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**➤ ENVIRONMENT****ENVIRONMENTAL POLICY**

**INTERNATIONAL ENGINES SOUTH AMERICA LTDA** is committed with the continuous search of the environment preservation in Diesel engines production for the worldwide market, through an efficient administration of its resources, processes and products.

**GUIDELINES:**

To attend the legislation, applicable environmental rules and other requirements that the Company has joined.

To develop products and procedures to reduce environmental impacts and to avoid pollution.

To apply an efficient administration system that promotes the continuous improvement to reach environmental objectives and targets.

To promote, in the Company, the sense of individual responsibility in relation with the environment.

To involve its suppliers and service suppliers in the development of habits which cooperate in the preservation of the environment.

**ENVIRONMENT**

The environment preservation is a basic point in the managerial philosophy of **INTERNATIONAL ENGINES SOUTH AMERICA LTDA**.

It has been approved a program of actuation that includes activities as natural resources conservation, elimination and residues recycling, water protection, noise reduction and acoustic isolation, air purity conservation and contaminants residues elimination.

All these subjects constitute the mark of a wide environment protection program, which is considered since the beginning of a new product project.

The International HS 2.8L engine was released in the market and accomplishes without problems all these requirements.

The systematical accomplishment of this philosophy can be appreciated especially in the main aspects, like disassembly easiness, less number of materials, usage of plastics of easy recycling.

It means, equally, that materials harmful to the environment are not used, like amianthus, cadmium and hydro-carbide fluor-chlorined.

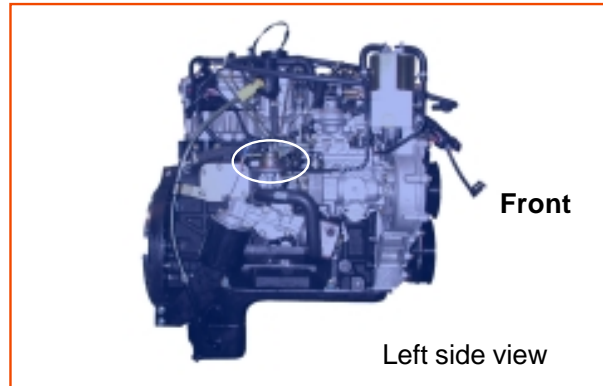
In the same field, gases and acoustics emissions reduction are considered, as well as the improvement of the active and passive safety.

This environment protection program is not limited only to the production process, because it is extended to the complete cycle of useful life of the engine, considering also its wear after a long operation period.

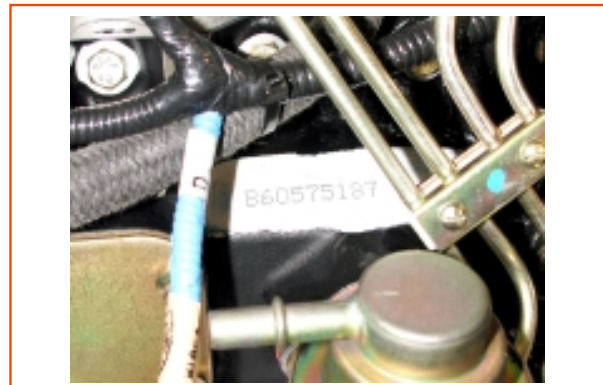
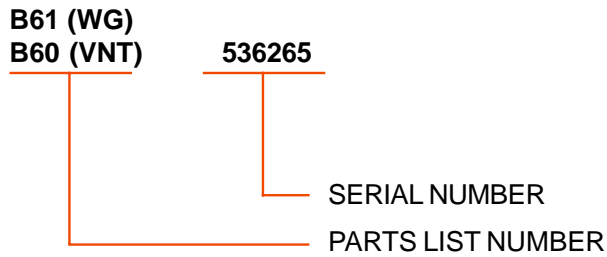
We have assumed a commitment with the planet we live in. A commitment that we take very seriously.

**LOCATION AND IDENTIFICATION OF THE ENGINE NUMBER**

**Location**



**Identification**



- For engines manufactured in Brazil - nr 000001 to 499999.
- For engines manufactured in Argentina - nr from 500000 on.

