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SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair 2008 SEA-DOO® watercraft as describe in the model list in the *INTRODUCTION*.

This edition was primarily published to be used by watercraft mechanical technicians who are already familiar with all service procedures relating to BRP made watercraft. Mechanical technicians should attend training courses given by BRPTI.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This Shop Manual uses technical terms which may be slightly different from the ones used in the *PARTS CATALOG*.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. *SERVICE* and *WARRANTY BULLETINS* may be published to update the content of this manual. Make sure to read and understand these.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

⚠ WARNING

Unless otherwise specified, engine should be turned OFF and cold for all maintenance and repair procedures.

This manual emphasizes particular information denoted by the wording and symbols:

⚠ WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

BRP disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic. It is understood that certain modifications may render use of the vehicle illegal under existing federal, provincial and state regulations.

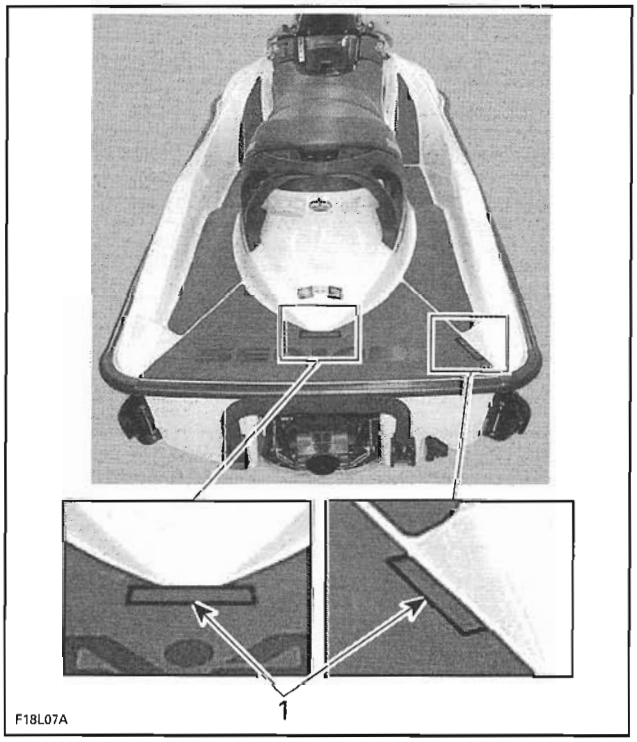
VEHICLE INFORMATION

Hull Identification Number (H.I.N.)

The hull identification number is composed of 12 digits:

YDV	12345	L	4	95
				Model year
				Year of production
				Month of production
				Serial number (a letter may also be used as a digit)
				Manufacturer

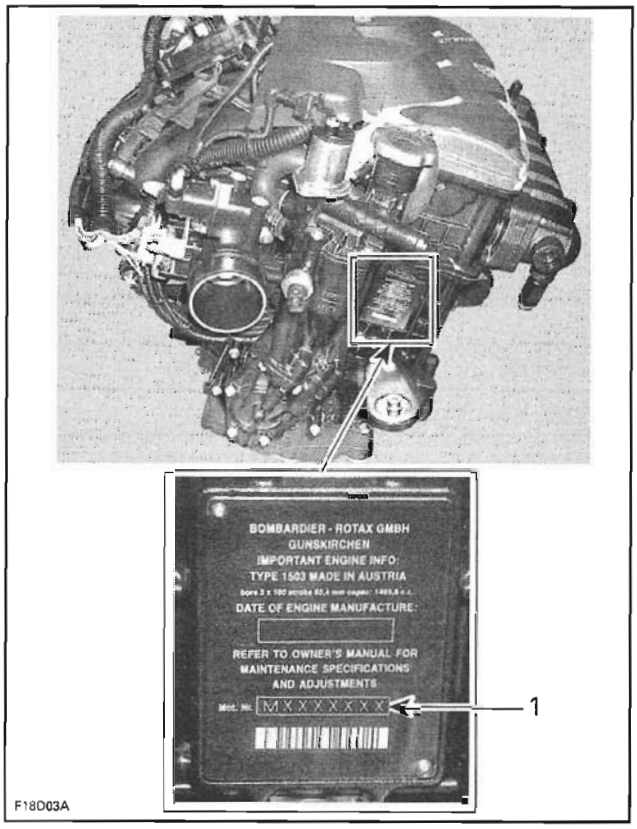
It is located on footboard at the rear of watercraft.



TYPICAL
1. *Hull Identification Number (H.I.N.)*

Engine Identification Number (E.I.N.)

The Engine Identification Number is located on front end of the engine.

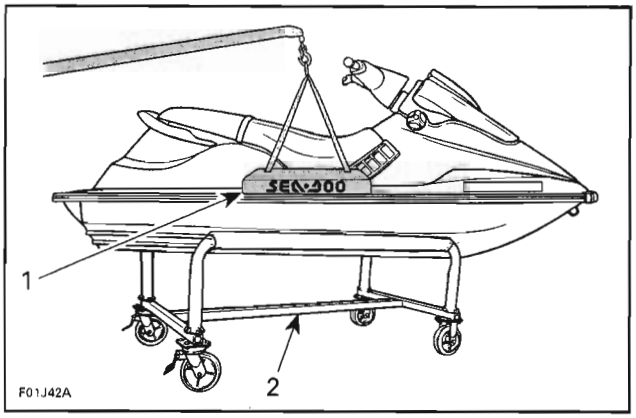


1. *Engine Identification Number (E.I.N.)*

WORKING ON WATERCRAFT

To work on watercraft, securely install it on a stand. Thus, if access is needed to water inlet area, it will be easy to slide underneath watercraft.

The lift kit (P/N 295 100 205) can be used to install watercraft on a stand.

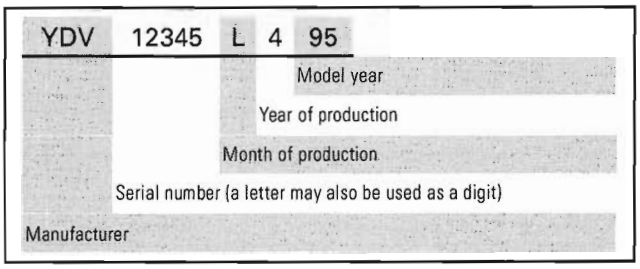


TYPICAL
1. *Lift kit*
2. *Work stand*

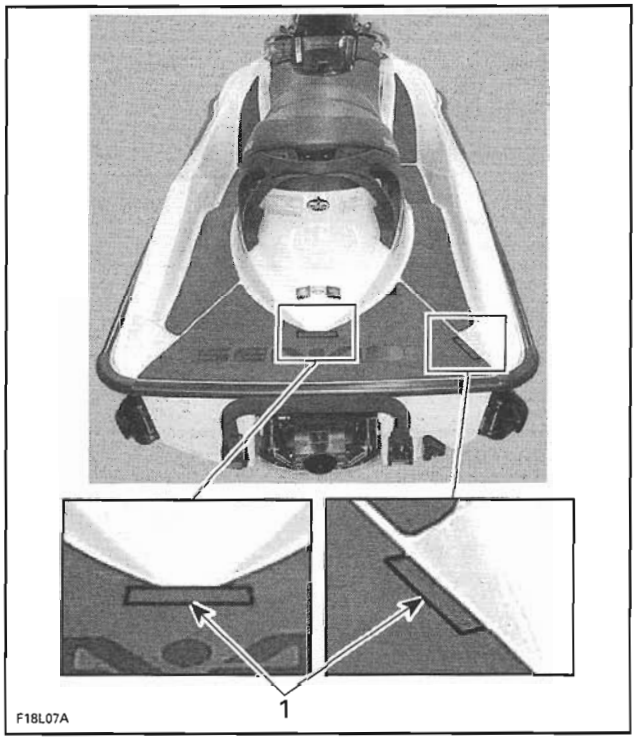
VEHICLE INFORMATION

Hull Identification Number (H.I.N.)

The hull identification number is composed of 12 digits:



It is located on footboard at the rear of watercraft.



TYPICAL
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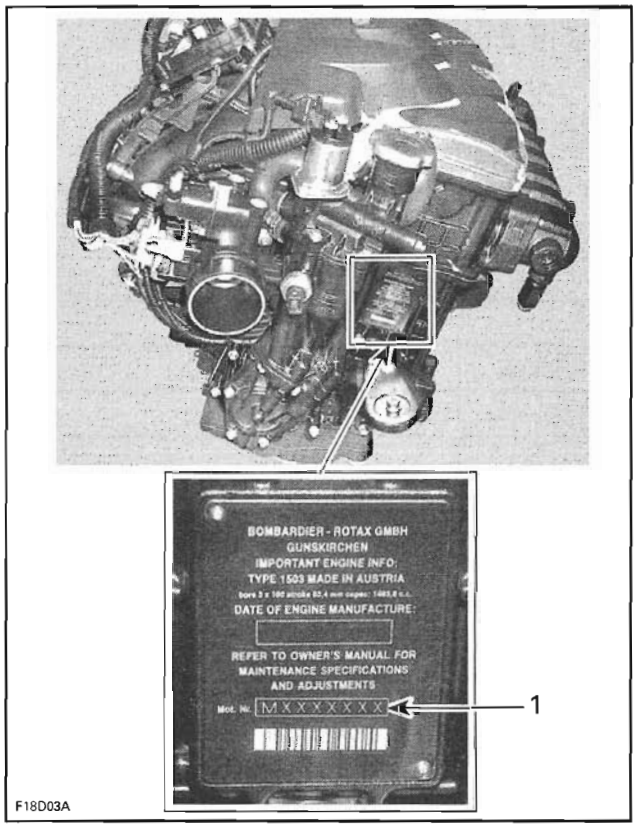

1. Engine Identification Number (E.I.N.)

WORKING ON WATERCRAFT

To work on watercraft, securely install it on a stand. Thus, if access is needed to water inlet area, it will be easy to slide underneath watercraft.

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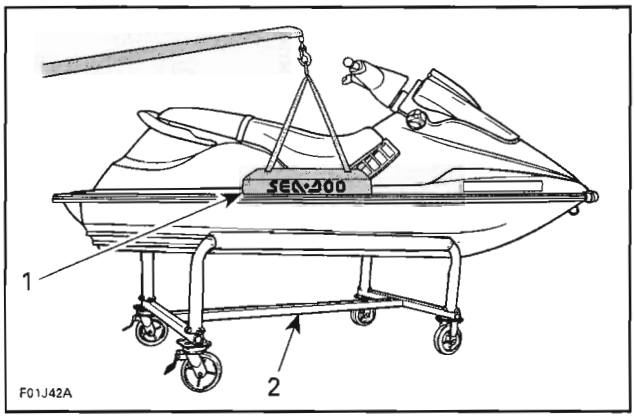


TYPICAL
1. Lift kit
2. Work stand

ENGINE EMISSIONS INFORMATION

Manufacturer's Responsibility

Beginning with 1999 model year engines, PWC manufacturers of marine engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States of America Environmental Protection Agency (EPA). An emissions control information label, showing emission levels and engine specifications, must be placed on each vehicle at the time of manufacture.

