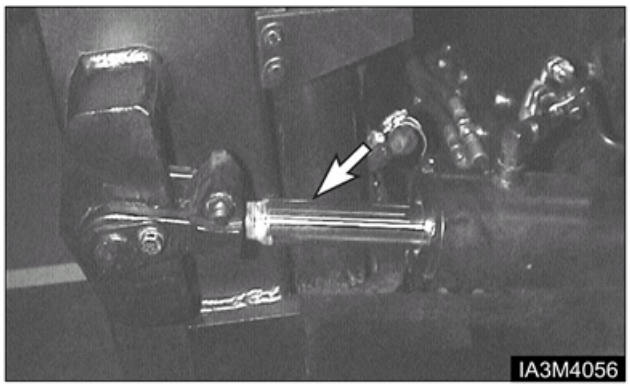
Cylinder Rod Extension

NOTE: The following description is for forward tilt. For cylinder rod back tilt, the collar should be stationary by the tilt eye. If it is not, the O-ring inside the collar may need to be replaced. To adjust back tilt, spacers must be added or removed.



Typical Example

1. Check to make sure the tilt cylinders extend and retract evenly.
2. If one cylinder continues to move after the other cylinder has stopped in full forward or backward tilt, an adjustment must be made to one cylinder.



Typical Example

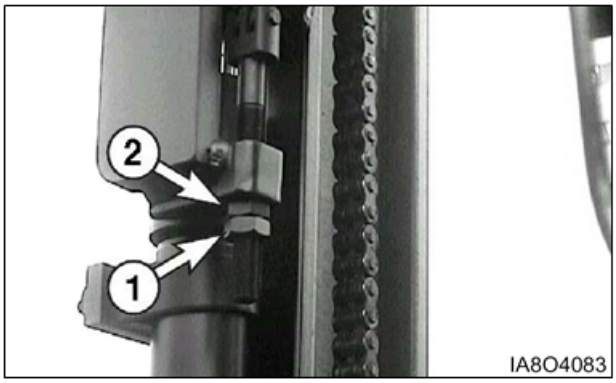
3. To adjust the cylinder rod extension, move the spacer to the rear and loosen the pinch bolt on the clevis.
4. Turn the cylinder rod in or out of the clevis to obtain the proper adjustment. Turning the rod into the clevis shortens the stroke. Turning the rod out of the clevis lengthens the stroke. When turning for extending rod, the overlapped length between clevis's thread and cylinder rod must be minimum 32 mm
5. Tighten the pinch bolts to a torque of 95 ± 15 N•m (70 ± 10 lb•ft). Check the cylinder rods again for even travel.

Carriage Chain Adjustment

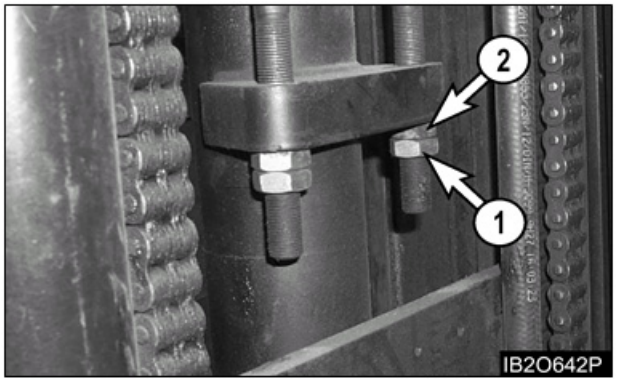
Make sure that carriage height is correct. If correct, adjust the chain for equal tension. If not, adjust the chain for correct carriage height by adjusting anchor nuts(1),(2).

NOTE: See the previous section, "Carriage Roller Extrusion" in "When Required" for proper height of carriage.

1. Fully lower the carriage and tilt mast forward or lift the carriage and put blocks under the carriage to release the tension from the lift chains.
2. Loosen nut(1) and adjust nut(2) to get proper distance from bottom of inner upright to the bottom of carriage bearing.