**PS:** (WG) - Wastegate Version  
(VNT) - Variable Nozzle Turbocharger Version

## ► OPERATION AND MAINTENANCE RECOMMENDATIONS

### START AND STOP

#### Before starting the engine

1. Check “Daily Maintenance” items, see PERIODIC MAINTENANCE.
2. Turn start key to contact position and check if battery charge and engine oil pressure indicator lamps are switched on.

If the engine has been stayed inactive for a long period, bleed the fuel system.

#### Start

**Warning:** POSITION TRANSMISSION LEVER TO NEUTRAL.

1. Position key in start position for seven seconds, at the maximum.

If engine doesn't work, repeat operation after 30 (thirty) seconds.

**Note:** Do not keep the key turned too much long, because it will damage the starter.

In turbocharged engines, after to start, do not accelerate over than 1000 rpm, during the firsts 30 (thirty) seconds. This allows turbocharger lubrication line pressure equalization avoiding damages to this equipment.



#### Key Positions

1. Off
2. Contact
3. Start

PERIODIC MAINTENANCE

PERIODS								CHECK
15,000 km (9,300 mi)	30,000 km (18,600 mi)	45,000 km (27,900 mi)	60,000 km (37,300 mi)	75,000 km (46,600 mi)	90,000 km (55,900 mi)	105,000 km (65,200 mi)	120,000 km (74,600 mi)	
Daily								Check engine oil level (complete if necessary).
Daily								Check water "reservoir" level (complete if necessary).
Daily								Drain impurities from the fuel filter and sedimentation filter.
Daily								Check air filter hoses and connections conditions.
●	●	●	●	●	●	●	●	Check the terminals and battery level.
●	●	●	●	●	●	●	●	Retighten engine rubber pads.
●	●	●	●	●	●	●	●	Replace lubricant oil and filter.
●	●	●	●	●	●	●	●	Replace fuel filter element.
●	●	●	●	●	●	●	●	Adjust valves clearance.
●	●	●	●	●	●	●	●	Check idle speed*.
●	●	●	●	●	●	●	●	Check teeth belt conditions, through the inspection lateral plug.
●	●	●	●	●	●	●	●	Check external belts conditions.
●	●	●	●	●	●	●	●	Cooling system: check anti-freezing (replace at each 2 years).
●	●	●	●	●	●	●	●	Check oil - fuel - cooling piping conditions.
							●	Replace external belts.
							●	Replace toothed belt.
			●				●	Evaluate starter, alternator and turbocharger**.

After the first change at 15.000 km (9,300 mi) lubricant oil and oil filter must be obligatory changed at each 15.000 km (9,300 mi) or 6 months maximum (which one first occurs). Fuel filter must be replaced and fuel tank clean (maximum) at each 6 months, even without reached the limit of 15.000 km (9,300 mi) (recommended for the fuel filter change).

\* Services that have to be made by Distributors / Authorized Services Net.

\*\* Services that have to be made by part manufacturer.

**Remark:** For vehicles that work predominantly in regions where sulfur index in fuel is over than 1%, lubricant oil change intervals must be at each 7.500 km.

**Reinstallation**

1. Reinstall water pump in the inverse order of the removal, using a new gasket.
2. Use two prisoners as guide to position the new gasket, reinstall the assembly support in the inverse order.
3. Apply Loctite 242 and tighten the bolts with the specified torque (See TIGHTENING SPECIFICATIONS).

**THERMOSTAT****Removal**

1. Partially drain cooling system, until the level of the coolant water is below the thermostat housing.
2. Disconnect hose from thermostat housing.
3. Disconnect electric connections of the water temperature switch.
4. Remove outlet elbow.
5. Remove thermostat.
6. Pay attention that the initial scale for the thermostat operation evaluation test is 88 °C (190 °F). Install the thermostat in a recipient with water. Heat the water up and check the temperature in which the thermostat begins to open. The thermostat will be satisfactory if it opens between 86 and 90 °C (187 and 194 °F).

**Reinstallation**

1. Put the thermostat with the breathe guide / hole pin totally upwards (12 o'clock position).
2. Install the outlet elbow and a new sealing washer. Tighten bolts within 22 to 28 Nm.
3. Invert the removal operations.
4. Tighten bolts within 22 to 28 Nm.
5. Check for coolant water leakages around all the connections and gaskets.