Dealer Responsibility

When performing service on all 1999 and more recent SEA-DOO watercrafts that carry an emissions control information label, adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are not to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturer's prescribed changes, such as altitude adjustments for example.

Owner Responsibility

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is not to, and should not allow anyone to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

EPA Emission Regulations

All new 1999 and more recent SEA-DOO watercrafts manufactured by BRP are certified to the EPA as conforming to the requirements of the regulations for the control of air pollution from new watercraft engines. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA requirements on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

FOR ALL COURIER SERVICES:
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
1310 L Street NW
Washington D.C. 20005

REGULAR US POSTAL MAIL:
1200 Pennsylvania Ave. NW
Mail Code 6403J
Washington D.C. 20460

INTERNET: http://www.epa.gov/otaq/

E-MAIL: otaqpublicweb@epa.gov

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following procedure:

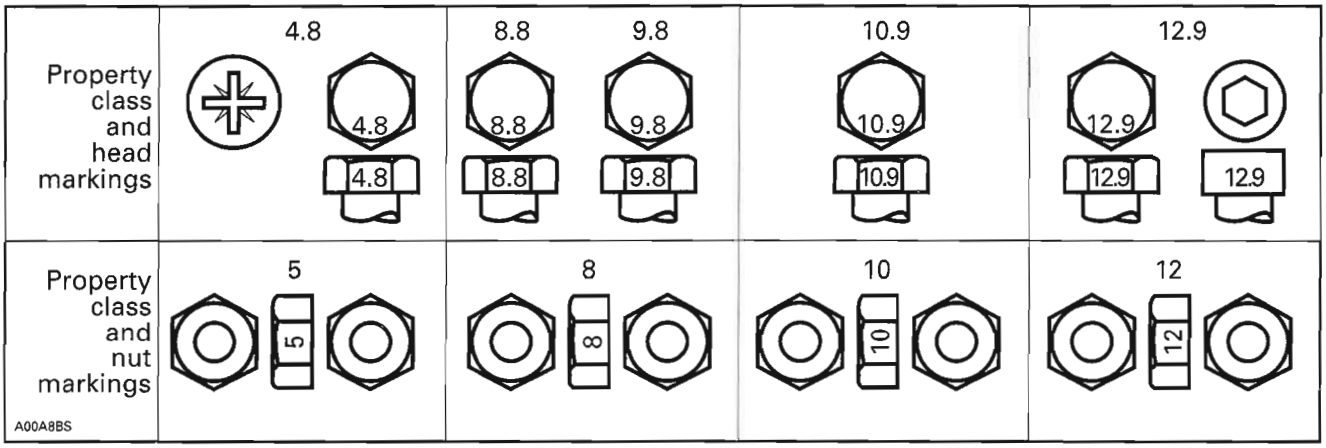
- Manually screw all screws, bolts and/or nuts.
- Apply the half of the recommended torque value.

CAUTION: Be sure to use proper tightening torque for the proper strength grade.

NOTE: When possible, always apply torque on the nut.

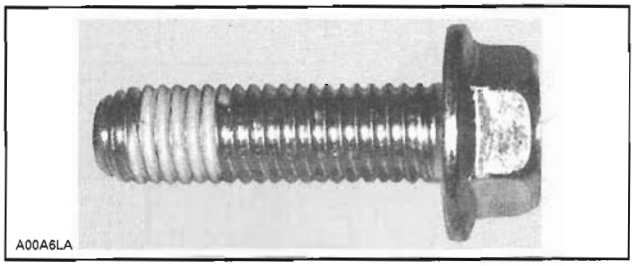
- Torque at the recommended torque value.

NOTE: Always torque screws, bolts and/or nuts in a crisscross sequence.



FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	**8.8** Grade	**10.9** Grade	**12.9** Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•**in**)	4 – 5 N•m (35 – 44 lbf•**in**)
M5	3 – 3.5 N•m (27 – 31 lbf•**in**)	4.5 – 5.5 N•m (40 – 47 lbf•**in**)	7 – 8.5 N•m (62 – 75 lbf•**in**)	8 – 10 N•m (71 – 89 lbf•**in**)
M6	6.5 – 8.5 N•m (58 – 75 lbf•**in**)	8 – 12 N•m (71 – 106 lbf•**in**)	10.5 – 15 N•m (93 – 133 lbf•**in**)	16 N•m (142 lbf•**in**)
M8	15 N•m (133 lbf•**in**)	25 N•m (18 lbf•ft)	32 N•m (23 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	73 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	128 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a tap to clean the hole properly then use a solvent, let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

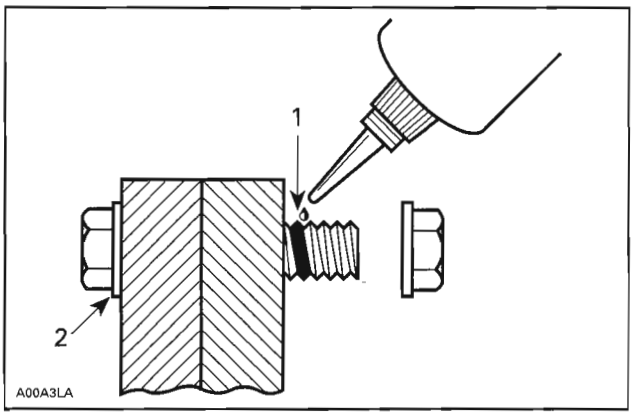
LOCTITE® APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this shop manual.

Threadlocker

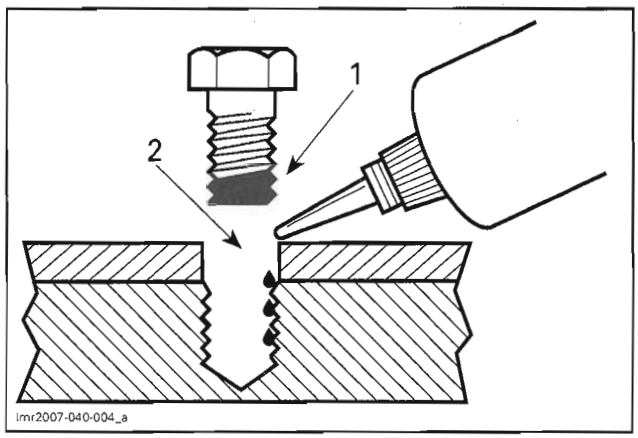
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

- Clean threads (bolt and nut) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
- Choose proper strength Loctite threadlocker.
- Fit bolt in the hole.
- Apply a few drops of threadlocker at proposed tightened nut engagement area.
- Position nut and tighten as required.

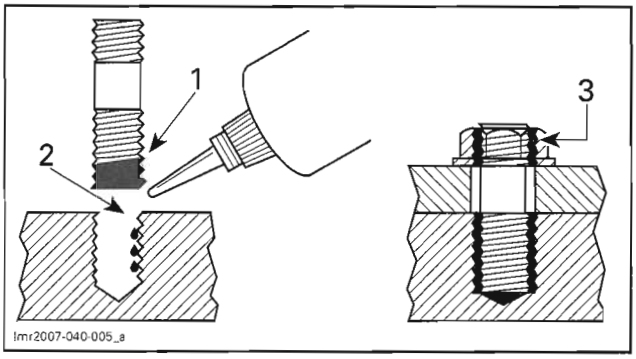
Blind Holes



1. On threads
2. On threads and at the bottom of hole

- Clean threads (bolt and hole) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
- Choose proper strength Loctite threadlocker.
- Apply several drops along the threaded hole and at the bottom of the hole.
- Apply several drops on bolt threads.
- Tighten as required.

Stud in Blind Holes



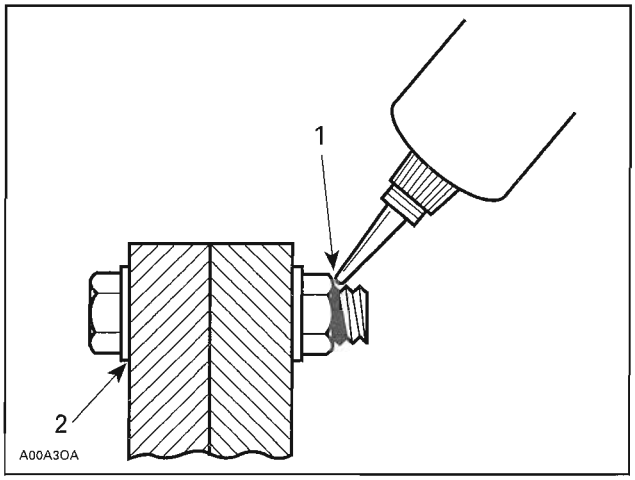
1. On threads
2. On threads and in the hole
3. Onto nut threads

- Clean threads (stud and hole) with solvent.
- Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
- Put 2 or 3 drops of proper strength Loctite threadlocker on female threads and in hole.

NOTE: To avoid a hydro lock situation, do not apply too much Loctite.

- Apply several drops of proper strength Loctite on stud threads.
- Install stud.
- Install cover, etc.
- Apply drops of proper strength Loctite on uncovered threads.
- Tighten nuts as required.

Pre-Assembled Parts

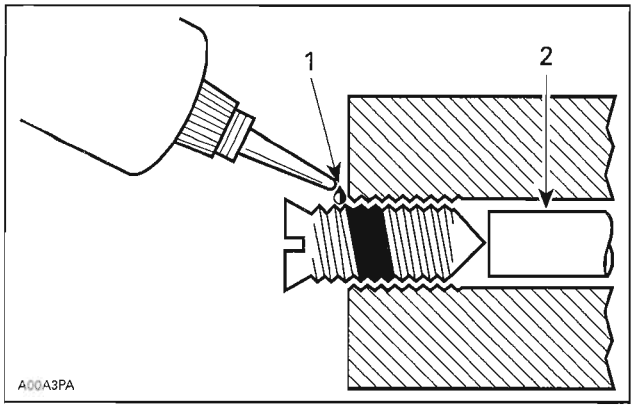


1. Apply here
2. Do not apply

- Clean bolts and nuts with solvent.
- Assemble components.
- Tighten nuts.
- Apply drops of proper strength Loctite on bolt/nut contact surfaces.
- Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw

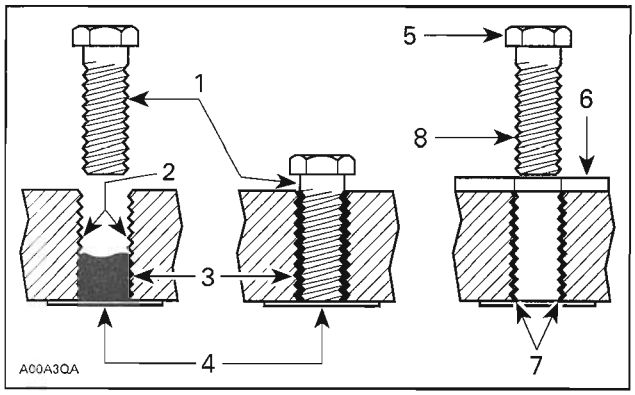


1. Apply here
2. Plunger

- Adjust screw to proper setting.
- Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
- Avoid touching metal with tip of flask.