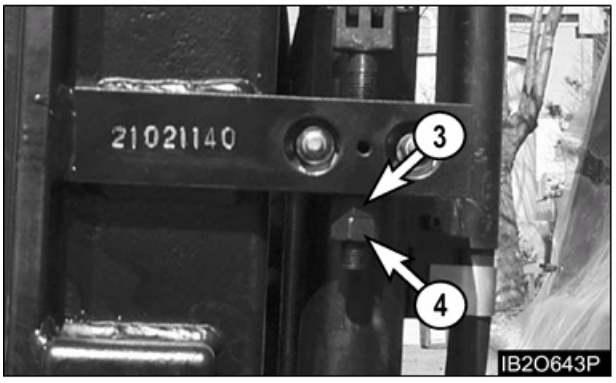
Typical example for carriage chain of STD mast



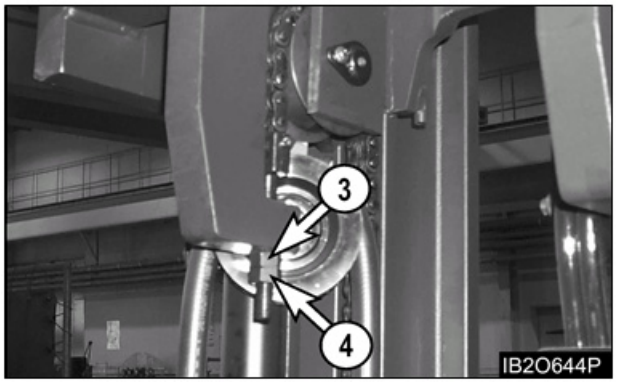
Typical example for carriage chain of FF,FFT mast

3. Make adjustment anchor nut(1),(2) for equal chain tension.
4. Set the mast vertical and raise the carriage and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 Tread lock on the threads of the anchor nuts(1),(2) after the adjustment is completed.

Mast Chain Adjustment - FF, FFT Mast



Typical example for FF mast



Typical example for FFT mast

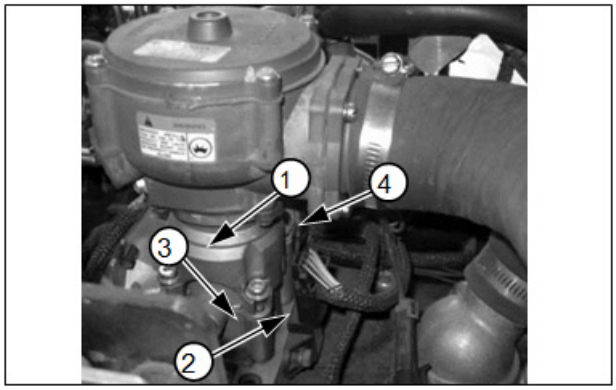
Make sure that mast height is correct. If correct, adjust chain for equal tension. If not, adjust mast chain for correct mast height by adjusting anchor nuts (3), (4).

NOTE: See the previous section, "Carriage Roller Extrusion" in "When Required" for proper inner mast height.

1. Lift the inner mast and put blocks under the inner mast to release the tension from the lift chains.
2. Loosen nut(3) and adjust nut(4) to make inner mast rail flush with outer mast rail bottom.
3. Make adjustment anchor nuts(3),(4) for equal chain tension.
4. Raise the inner mast and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 tread lock on the threads of the anchor nuts(3),(4) after the adjustment is completed.

Checking the TMAP Sensor (LP Engine Only)

1. Verify that the TMAP sensor (2) is mounted tightly into the manifold adapter (3), with no leakage.
2. If the TMAP is found to be loose, remove the TMAP retaining screw and the TMAP sensor from the manifold adapter.
3. Visually inspect the TMAP O-ring seal for damage. Replace as necessary.
4. Apply a thin coat of an approved silicon lubricant to the TMAP o-ring seal.
5. Re-install the TMAP sensor into the manifold adapter and securely tighten the retaining screw.