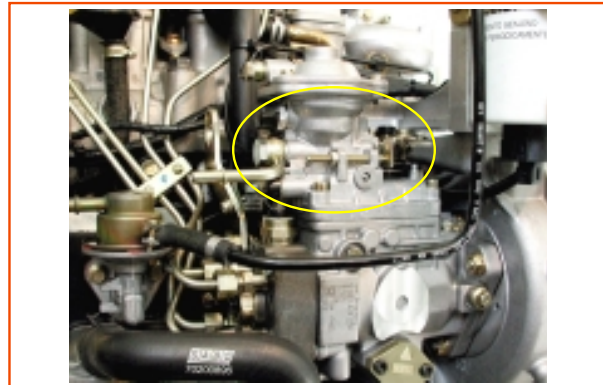
20. Using adequate anti-adherent compound, install the flywheel housing plug and tighten it according to specification.
21. Install inspection cover with a new gasket on timing housing cover and tighten bolts according to specification.
22. Reinstall nozzle-holders pipes.
23. Assembly accelerator cables at fuel injection pump.

**Note:** Remove special tool.

24. Bleed fuel system, see FUEL SYSTEM - Bleeding.
25. Start engine and check system for leakages.

### IDLE SPEED ADJUSTMENT

1. Check and adjust accelerator cable.
2. Start engine and let it work until reach normal operation temperature always varying its speed.
3. Using an appropriate tachometer, check idle speed value.
4. Loosen counter-nut in fuel injection pump, if adjustment is necessary.
5. Turn adjustment screw clockwise to increase engine speed, or counter clockwise to decrease it. Operate engine at a higher speed during a few seconds and check idle speed again.
6. Once correct speed is get, tighten screw and counter-nut.



**Note:** The idle speed is the only adjustment allowed in service. Any other additional adjustment must be made by a Bosch authorized representative.

## ► CYLINDER HEAD

### Removal

**Warning:** Loosen radiator lower and upper hoses. Remove reservoir cover and loosen water outlet hose from thermostat housing. Drain Coolant water.

**Warning:** Loosen exhaust duct from the manifold.

1. Remove outlet elbow and thermostat.
2. Loosen intake duct from manifold.
3. Loosen nozzle-holder return pipe from fuel injection pump.
4. Remove all fuel system pipes.
5. Remove nozzle-holders and washers.
6. Remove air filter and / or intake manifold hose.
7. Remove turbocharger hoses.
8. Remove intake and exhaust manifolds.
9. Remove valves cover breather lateral hose.
10. Loosen the breather valve fixation bolt, remove valve together with valve pipe from intake manifold, remove and discard o'ring.



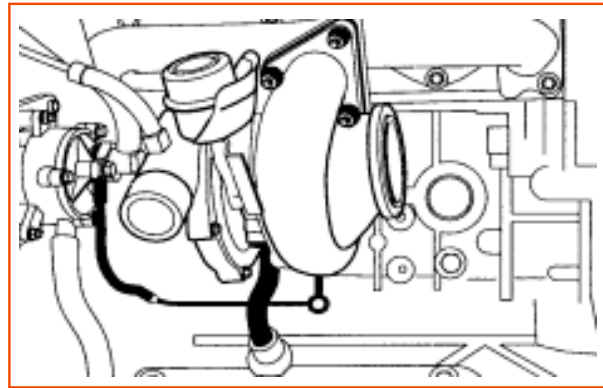
11. Remove valves cover and gasket.





**TURBOCHARGER****Removal**

1. Loosen clamp and disconnect turbocharger inlet pipe from intake manifold.
2. Loosen clamp and disconnect breather hose from turbocharger inlet elbow.
3. Loosen clamp and disconnect air filter hose.
4. Remove inlet elbow, loosening support bolts.
5. Loosen lower exhaust pipe in the silencer flange nuts, making sure if the pipe turns freely.
6. Remove turbocharger outlet elbow from exhaust pipe.
7. Position an appropriate recipient under the engine and remove banjo bolt from turbocharger lubrication pipe and disconnect turbocharger oil return pipe from cylinder block.
8. Loosen turbocharger fixation prisoners nuts from exhaust manifold, removing it carefully.