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

Stripped Thread Repair



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tapes
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

– Follow instructions on Loctite FORM-A-THREAD 81668 package.
– If a plate is used to align bolt:

a. Apply release agent on mating surfaces.
b. Put waxed paper or similar film on the surfaces.

– Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

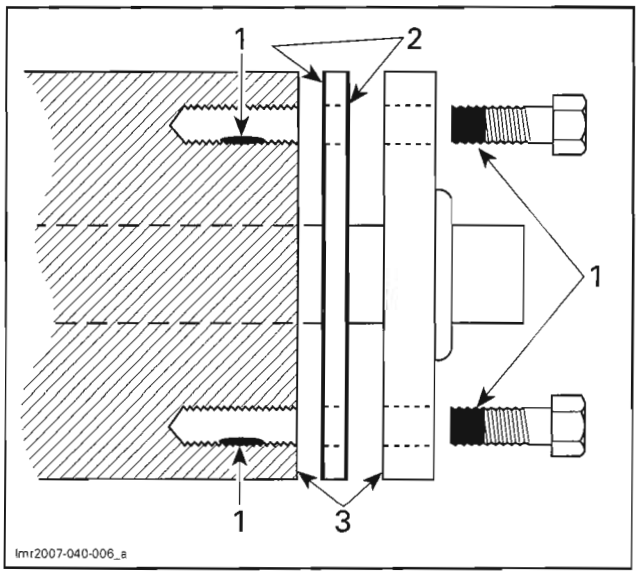
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

- Use a stud or thread on desired length.
- DO NOT apply release agent on stud.
- Do a *STANDARD THREAD REPAIR*.
- Allow to cure for 30 minutes.
- Assemble.

Gasket Compound



1. *Proper strength Loctite*
2. *Loctite Primer N (P/N 293 800 041) and Loctite 518 (P/N 293 800 038) on both sides of gasket*
3. *Loctite Primer N only*

- Remove old gasket and other contaminants with Loctite Chisel (gasket remover (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

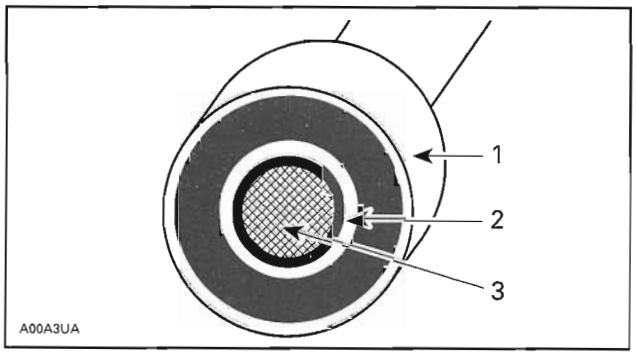
- Clean both mating surfaces with solvent.
- Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
- Apply Loctite 518 (P/N 293 800 038) on both sides of gasket, using a clean applicator.
- Place gasket on mating surfaces and assemble immediately.

NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

- If holes are sunken, apply proper strength Loctite on bolt threads.
- Tighten as usual.

Mounting on Shaft

Mounting with a Press



1. *Bearing*
2. *Proper strength Loctite*
3. *Shaft*

- Clean shaft external part and element internal part.
- Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

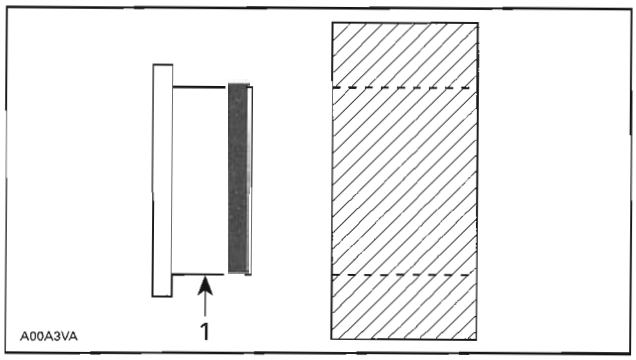
- DO NOT use antiseize Loctite or any similar product.
- No curing period is required.

Mounting in Tandem

- Apply retaining compound on internal element bore.
- Continue to assemble as shown above.

Case-In Components

Metallic Gaskets



1. *Proper strength Loctite*

- Clean inner housing diameter and outer gasket diameter.

- Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
- Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

- Install according to standard procedure.
- Wipe off surplus.
- Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

MANUAL INFORMATION

The manual is divided into many major sections as you can see in the main table of contents at the beginning of the manual.

Each section is divided in various subsections, and again, each subsection has one or more division.

Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

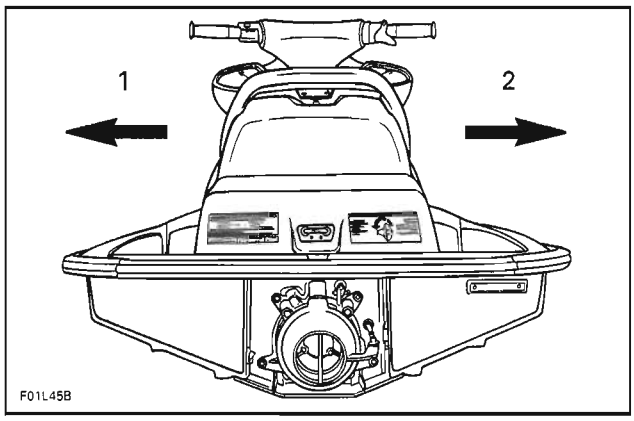
CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

The use of RIGHT (starboard) and LEFT (port) indications in the text, always refers to driving position (when sitting on watercraft).

Besides, in the marine industry, FRONT is called BOW and REAR is called STERN.

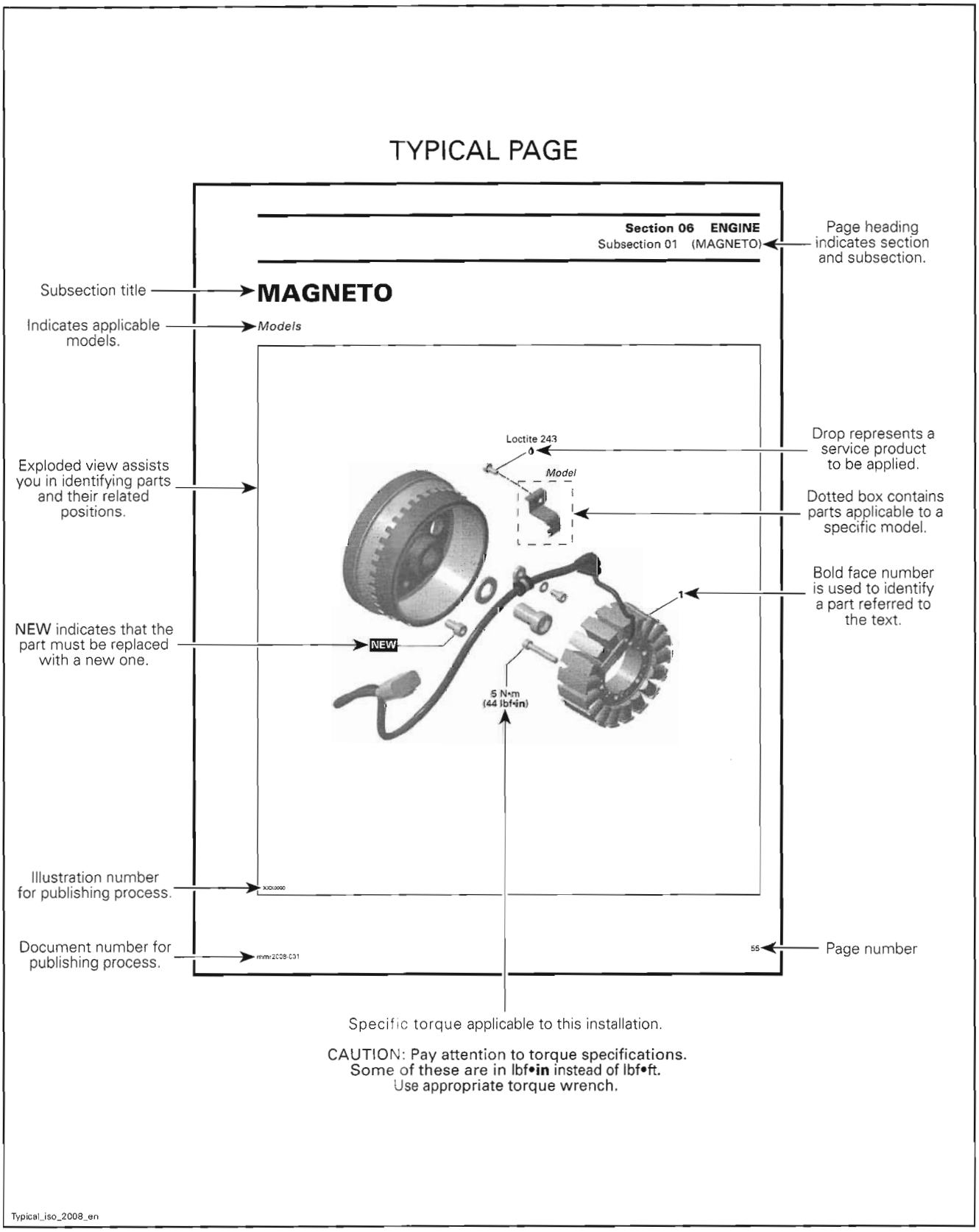


1. Left (port)
2. Right (starboard)

This manual uses technical terms which may be different from the ones of the *PARTS CATALOGS*.

When ordering parts always refer to the specific model *PARTS CATALOGS*.

TYPICAL PAGE



TYPICAL PAGE

Tittle in bold indicates category of information to be carried out.

GENERAL

NOTE: The following procedures can be done without removing the engine.