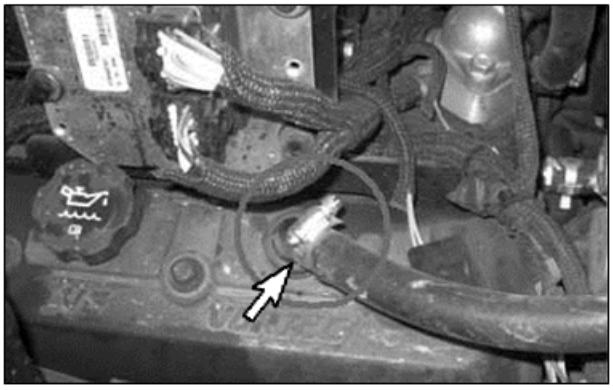
(1) Adapter-Throttle body, (2) TMAP sensor,
(3) Adapter-Manifold, (4) Throttle body

Inspect for Intake Leaks (LP Engine Only)

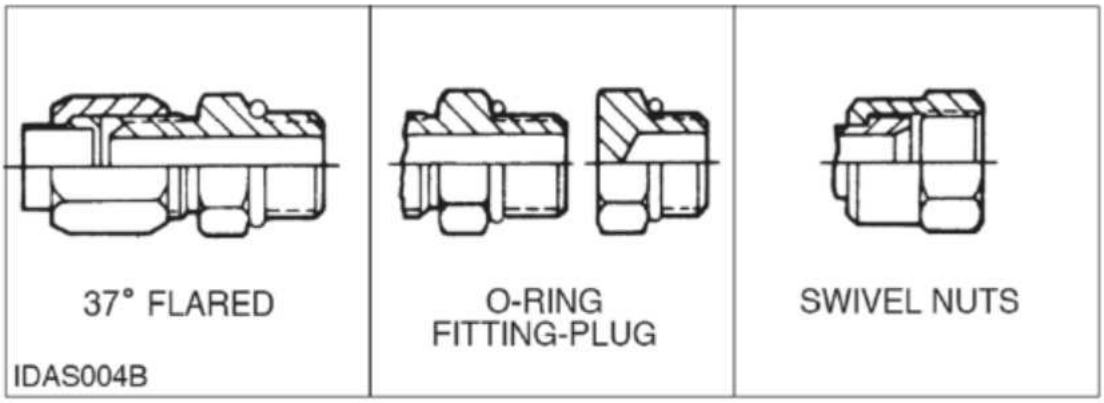
1. Visually inspect the intake manifold, throttle assembly (4), and manifold adapters (3), for looseness and leaks. Repair as necessary.

Replace PCV Valve and breather element - Change (LP Engine Only)