**Reinstallation**

1. Reinstall in inverse order of removal.

**INTAKE MANIFOLD****Removal**

1. Loosen clamp and disconnect turbocharger inlet pipe from intake manifold.
2. Remove valve fixation bolts and vacuum derivation and remove the set.
3. Remove bolt that fix intake manifold to intake elbow from turbocharger.
4. Remove boost pipe control banjo bolt.

2. Remove camshaft rear seal.



### Cleaning, inspection and assembly

1. Check camshaft bushing housing bores.



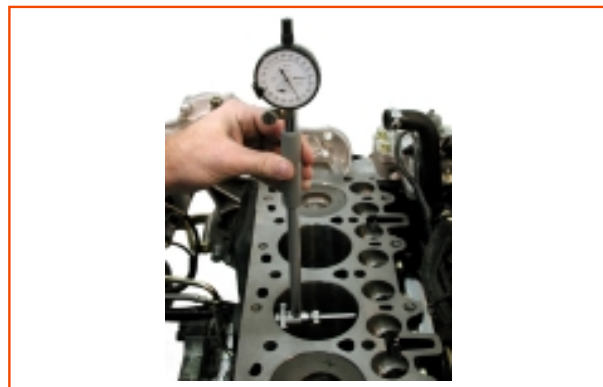
2. Position bushing in engine block.
3. Assemble bushing, making sure that lubrication hole is aligned with the hole in the block.
4. Assemble camshaft rear seal, applying Loctite 601.



### CYLINDER

#### Verification

1. Check cylinder inner diameter and out-of-roundness. If dimensions found are higher than specified, replace the engine block. Maximum bore allowed for service.

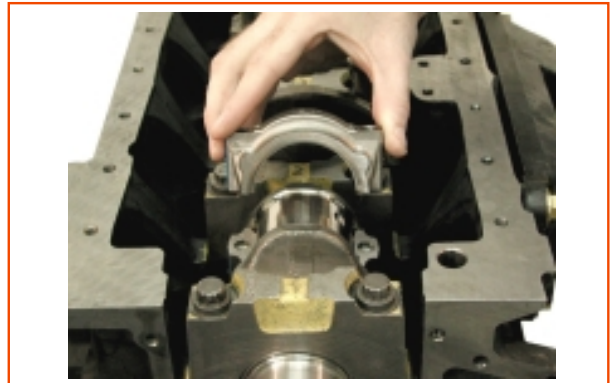


**► CRANKSHAFT****Removal**

1. Remove engine.
2. Remove cylinder head and push rods.
3. Remove accessories support.
4. Remove oil pan.
5. Remove timing housing and camshaft.
6. Remove flywheel housing and flywheel.
7. Remove pistons and connecting rods.

**Disassembly**

1. To disassembly, position engine topside down. Remove rear oil seal housing and gasket.
2. Remove connecting rod caps and shells.



3. Remove main bearing caps and shells.

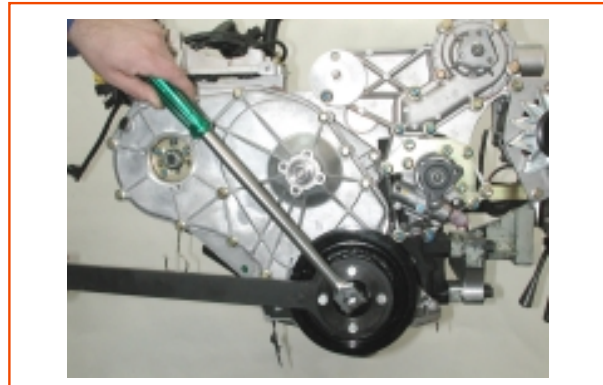


**► CRANKSHAFT PULLEY****Removal**

1. Drain coolant water.
2. Remove radiator upper hose.
3. Remove fan, see FAN -Removal
4. Remove moving belt, see ACCESSORIES MOVING BELT - Removal.
5. Install tool nr. 8130638 in crankshaft pulley and fix it with 4 bolts.
6. Remove crankshaft pulley fixation bolt, using a lever of an appropriate length.
7. Remove pulley. If necessary, use extractor nr. 8130628.

**Reinstallation**

1. Reinstall in inverse order, tightening fixation bolt with 80 Nm + 125°.

**TIMING HOUSING COVER****Removal**

1. Remove crankshaft pulley, see CRANKSHAFT PULLEY - REMOVAL
2. Remove 14 fixation bolts from timing housing cover.
3. Remove cover with gasket.