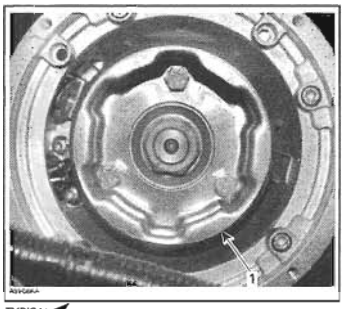
During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* sections at the beginning of this manual for complete procedure.

Reference to a specific section or subsection.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be replaced with new ones.



TYPICAL
1. Starting pulley

"TYPICAL" indicates a general view which may not represent exact details.

Call-outs pertaining to above illustration.

PROCEDURES

Indicates component procedures apply to.

MAGNETO FLYWHEEL

Magneto Flywheel Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Indicates specific procedure to be carried out.

Magneto Flywheel Removal

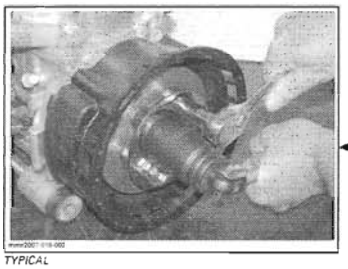
Remove muffler, refer to the *EXHAUST SYSTEM* section.

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.

NOTE: To remove starting pulley bolts, hold magneto flywheel with a socket as shown.



TYPICAL

Illustration always follows text to which it applies.

Models

Remove the connecting flange retaining the rewind starter to the engine housing.

Italic bold face typesetting indicates a procedure applicable to a specific model(s).

Bold face number following part name refers to exploded view at beginning of subsection.

typical_txt_2008_en

MAINTENANCE CHART

The schedule should be adjusted according to operating conditions and use.

NOTE: The chart gives an equivalence between number of hours and months/year. Perform the maintenance operation to whatever time comes first.

IMPORTANT: Watercraft rental operations or intensive use of watercraft, will require greater frequency of inspection and maintenance.

4-TEC MODELS						
A: ADJUST C: CLEAN I: INSPECT L: LUBRICATE R: REPLACE	FIRST 10 HOURS	EVERY 25 HOURS OR 3 MONTHS	EVERY 50 HOURS OR 6 MONTHS	EVERY 100 HOURS OR 1 YEAR	EVERY 200 HOURS OR 2 YEAR	
PART/TASK						REFER TO
ENGINE						
Engine oil and filter	R			R (1)		*LUBRICATION SYSTEM*
Rubber mounts	I			I		*ENGINE REMOVAL/INSTALLATION*
Exhaust system (2)	I			I, C (3)		*EXHAUST SYSTEM*
Supercharger clutch	(4)					*SUPERCHARGER*
Lubrication/corrosion protection			L			*STORAGE PROCEDURES*
COOLING SYSTEM						
Hose and fasteners	I					*COOLING SYSTEM*
Coolant	I				R	
FUEL SYSTEM						
Throttle cable	I			I (1)		*STEERING SYSTEM*
Throttle body (IMPORTANT: see (5))	I			L		*ELECTRONIC FUEL INJECTION (EFI)*
Fuel cap, filler neck, fuel tank, fuel lines and connections	I			I		*FUEL TANK/FUEL PUMP*
Fuel system leak test	I			I		
Fuel tank straps	I			I		
AIR INTAKE SYSTEM						
Air intake silencer	I			I		*AIR INTAKE SYSTEM*
Intercooler (255 engines)				I, C		*INTERCOOLER (255 ENGINES)*
ELECTRICAL SYSTEM						
Spark plug	I			I	R	*IGNITION SYSTEM*
Electrical connections and fastening (ignition system, starting system, fuel injectors etc.)	I			I		*ELECTRICAL SYSTEM*
Digitally Encoded Security System (DESS)	I			I		*DIGITALLY ENCODED SECURITY SYSTEM*
Monitoring beeper	I			I		*GAUGE/FUSES*
Battery and fasteners	I			I		*CHARGING SYSTEM*
ENGINE MANAGEMENT SYSTEM						
EMS sensors				I		*ENGINE MANAGEMENT SYSTEM*
EMS fault codes	I			I		

4-TEC MODELS						
A: ADJUST C: CLEAN I: INSPECT L: LUBRICATE R: REPLACE	FIRST 10 HOURS	EVERY 25 HOURS OR 3 MONTHS	EVERY 50 HOURS OR 6 MONTHS	EVERY 100 HOURS OR 1 YEAR	EVERY 200 HOURS OR 2 YEAR	
PART/TASK						REFER TO
STEERING SYSTEM						
Steering cable and connections	I			I		*STEERING SYSTEM*
Steering nozzle bushings	I			I		
Off-power assisted steering (O.P.A.S.)	I			I		*OFF-POWER ASSISTED STEERING SYSTEM (O.P.A.S.)*
PROPULSION SYSTEM						
Drive shaft				L (1)		*DRIVE SYSTEM*
Carbon ring and rubber boot (drive shaft)	I			I		
Reverse system, cable and connections	I			I		*REVERSE SYSTEM*
VTS (Variable Trim System) (if so equipped)	I			I		*VARIABLE TRIM SYSTEM (VTS)*
Drive shaft/impeller splines				I, L		*JET PUMP and DRIVE SYSTEM*
Impeller boot	I			I		*JET PUMP*
Impeller shaft seal, sleeve and O-ring				I (1)		
Impeller and wear ring clearance	I			I		
Sacrificial anode	(6)					
HULL/BODY						
Ride plate and water intake grate	I			I		*BODY/HULL*
Drain plugs (inside bilge), check for obstructions	I			I		
Hull	I			I		
Ski/wakeboard post and fasteners	I					

(1) In fresh water, perform for storage period or after 100 hours of use whichever comes first. In salt water use, lubricate drive shaft as indicated to protect it from corrosion.

(2) Including intercooler on supercharged models.

(3) Daily flushing in salt water or foul water use.

(4) The supercharger requires replacement when the MAINTENANCE SUPERCHARGER message is displayed on the information center every 100 hours of operation or earlier depending on the riding style (speed, engine RPM's, water conditions). This is determined by the engine management system. The supercharger will need to be replaced within 5 hours of the message display by an authorized Sea-doo dealer.

(5) IMPORTANT: When use in salt water, the throttle body lubrication is highly recommended after every 10 hours of use. Failure to perform lubrication will result in damage to the throttle body.

6) In salt water use.

PRESEASON PREPARATION

Proper vehicle preparation is necessary after the winter months or when a vehicle has not been used during several weeks.

Any worn, broken or damaged parts found during the storage procedure should have been replaced. If not, proceed with the replacement.

⚠ WARNING

Unless otherwise specified, engine should be turned off during preseason preparation procedure.

PRESEASON PREPARATION	TO BE PERFORMED BY		REFER TO
	CUSTOMER	DEALER	
ENGINE			
Exhaust system and intercooler hoses condition and fasteners inspection		✔	*EXHAUST SYSTEM*
Oil level (1)		✔	*LUBRICATION SYSTEM*
Corrosion protection	✔		*STORAGE PROCEDURES*
COOLING SYSTEM			
Coolant level (2)		✔	*COOLING SYSTEM*
Hoses and fasteners		✔	
FUEL SYSTEM			
Fuel system leak test		✔	*FUEL TANK/ FUEL PUMP*
Condition of fuel cap, filler neck, fuel tank, fuel lines and connections		✔	
Fuel tank straps	✔		
Refill fuel tank	✔		Refer to the appropriate *OPERATOR'S GUIDE*
ELECTRICAL SYSTEM			
Spark plugs (3)		✔	*IGNITION SYSTEM*
Battery condition/charging and installation		✔	*CHARGING SYSTEM*
Monitoring beeper verification		✔	*GAUGE/FUSES*
Digitally Encoded Security System (DESS)		✔	*DIGITALLY ENCODED SECURITY SYSTEM*
ENGINE MANAGEMENT SYSTEM			
EMS fault codes		✔	*ENGINE MANAGEMENT*
STEERING SYSTEM			
Steering adjustment and inspection		✔	*STEERING SYSTEM*
Check O.P.A.S. condition		✔	*OFF-POWER ASSISTED STEERING*

PRESEASON PREPARATION	TO BE PERFORMED BY		REFER TO
	CUSTOMER	DEALER	
PROPULSION SYSTEM			
Shifter system condition and cable adjustment		✔	*REVERSE SYSTEM*
Variable Trim System (VTS) condition (if so equipped)		✔	*VTS SYSTEM*
Propulsion system inspection		✔	*JET PUMP* and *DRIVE SYSTEM*
HULL AND BODY			
Inspection of bilge drain plugs		✔	*BODY/HULL*
Ski/wakeboard post and fasteners (if so equipped)	✔		

(1) If oil and filter were not replaced at storage, proceed with oil change.

(2) Replace every 200 hours or 2 years.

STORAGE PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
quick connector	293 710 077	7

SERVICE PRODUCTS

Description	Part Number	Page
anticorrosion spray	219 700 304	5
XP-S Lube	293 600 016	5, 7
Loctite 767 (antiseize lubricant)	293 800 070	7
BRP fuel stabilizer	413 408 600	5
Dow Corning 111	413 707 000	7
storage oil	413 711 600	7
storage oil (US)	413 711 900	7

PROCEDURES

PROPULSION SYSTEM

Jet Pump Cleaning

Clean jet pump by spraying water in its inlet and outlet and then apply a coating of XP-S Lube (P/N 293 600 016) or equivalent.

⚠ WARNING

Always remove safety lanyard cap from post to prevent unexpected engine starting before cleaning the jet pump area. Engine must not be running for this operation.

Jet Pump Inspection

Remove cone and check if jet pump is water contaminated; if so, refer to *JET PUMP* section for the repair procedure.

Drive Shaft Corrosion Protection

If the vehicle is used in salt water, apply the anticorrosion spray (P/N 219 700 304) on drive shaft. Refer to *DRIVE SYSTEM* section.

FUEL SYSTEM

Fuel System Inspection

Verify fuel system. Check fuel hoses for leaks. Replace damaged hoses or clamps if necessary.

Fuel System Protection

The BRP fuel stabilizer (P/N 413 408 600) or equivalent should be added in fuel tank to prevent fuel deterioration and fuel system gumming. Follow manufacturer's instructions for proper use.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure fuel system components protection against varnish deposits.

Fill up fuel tank completely. Ensure there is no water inside fuel tank.

⚠ WARNING

Always stop the engine before refueling. Fuel is inflammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. When fueling, keep watercraft level. Do not overfill or top off the fuel tank and leave watercraft in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the watercraft. Periodically inspect fuel system.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system.

Throttle Body Lubrication

Lubricate throttle body. Refer to *ELECTRONIC FUEL INJECTION (EFI)* section.