2. Loosen the hose clamps and remove the PCV valve.
3. Assemble new PCV valve and hose.
4. Tighten hose clamps



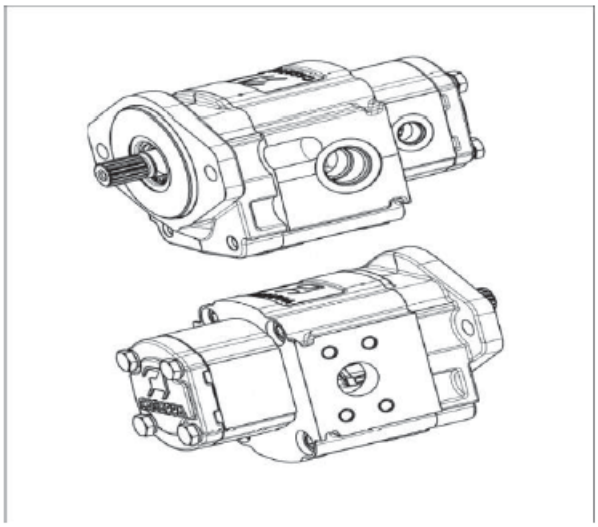
37° FLARED AND STRAIGHT THREAD O-RING FITTINGS



37° FLARED AND STRAIGHT THREAD O-RING FITTINGS (EXCEPT O-RING FACE SEAL FITTINGS)				
NOMINAL TUBE O.D.		THREAD SIZE	STANDARD TORQUE	
METRIC	INCH	inch	(N • m)	(lb ft)
3.18	.125	5/16	5.0 ± 1.5	4 ± 1
4.76	.188	3/8	11.0 ± 1.5	8 ± 1
6.35	.250	7/16	16 ± 2	12 ± 1
7.94	.312	1/2	20 ± 5	15 ± 4
9.52	.375	9/16	25 ± 5	18 ± 4
9.52	.375	5/8	35 ± 5	26 ± 4
12.70	.500	3/4	50 ± 7	37 ± 5
15.88	.625	7/8	65 ± 7	48 ± 5
19.05	.750	1-1/16	100 ± 10	75 ± 7
22.22	.875	1-3/16	120 ± 10	90 ± 7
25.40	1.000	1-5/16	135 ± 15	100 ± 11
31.75	1.250	1-5/8	180 ± 15	135 ± 11
38.10	1.500	1-7/8	225 ± 15	165 ± 11
50.80	2.000	2-1/2	320 ± 30	240 ± 22

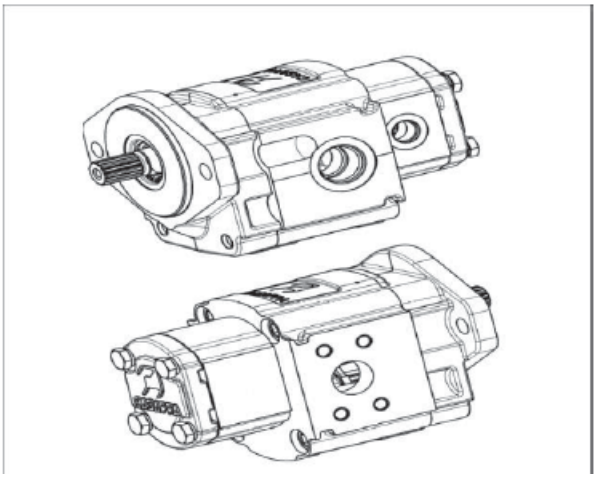
Hydraulic Pump

D35S/40S/45S/50CS/55CS-5



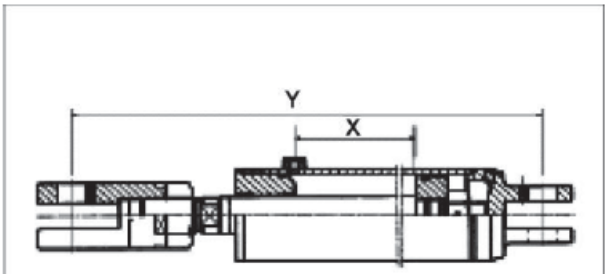
Type:
Tandem gear pump
Displacement: 46 cc/rev (front) + 6 cc/rev (rear) for ODB system
46 cc/rev (front) +16 cc/rev (rear) for SHOE BRAKE system
Max working pressure: 25 Mpa (front) +28 Mpa (rear)
Max speed 2500 rpm, minimum speed 600 rpm