**Seal replacement**

1. Remove used cover seal and clean housing
2. Support cover and install a new seal, open side turned to the housing, using tool nr. 8130637.



**TIMING HOUSING****Removal**

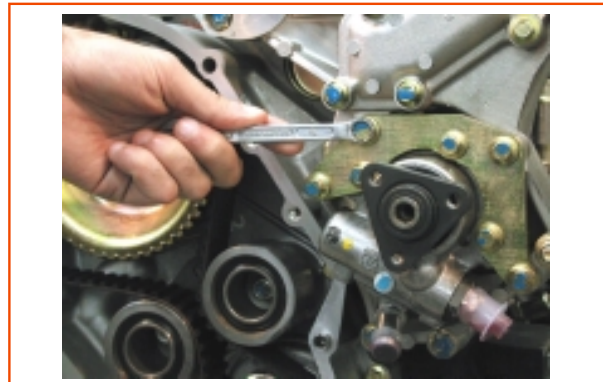
1. Remove distribution belt and toothed pulleys, see DISTRIBUTION BELT - Removal.
2. Remove fuel injection pump, see FUEL INJECTION PUMP Removal.
3. Remove crankshaft gear, see CRANKSHAFT GEAR- Removal.
4. Remove oil pan, see ENGINE OIL PAN Removal.
5. Remove oil suction pipe.
6. Remove timing housing fixation bolts.
7. Remove timing housing with gasket.
8. Remove all gasket material from contact surfaces.

**Reinstallation**

1. Install guide prisoners to position gasket.
2. Install a new gasket, on guide prisoners in engine block.
3. Align oil pump grooves with crankshaft grooves.
4. Install timing housing on the block, taking care to do not damage oil seal.
5. Fix bolts with correct length in the positions where guide prisoners were not installed.
6. Remove guide prisoners, installing on its places bolts with correct size.
7. Tighten all bolts according to specification.
8. Install oil suction pipe.
9. Install oil pan, see ENGINE OIL PAN Installation.
10. Reinstall fuel injection pump, see FUEL INJECTION PUMP Reinstallation.
11. Reinstall teeth pulleys, crankshaft gear and belt.

**➤ ACCESSORIES****POWER STEERING PUMP****Removal**

1. Remove radiator upper hose from thermostat.
2. Remove fan, see FAN Removal.
3. Loosen power steering pump pulley bolts.
4. Remove moving belt, see ACCESSORIES MOVING BELTS Removal.
5. Remove power steering pump pulley.
6. Disconnect hydraulic oil inlet pipe (low pressure lower pipe) and drain fluid in an appropriate recipient.
7. Disconnect outlet pipe (pipe with union) and drain fluid.
8. Cover the pump and hoses extremity.
9. Loosen pump assembly support fixation bolts and remove the complete pump with assembly support.
10. In case of a new pump assembly, remove assembly support and pump hoses connectors and install them on the new pump.



14. Clean starter motor and alternator terminals and apply a light layer of grease. If the vehicle is exposed to the weather, alternator, starter motor, and instruments panel must be protected.

### Engine preparation to return to operation

Before starting an engine, which was being inactive for a long time, back to operation, take the following cares:

1. Clean perfectly all the outer parts.
2. Close all block and radiator drain plugs and fill cooling system with clean water. Check for leakages.
3. Turn water pump pulley with the hand to assure if the water pump seals are free.
4. Install fan belt and adjust its tension.
5. Remove valves cover, lubricate rocker arms with engine oil and assembly it again.
6. Clean and assembly air filter and filling inlet, remove the sealing adhesive tape from intake and exhaust manifolds.
7. Assembly exhaust pipe.
8. Pressurize with new engine oil engine galleries (50/60 lbf/pol<sup>2</sup>) and turn crankshaft with the hands, so it displaces the shells. Depressurize system and remove pressurization tank.
9. Connect battery(ies):



**Warning:** In terminals fixation, do not invert cables position in relation to battery contacts. First connect positive terminal.

10. Remove the excess of grease from alternator and starter motor terminals. Check if all the connections are ok.
11. Drain oil from oil pan and fill it up to correct level.
12. Remove adhesive tape from tank or from filling pipe breather.