ENGINE

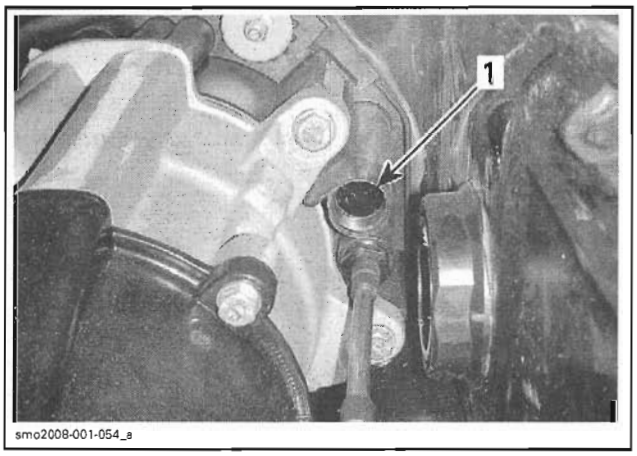
Engine Oil and Filter Replacement

Change engine oil and filter. Refer to *LUBRICATION SYSTEM* section.

Exhaust System Flushing

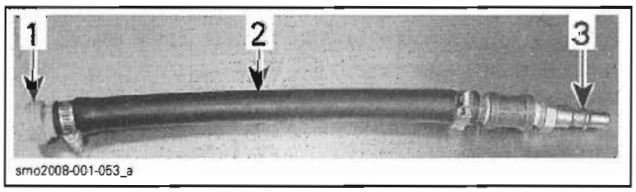
The exhaust system is self draining, but the intercooler (supercharged models) and exhaust manifold needs to be drained to avoid damages if watercraft is stored in area where freezing weather is present.

Using the flushing connector on jet pump support, inject pressurized air (around 689 kPa (100 PSI)) into system until there is no more water flowing from jet pump.



1. Flushing connector — location may differ

The following hose can be fabricated to ease draining procedure.



TYPICAL
1. Flushing adaptor (P/N 295 500 473)
2. Hose 12.7 mm (1/2 in)
3. Air hose male adapter

CAUTION: Failure to drain the intercooler (supercharged models) and exhaust manifold may cause severe damage to these components.

On **255 engines**, the intercooler might also have water on the air side caused by humidity condensation. Therefore, the intercooler needs to be drained on the air side.

To drain the air side of intercooler, do the following:

- Remove inlet and outlet air hoses.
- Remove the bleed hose.
- Detach straps retaining the intercooler.
- Position the intercooler with the air openings downward for approximately 30 minutes.

Engine Coolant Replacement

Antifreeze should be replaced every 200 hours or every two years to prevent antifreeze deterioration.

CAUTION: Failure to replace the antifreeze as recommended may allow its degradation that could result in poor engine cooling.

If coolant is not replaced, test the coolant density using an antifreeze hydrometer.

Replace coolant if necessary. For the coolant replacement procedure, refer to *COOLING SYSTEM* section.

CAUTION: Improper antifreeze density might lead coolant to freeze if vehicle is stored in area where freezing point is reached. This would seriously damage the engine.

Engine Lubrication

Engine must be lubricated to prevent corrosion on internal parts.

Lubrication of the engine is recommended at the end of the season and before any extended storage period to provide additional corrosion protection. This will lubricate the engine intake valves, the cylinders and the exhaust valves.

To lubricate the engine, proceed as follows:

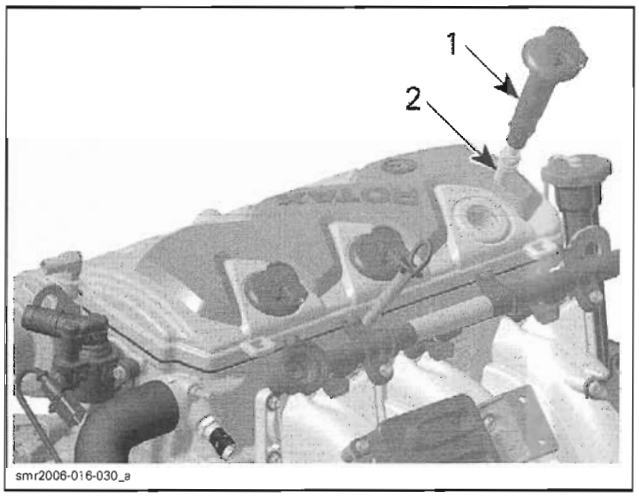
- Pull engine cover upward to remove it.
- Disconnect ignition coil connectors.

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

CAUTION: Never cut the locking ties of ignition coil connectors. This would allow mixing the wires between cylinders.

- Clean ignition coil areas to avoid falling dirt into cylinder.
- Remove ignition coils.
- Unscrew spark plugs.
- Using an ignition coil as a puller, remove spark plugs.



1. *Ignition coil*
2. *Spark plug*

- Spray storage oil (P/N 413 711 600) into each spark plug hole.

NOTE: For US citizens, use storage oil (US) (P/N 413 711 900) only.

CAUTION: Do not inject storage oil into throttle body bore to avoid blocking idle bypass valve.

To prevent fuel to be injected and also to cut the ignition at the engine cranking, proceed as follows.

- While engine is stopped, fully depress throttle lever and HOLD for cranking.
- Crank the engine a few turns to distribute the oil on cylinder wall.
- Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on spark plug threads then reinstall them.
- Prior to inserting the ignition coil to its location, apply some Dow Corning 111 (P/N 413 707 000) around the seal area that touches the spark plug hole.
- Reinstall ignition coils.
- Ensure the seal seats properly with the engine top surface.
- Reconnect ignition coil connectors.
- To reinstall engine cover, push it downward until it snaps.

ELECTRICAL SYSTEM

Battery Removal

For battery removal, cleaning and storage, refer to *CHARGING SYSTEM* section.

VEHICLE

Ballast

WAKE Models

Ballast tanks should be removed from watercraft and flushed with fresh water to remove any marine organisms.

Connect a garden hose to ballast tanks filling hose using the quick connector (P/N 293 710 077) to ease cleaning.

Ballast tanks should be properly stored in a vertical position with drain plugs at the bottom and opened to ensure water drainage.

Bilge Cleaning

Clean the bilge with hot water and mild detergent or with bilge cleaner.

Rinse thoroughly.

Lift front end of watercraft to completely drain bilge.

Body Rinsing/Repair

Wash the body with soap and water solution (only use mild detergent). Rinse thoroughly with fresh water. Remove marine organisms from the hull.

Apply a good quality marine wax on body and hull.

CAUTION: Never clean fiberglass and plastic parts with strong detergent, degreasing agent, paint thinner, acetone, etc.

If any repairs are needed to body or to the hull, refer to *BODY/HULL* section.

Replace damaged labels/decals.

Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray XP-S Lube (P/N 293 600 016) over all metallic components in engine compartment.

Vehicle Protection

The seat and the seat extension should be partially left opened during storage. This will avoid engine compartment condensation and possible corrosion.

If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

CAUTION: The watercraft should never be left in water for storage, stored in direct sunlight or stored in a plastic bag.

WATERCRAFT
SERVICE
Bulletin

Date: **September 14 2006** Subject: **Storage Procedure for 4-TEC™ Engine Equipped Vehicles** No. **2006-15**

MODEL YEAR	MODEL	MODEL NUMBER	SERIAL NUMBER
2006	All 4–TEC engine equipped vehicles	All	All

NOTE: Refer to appropriate Sea-Doo *SHOP MANUAL* when servicing a Sea-Doo watercraft.

NOTE: Intercooler equipped models require extra maintenance. Refer to *INTERCOOLER ANTIFREEZING PROTECTION* section of this bulletin.

PROPULSION SYSTEM

- Verify jet pump grease for water contamination. Check for the presence of water in cone and bearing; if so, replace oil seal and sleeve. Refer to *SHOP MANUAL* for proper procedure.

CAUTION: Use only Bombardier* jet pump grease or equivalent, otherwise components service life could be reduced. Do not mix grease brands or types.

FUEL SYSTEM

- Verify fuel system.
- Check fuel hoses for leaks.
- Replace damaged hoses or clamps if necessary.
- Fill up fuel tank completely. Ensure there is no water inside fuel tank.

NOTE: Sea-Doo Fuel Stabilizer (P/N 413 408 600) or equivalent should be added in fuel tank to prevent fuel deterioration. Follow manufacturer's instructions for proper use.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system (if so equipped).

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure fuel system components protection against varnish deposits.

⚠ WARNING

Fuel is inflammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, turn cap slowly when opening. Never use an open flame to check fuel level. When fueling, keep watercraft level. Do not overfill or top off the fuel tank and leave watercraft in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the watercraft. Periodically inspect fuel system. Always turn the fuel tank valve **(if so equipped)** to OFF position when storing the watercraft.

ENGINE OIL AND FILTER CHANGE

- Change engine oil and filter.

Refer to LUBRICATION in ENGINE section of *SHOP MANUAL*.

EXHAUST COOLING SYSTEM FLUSHING

- Flush exhaust cooling system **with fresh water** to prevent salt, sand or dirt accumulation which will clog water passages.

For proper procedure, refer to FLUSHING AND LUBRICATION in *SHOP MANUAL*.

CLOSE LOOP COOLING SYSTEM (ENGINE)

- Replaced antifreeze for the storage period to prevent antifreeze deterioration.

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- Perform an antifreeze density test.

For the coolant replacement procedure, refer to the appropriate *SHOP MANUAL*.

CAUTION: Improper antifreeze mixture might allow freezing of the liquid in the cooling system if vehicle is stored in area where freezing point is reached. This would seriously damage the engine. Failure to replace the antifreeze for storage may allow its degradation that could result in poor cooling when engine will be used.

ENGINE LUBRICATION

Fogging of the engine is recommended at the end of the season and before any extended storage period to provide additional corrosion protection. The goal is to lubricate the engine intake valves, the cylinders and the exhaust valves.

To fog the engine , proceed as follows:

- Remove the two bolts that hold the fuel rail on.
- Remove the rail along with the three fuel injectors.
- Spray liberally BOMBARDIER LUBE lubricant into the intake ports. **Ensure enough BOMBARDIER LUBE is sprayed in the intake ports so when the engine is cranked the exhaust valves will be fully lubricated.**
- Crank engine several times while keeping throttle fully depressed (drown engine mode) to distribute lubricant in cylinders, on intake valves and exhaust valves.
- Carefully inspect O-rings condition before reinstalling fuel injectors. Replace O-rings with new ones if damaged. Lubricate O-rings with injection oil prior to installing.
- Reinstall the injectors.
- Apply Loctite† 243 (P/N 293 800 060) and torque the two bolts that hold the fuel rail on to 10 N•m (89 lbf•**in**).
- Make sure there is no leak at injectors when cranking the engine in the upcoming steps.