G35S/40S/45S/50CS/55CS-5
GC35S/40S/45S/50CS/55CS-5

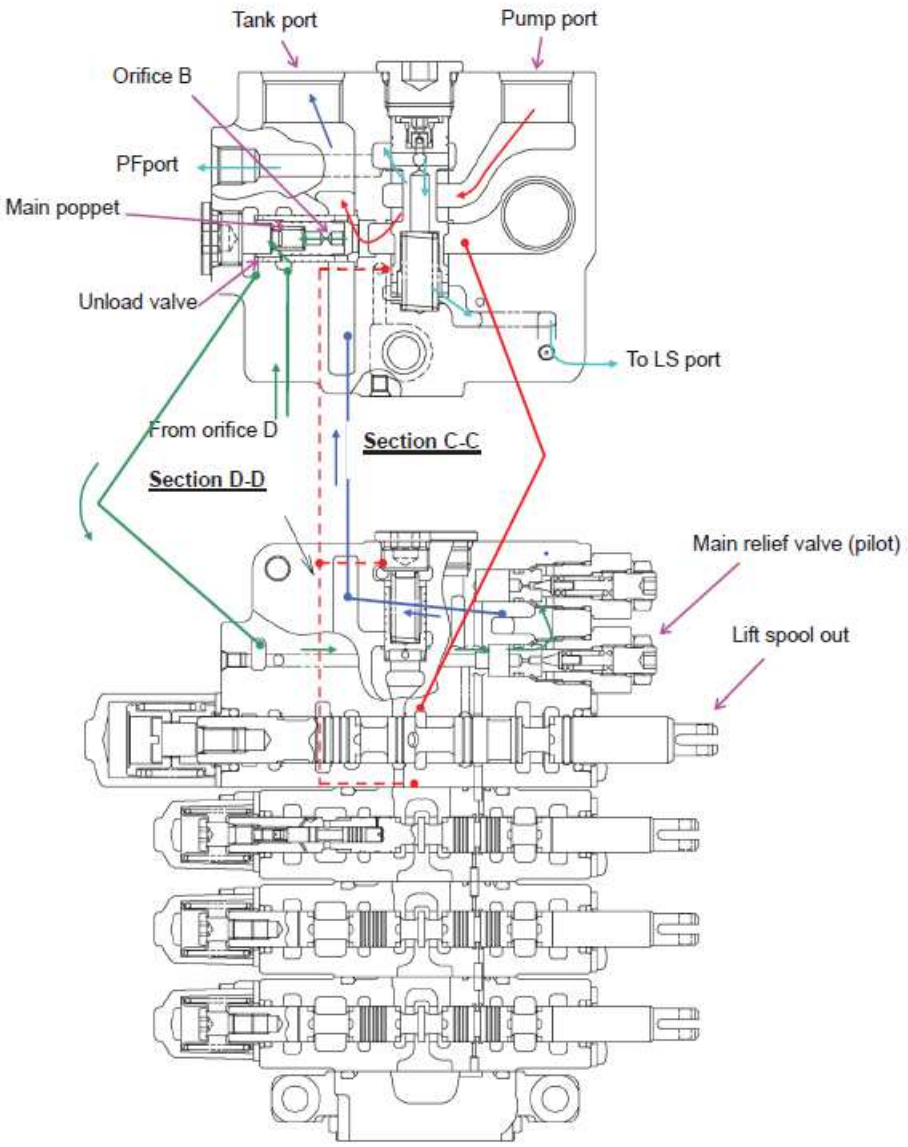


Type:
Tandem gear pump
Displacement: 41 cc/rev (front) + 6 cc/rev (rear) for ODB system
41 cc/rev (front) +16 cc/rev (rear) for SHOE BRAKE system
Max working pressure: 25 Mpa (front) +28 Mpa (rear)
Max speed 3000 rpm, minimum speed 600 rpm

Tilt Cylinder



Truck	p/no	Tilting angle [degree]		Closed length (Y)	Stroke (X)	Tube O.D(mm)x Rod(mm)
		FWD	BWD			
D35S/40S/45S/50SC/55SC-5 G35S/40S/45S/50SC/55SC-5	D512979	8	10	528 mm	203 mm	90 x 40
	D512980	12	8	528 mm	222 mm	90 x 40
GC35S/40S/45S/50SC/55SC-5	D518158	5	6	552 mm	95 mm	90 x 40