⚠ WARNING

If a leak is present, immediately stop the engine. Do not start engine until the leak is repaired.

⚠ WARNING

At preseason preparation, ensure to perform a fuel pressure test and ensure there is no leak. Also run engine and check for leaks. Refer to ENGINE MANAGEMENT section in *SHOP MANUAL*.

THROTTLE BODY LUBRICATION

Vehicles Without Throttle Body Quick Lubrication Kit

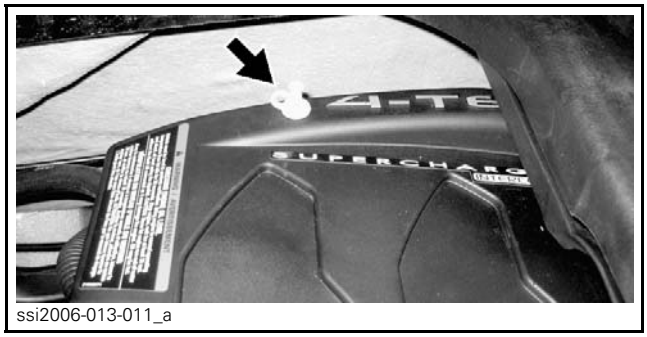
- Lubricate the throttle body to prevent corrosion on external and internal parts especially if the craft is used in salt water.
- Remove the air intake hose from throttle body.
- Open the throttle body valve by pressing slightly the throttle lever and spray BOMBARDIER LUBE lubricant (P/N 293 600 016) through the throttle body bore to lubricate valve mechanism.
- Spray generously the external parts of throttle body.
- Install air intake hose.

NOTE: A throttle body optional quick lubrication kit can be purchased (P/N 295 501 048) to facilitate maintenance by creating a direct access to the throttle body valve mechanism.

Vehicles With Throttle Body Quick Lubrication Kit

Late production vehicles are equipped with a throttle body quick lubrication kit. Their location may be different depending on the model, but they all can be easily located with the seat removed.

† Loctite is a registered trademark of Loctite Corporation.



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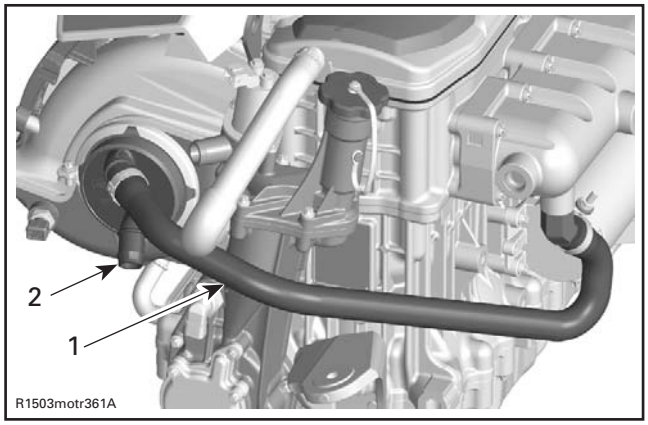
- Lubricate the throttle body to prevent corrosion on external and internal parts especially if the craft is used in salt water.
- Remove the throttle body lubrication fitting cap.
- Open the throttle body valve by pressing slightly the throttle lever and spray BOMBARDIER LUBE lubricant (P/N 293 600 016) through the fitting to lubricate valve mechanism.
- Spray generously the external parts of throttle body.
- Close the throttle body lubrication fitting cap.

INTERCOOLER AND EXHAUST MANIFOLD ANTIFREEZE PROTECTION

The intercooler and manifold are not self draining; they need the following protection.

- With the vehicle leveled, remove both intercooler hoses [1] and [2].



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- Let the intercooler drain and at the same time position the bottom hose as low as possible into the bilge to drain as much water from the exhaust manifold, then reconnect the bottom hose.
- Connect an extra piece of hose to the upper intercooler nipple and pour approximately 200 mL (6.76 oz U.S.) of antifreeze into the intercooler.
- Then pour approximately 300 mL (10.14 oz U.S.) of antifreeze into the upper Intercooler hose, toward the exhaust manifold.
- Reconnect the intercooler upper hose.

CAUTION: Failure to pour antifreeze into the intercooler and exhaust manifold, may cause severe damage to these components.

CAUTION: Use only undiluted antifreeze (100% concentration). The premixed antifreeze available from BRP is NOT suitable for this particular application. Its concentration will be reduced when mixed with remaining water trapped in water jackets.

NOTE: Antifreeze must be compatible with internal combustion aluminum engines. It is recommended to use biodegradable antifreeze. This will contribute to protect the environment. Recreational vehicle (RV) antifreeze can be used.

NOTE: The engine will not have to run during this operation but should have been ran before, to exhaust as much water as possible, from cooling system components.

BATTERY

- Remove
- Clean
- Charge
- Store

Refer to CHARGING SYSTEM in *SHOP MANUAL*.

WATERCRAFT CLEANING

- Clean the bilge with hot water and mild detergent or with bilge cleaner. Rinse thoroughly. Lift front end of watercraft to completely drain bilge. If any repairs are needed to body or to the hull, touch up paint and Gelcote†† repair kits are available. Replace damaged labels/decals.
- Wash the body with soap and water solution (use mild detergent only). Rinse thoroughly with fresh water. Remove marine organisms from the hull. Apply a nonabrasive wax.

†† Gelcote is a registered trademark of Gelcote International.

CAUTION: Never clean fiberglass and plastic parts with strong detergent, degreasing agent, paint thinner, acetone, etc.

- If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

CAUTION: The watercraft must never be left in water for storage. Never leave the watercraft stored in direct sunlight.

ANTICORROSION TREATMENT

- Wipe off any residual water in the engine compartment.
- Spray BOMBARDIER LUBE lubricant over all metallic components in engine compartment.
- Lubricate the throttle cable with BOMBARDIER LUBE lubricant.
- Apply an anticorrosion product (P/N 219 700 304) on drive shaft. Refer to PROPULSION is appropriate *SHOP MANUAL*.

NOTE: The seat should be partially left opened during storage. This will avoid engine compartment condensation and possible corrosion.

CHECK LIST

OPERATION	✔
Propulsion System	
Fuel System	
Engine Oil and Filter Change	
Exhaust Cooling System Flushing	
Close Loop Cooling System (engine)	
Engine Lubrication	
Throttle Body Lubrication	
Intercooler and Exhaust Manifold Antifreeze Protection	
Battery	
Watercraft Cleaning	
Anticorrosion Treatment	

WATERCRAFT
SERVICE
Bulletin

October 16, 2008 Subject: **Storage Procedure** No. **2008-10**

YEAR	MODEL	MODEL #	SERIAL #
2008	All	All	All

This is just a quick reference to the storage procedure. Refer to the appropriate *SHOP MANUAL* for the complete storage procedure.

NOTE: Carry out the following tasks in the same order as detailed in this bulletin.

PROCEDURES

Fuel System

Fuel System Inspection

Inspect all fuel hoses for leaks. Replace damaged hoses or clamps if necessary.

NOTICE Salt water use may cause clamps to prematurely corrode. Therefore, they would require a closer look and a more frequent preventive replacement.

Fuel System Protection

BRP fuel stabilizer (P/N 413 408 600) or equivalent should be added in fuel tank to prevent fuel deterioration. Follow manufacturer's instructions for proper use.

Fill up fuel tank completely. Ensure there is no water inside fuel tank.

⚠ WARNING

Fuel is inflammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in vicinity. Fuel tank may be pressurized, turn cap slowly when opening. When fueling, keep watercraft level. Do not overfill or top off fuel tank and leave watercraft in direct sunlight; as temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage.

NOTICE Should any water be trapped inside fuel tank, severe internal damage will occur to fuel injection system.

Throttle Cable Lubrication

Lubricate throttle cable with XP-S Lube.

Propulsion System

Jet Pump Grease Inspection

Refer to *SHOP MANUAL* for proper procedure.

Drive Shaft Lubrication

Refer to *DRIVE SYSTEM* subsection in 2008 *SHOP MANUAL*.

Engine

Exhaust System Flushing

Inspect all exhaust and coolant hoses for leaks. Replace damaged hoses or clamps if necessary.

NOTICE Salt water use may cause clamps to prematurely corrode. Therefore, they would require a closer look and a more frequent preventive replacement.

Refer to *EXHAUST SYSTEM* subsection in 2008 *SHOP MANUAL*.

Engine Oil and Filter Replacement

Refer to *LUBRICATION* subsection in 2008 *SHOP MANUAL*.

Throttle Body Lubrication

Refer to *ELECTRONIC FUEL INJECTION* subsection in the 2008 *SHOP MANUAL*.

Printed in Canada. (sbs2008-005 en JPM)

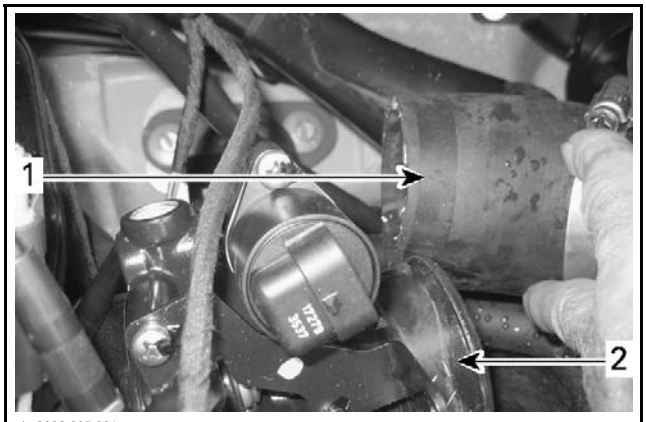
Intercooler Protection

255 Models (X Packages)

It is important to expel any trapped water that may have accumulated from condensation in the external intercooler.

Proceed as follows:

1. Removed the intake hose from the throttle body.



1. Intake hose (from intercooler)
2. Throttle body

2. Start and rev up the engine to 4000 RPMs several times.

WATER EXPELLED FROM INTERCOOLER

3. Stop engine.
4. Liberally lubricate throttle body inside and out.
5. Clean off any lubrication on the throttle body intake hose flange.
6. Install air intake hose to the throttle body.

Engine Lubrication

Refer to *ENGINE LUBRICATION* in *STORAGE PROCEDURE* section in 2008 *SHOP MANUAL*.

Exhaust System Protection

In areas where temperature may freeze, water trapped in the exhaust system must be removed.

Refer to *STORAGE PROCEDURE* in the *2008 SHOP MANUAL*

Engine Coolant Test

NOTE: Antifreeze replacement should be performed every 2 years.

Perform an antifreeze density test.

NOTICE **Improper antifreeze density in cold areas may lead to serious engine damage.**

Battery

Remove, clean, charge and store.

Refer to CHARGING SYSTEM in *SHOP MANUAL*.

NOTE: Poor maintenance and improper charging methods contribute to the majority of battery failures. Over 60% of battery claims are filed after the storage season. **BRP will not consider claims for batteries following a storage season.**

Watercraft Cleaning and Protection

Refer to *STORAGE PROCEDURE* in the *2008 SHOP MANUAL*

SPECIAL PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
large hose pincher	529 032 500	9, 11
suction pump	529 035 880	10

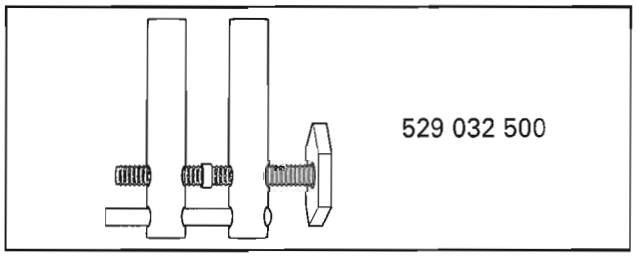
TOWING THE WATERCRAFT IN WATER

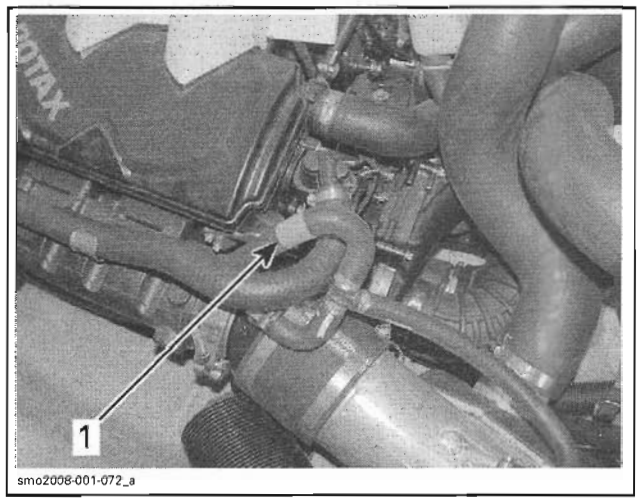
Special precautions should be taken when towing a SEA-DOO watercraft in water.

Maximum recommended towing speed is 24 km/h (15 MPH).

When towing your watercraft in water, pinch the water supply hose from the exhaust manifold to the muffler with a large hose pincher (P/N 529 032 500).

NOTE: A red tape on the exhaust manifold water outlet hose indicates which hose to pinch.





TYPICAL
1. Install the hose pincher on this hose

This will prevent the exhaust cooling system from filling which may lead to water being injected into and filling the exhaust system and the engine. Without the engine running there isn't any exhaust pressure to carry the water out the exhaust outlet.

CAUTION: Failure to do this may result in damage to the engine. If you must tow a stranded watercraft in water and do not have a hose pincher be sure to stay well below the maximum towing speed of 24 km/h (15 MPH).

CAUTION: When finished towing the watercraft, the hose pincher must be removed before operating it.

SUBMERGED WATERCRAFT

Drain bilge.

If it was submerged in salt water, spray bilge and all components with fresh water using a garden hose to stop the salt corroding effect.

Engine Lubrication

Refer to *WATER-FLOODED ENGINE* in this section.

Fuel Inspection

Check fuel tank for water contamination. If necessary, siphon and refill with fresh fuel.

WATER-FLOODED ENGINE

If engine is water-flooded, it must be serviced within a few hours after the event. Otherwise engine will have to be overhauled.

CAUTION: Never try to crank or start the engine. Water trapped in the intake manifold would enter the combustion chamber through the intake valves and may cause damage to the engine.

CAUTION: A water-flooded engine must be properly drained, lubricant replaced (oil change), operated (boil out procedure), then lubricant replaced again, otherwise parts will be seriously damaged.

Whenever the engine is stopped, all the valves close thus preventing water from being ingested in the engine.

Exhaust System Draining

If water is suspected to be in the exhaust system, remove the exhaust pipe and the muffler. Drain them or siphon the water out of them. Refer to *EXHAUST SYSTEM* section.

Intake System Draining

If water is suspected in the intake manifold, remove the intake manifold and drain it. Then suck out the water from the intake valve ports. Refer to *INTAKE MANIFOLD/INTERCOOLER* section.

Remove the water from oil/air separator breather hose.

Throttle Body Lubrication

Throttle body should be lubricated to prevent corrosion. Refer to *ELECTRONIC FUEL INJECTION (EFI)* section.

Supercharger Servicing

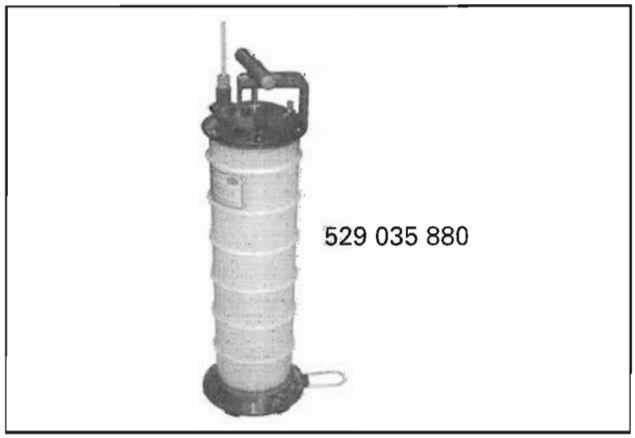
215 and 255 Engines

If there was water in the oil or in the intake manifold, it is recommended to take the supercharger apart, dry all the components, replace the slip clutch needle bearings and shaft ball bearings. Refer to *SUPERCHARGER* section.

Engine Oil and Filter Replacement

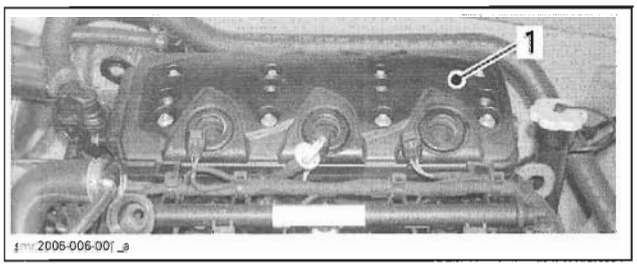
If water gets in the oil (oil will be milky), change the engine oil and filter as per procedure further in this subsection.

- Using the suction pump (P/N 529 035 880), siphon the contaminated oil from the engine reservoir through dipstick hole.



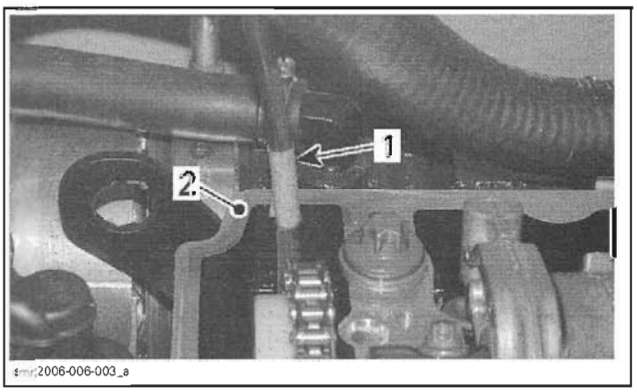
CAUTION: Never crank or start engine when siphon tube is in dipstick hole. Never start engine when there is no oil in engine.

- Remove the suction pump tube from the dipstick hole.
- Fully depress throttle lever and HOLD it for cranking.
- Crank the engine for 5 seconds.
- Remove the oil filter cap and the oil filter. Refer to *LUBRICATION SYSTEM* section.
- Again, siphon the contaminated oil from the oil filter reservoir.
- Remove valve cover. Refer to *CYLINDER HEAD* section.



1. Valve cover

- Put a tape at 400 mm (16 in) from the end of the suction pump tube.
- Insert the tube in the PTO area until the tape reach the cylinder-block edge. Then, siphon contaminated oil out.



TYPICAL
1. Suction pump tube with tape
2. Edge of cylinder-block

- Remove the suction pump tube.
- Reinstall valve cover.
- Install a NEW oil filter and reinstall the oil filter cap.
- Fill up the reservoir with fresh oil.
- Proceed with one of the boil out procedure:

NOTE: The boil out procedure is intended to evaporate the water contained in the oil. The procedure with the watercraft in water is the preferred one, but it can also be done using the flush kit.

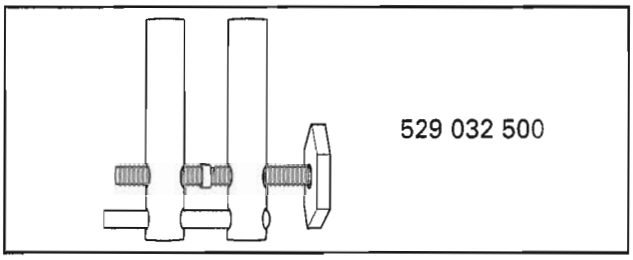
Boil Out Procedure in a Test Tank or Tied to a Trailer with Watercraft in Water

- Connect the vehicle to B.U.D.S. to monitor the coolant temperature. It must exceed 100°C (212°F) in order for the water boil out. Once the boil point is reached, it won't take long to evaporate the water.
- Run the engine for 5 minutes at 3500 RPM.

⚠ WARNING

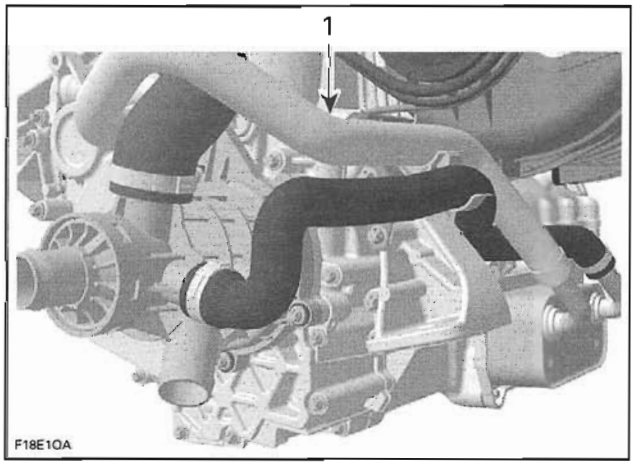
Make sure to safely secure the watercraft.

- With the engine still running at 3500 RPM, install a large hose pincher (P/N 529 032 500) to the coolant line going to the oil cooler.



⚠ WARNING

Certain components in the engine compartment may be very hot. Direct contact may result in skin burn. Do not touch any electrical parts or jet pump area when engine is running.



1. Oil cooler coolant inlet hose

- Continue to run the engine at 3500 RPM for 15 more minutes (20 minutes total run time).
- Shut the engine off.
- Remove the hose pincher on the coolant line going to the oil cooler.