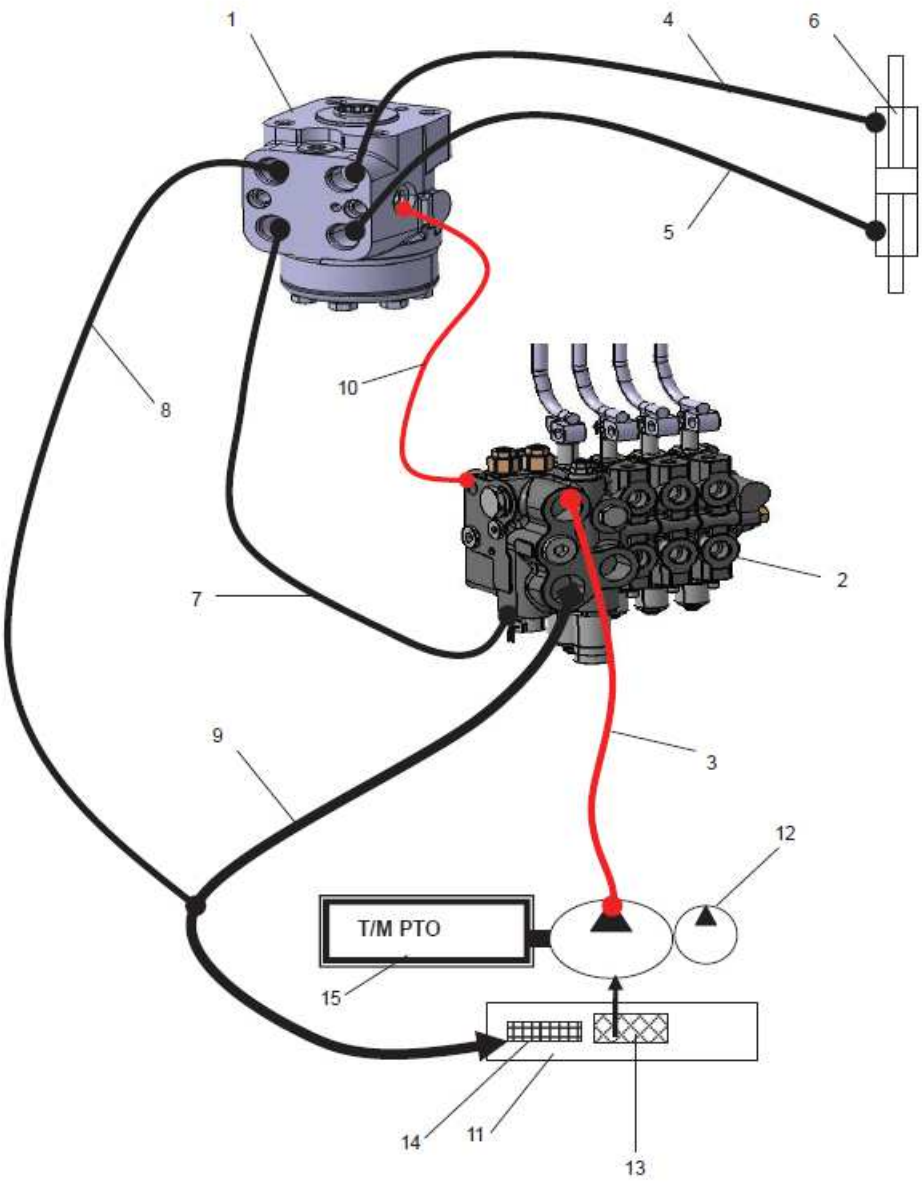

Tank port
Pump port
Orifice B
PFport
Main poppet
Unload valve
To LS port
From orifice D
Section C-C
Section D-D
Main relief valve (pilot)
Lift spool out
Section E-E

【Fig 1-4】

Steering System

Hydraulic Operation

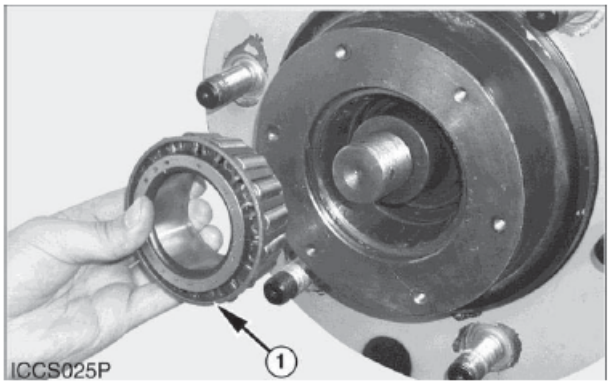
Hydraulic Schematic



steering system schematic (1). steering unit (2). control valve (3). hydraulic line (4). hydraulic line (5). hydraulic line (6). power steering cylinder (7). hydraulic line (8). hydraulic line (9). hydraulic line (10). hydraulic line (11). hydraulic tank (12). tandem gear pump (13). suction filter (14). filter-return (15). transmission PTO

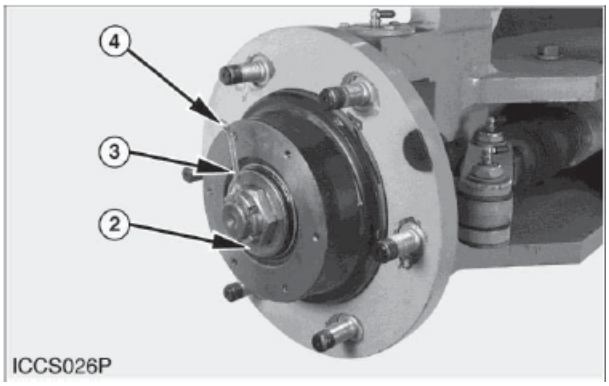
Steering System

Steer Wheel Bearing Adjustment



Outer Wheel Bearing
(1) Outer Wheel Bearing.

1. Install outer wheel bearing (1). Be sure the wheel bearings have the correct lubrication.



Locknut Installation
(2) Washer. (3) Nut-Castle. (4) Pin-Cotter.

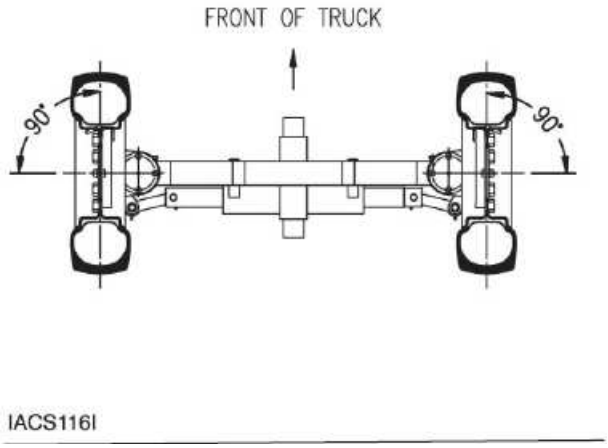
2. Install washer (2) and Nut-Castle (3).
3. Tighten Nut-Castle (3) to 135 L 5 N·m while the wheel is turned to put bearing (1) in position.
4. Loosen the nut (3) by one-fourth turn of one torn.
5. Install Pin-Cotter (4) to locking position and lock it.

Steer Axle Stop Adjustment

WARNING

To prevent personal injury, apply the parking brakes and put blocks in front of drive wheels to stop any movement of the truck.

1. Raise the steer wheels just enough from the floor so steer wheels can be turned freely.



Steer Wheels In Straight Ahead Position

2. Turn the steer wheels in a straight ahead position. Put a straight line with chalk, in parallel with the axle beam, across the width of the tires. Make a line at a 90° angle toward the center of each tire. Make a line around the center of each steer tire.