CAUTION: Hose pincher must be removed prior to operating the watercraft. Failure to do this will result in damage to the engine.

- Change the oil and filter again.
- Procedure is now completed.

Boil Out Procedure Connected to a Flush Kit

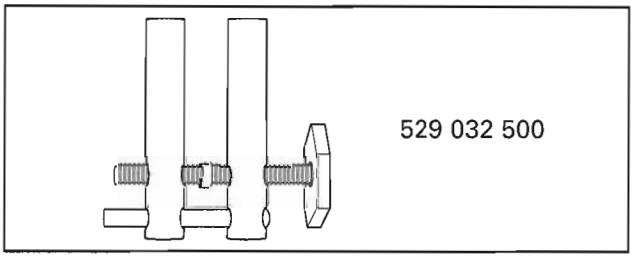
- On drive shaft, remove the C-clip then move forward the ring seal carrier. Refer to *DRIVE SYSTEM* section.

CAUTION: Make sure that the ring seal carrier is not in contact with the PTO seal assembly, neither with the carbon ring.

- Connect the vehicle to B.U.D.S. to monitor the coolant temperature. It must exceed 100°C (212°F) in order for the water boil out. Once the boil point is reached, it won't take long to evaporate the water.
- Connect a flush kit to the coolant line.

CAUTION: Never run engine without supplying water to the exhaust cooling system when watercraft is out of water.

- Run the engine for 5 minutes at 3000 RPM.
- With the engine still running at 3000 RPM, install a large hose pincher (P/N 529 032 500) to the coolant line going to the oil cooler.



⚠ WARNING

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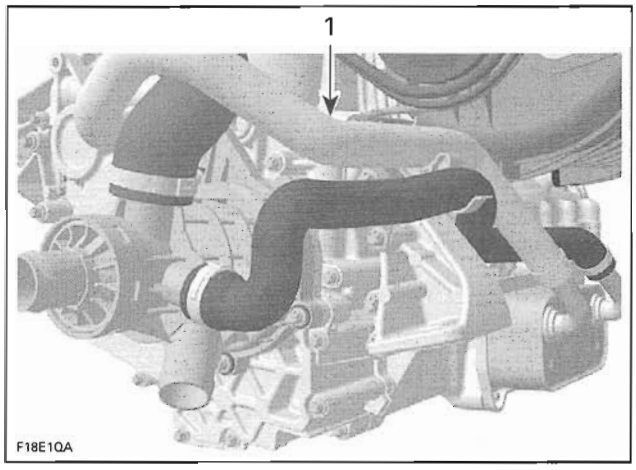


1. Oil cooler coolant inlet hose

- Continue to run the engine at 3000 RPM for 15 more minutes (20 minutes total run time).
- Shut off the engine.
- Remove the hose pincher on the coolant line going to the oil cooler.

CAUTION: Hose pincher must be removed prior to operating the watercraft. Failure to do this will result in damage to the engine.

- Change the oil and filter again.
- Move rearward the ring seal carrier and reinstall the C-clip. Refer to *DRIVE SYSTEM* section.

CAPSIZED WATERCRAFT

Capsized for More Than 5 Minutes

Refer to *WATER-FLOODED ENGINE* in this section.

TECHNICAL GUIDELINES

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to show all causes for all problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *ENGINE MANAGEMENT* section.

ENGINE

Symptom: ENGINE WILL NOT START (ENGINE DOES NOT TURN OVER)

1. **DESS operation non functional or wrong safety lanyard**
   - *If 2 short beeps are not heard when installing safety lanyard, refer to DIGITALLY ENCODED SECURITY SYSTEM.*
2. **Burnt fuse: battery, starting system**
   - *Check wiring then replace fuse.*
3. **Discharged battery**
   - *Check/recharge. Refer to CHARGING SYSTEM.*
4. **Defective start/stop switch**
   - *Check, refer to STARTING SYSTEM.*
5. **Battery connections**
   - *Check/clean/tighten.*
6. **Poor/bad or corroded ground contacts (engine, starter etc.)**
   - *Check/clean/repair.*
7. **Starter solenoid**
   - *Check, refer to STARTING SYSTEM.*
8. **Starter malfunction**
   - *Check, refer to STARTING SYSTEM.*
9. **Seized jet pump**
   - *Check, refer to JET PUMP.*
10. **Water/fuel hydro-lock**
    - *Check, refer to SPECIAL PROCEDURES.*
11. **Seized or obstructed engine**
    - *Check/repair, refer to ENGINE.*
12. **Seized or obstructed supercharger (if so equipped)**
    - *Check/repair, refer to SUPERCHARGER.*
13. **Obstructed starter drive gear assembly**
    - *Check/repair, refer to PTO HOUSING/MAGNETO.*

Symptom: ENGINE WILL NOT START (ENGINE TURNS OVER)

1. **Fouled or defective spark plug**
   - *Replace.*
2. **Defective CPS**
   - *Check operation of CPS and replace if necessary. Refer to ELECTRONIC FUEL INJECTION section.*

Symptom: ENGINE WILL NOT START (ENGINE TURNS OVER) (cont'd)

3. **Defective trigger wheel**
   - *Check, refer to PTO HOUSING/MAGNETO.*
4. **Defective ignition circuit**
   - *Check, refer to IGNITION SYSTEM.*
5. **Low or no fuel pressure**
   - *Check fuel pump pressure output.*
   - *Check fuel pump fuse.*
   - *Check wiring harness.*
6. **Water-contaminated fuel**
   - *Check/siphon and refill.*
7. **Dirty fuel filter**
   - *Clean/replace.*
8. **Water in engine**
   - *Check, refer to SPECIAL PROCEDURES.*
9. **Idle bypass valve stuck or not functioning**
   - *Check, refer to ELECTRONIC FUEL INJECTION.*
10. **Insufficient engine compression**
    - *Replace defective part(s).*

Symptom: ENGINE WILL NOT START (ENGINE TURNS OVER SLOWLY)

1. **Loose battery cables**
   - *Check/clean/tighten.*
2. **Discharged/weak battery**
   - *Check/charge/replace. Refer to CHARGING SYSTEM.*
3. **Restriction in jet pump**
   - *Check/clean pump. Refer to JET PUMP.*
4. **Partial seizure in jet pump**
   - *Inspect, refer to JET PUMP.*
5. **Partial engine hydro-lock**
   - *Check, refer to SPECIAL PROCEDURES.*
6. **Worn starter**
   - *Check, refer to STARTING SYSTEM.*

Symptom: ENGINE HARD TO START

1. **Spark plug faulty, fouled or worn out**
   - *Check spark plug condition. Replace if necessary.*
2. **Wrong TPS zero setting**
   - *Refer to ELECTRONIC FUEL INJECTION.*
3. **Defective idle bypass valve**
   - *Refer to ELECTRONIC FUEL INJECTION.*
4. **Water in intake system (defective MAP sensor)**
   - *Check and remove water. Refer to SPECIAL PROCEDURES.*

Symptom: ENGINE HARD TO START (cont'd)

5. **Water in fuel reservoir or contaminated fuel**
   - *Flush reservoir and refill with fresh gas.*
6. **Low fuel pressure**
   - *Check fuel pump and regulator operations. Refer to FUEL TANK/FUEL PUMP.*

Symptom: ENGINE MISFIRES, RUNS IRREGULARLY

1. **Fouled, defective, worn spark plugs**
   - *Check/verify heat range/gap/replace.*
2. **Damaged trigger wheel/loose CPS**
   - *Check, refer to PTO HOUSING/MAGNETO.*
3. **Defective ignition circuit**
   - *Check coil, wiring condition and proper grounding of ignition coil.*
4. **Poor engine ground**
   - *Check/clean/repair.*
5. **Fuel pressure (low or high)**
   - *Check pump, regulator, injectors and hose pinchers or if filter is plugged. Replace if necessary.*
6. **Stale or water fouled fuel**
   - *Check/siphon and refill.*
7. **Fuel filter dirty or restricted**
   - *Check/clean/replace.*
8. **Clogged fuel injectors**
   - *Remove and clean fuel injectors.*
9. **Defective sensor**
   - *Check faulty codes, refer to ENGINE MANAGEMENT SYSTEM.*
10. **Flame arrester dirty or restricted**
    - *Check/replace.*
11. **Faulty fuel injector(s)**
    - *Replace fuel injector(s), refer to ELECTRONIC FUEL INJECTION.*
12. **Fuel pressure fluctuating**
    - *Inspect fuel pressure regulator. Refer to FUEL SYSTEM.*

Symptom: ENGINE CONTINUALLY BACKFIRES

1. **Fouled, defective spark plugs**
   - *Clean/replace.*
2. **Damaged trigger wheel/defective or loose CPS**
   - *Check, refer to ELECTRONIC FUEL INJECTION.*
3. **Intake or exhaust valve(s) leak**
   - *Pressurize the engine to find the leak, refer to CYLINDER HEAD.*

Symptom: ENGINE DETONATION OR PINGING

1. **Fuel octane too low or poor fuel quality**
   - *Flush reservoir and refill with good quality fuel.*

Symptom: ENGINE DETONATION OR PINGING (cont'd)

2. **Knock sensor disconnected or faulty**
   - *Check, refer to ELECTRONIC FUEL INJECTION.*

Symptom: ENGINE LACKS ACCELERATION OR POWER

1. **Weak spark**
   - *Check/replace, refer to IGNITION SYSTEM.*
2. **Throttle does not open fully**
   - *Check/readjust throttle cable, refer to STEERING SYSTEM.*
3. **Low compression**
   - *Check/repair, refer to ENGINE section.*
4. **Intake restriction**
   - *Check for restriction in the air intake system.*
5. **Exhaust system blockage/muffler damage**
   - *Check and repair.*
6. **Water in fuel**
   - *Check/siphon/replace.*
7. **Impeller leading edge damaged**
   - *Check/replace, refer to JET PUMP.*
8. **Too much engine oil**
   - *Siphon or adjust level. Refer to LUBRICATION SYSTEM.*
9. **Poor fuel quality**
   - *Siphon then refill with fresh fuel.*
10. **Clogged fuel injectors**
    - *Remove and clean fuel injectors.*
11. **Low fuel pressure**
    - *Check fuel line and fuel pump pressure.*
12. **Incorrect throttle position sensor (TPS) adjustment**
    - *Check and adjust TPS, refer to ELECTRONIC FUEL INJECTION.*
13. **Defective supercharger**
    - *Check/repair, refer to SUPERCHARGER.*
14. **Dirt in supercharger due to vapor oil and salt contamination**
    - *Check and clean supercharger, refer to SUPERCHARGER.*
    - *Check engine oil level. Siphon excess of oil.*
15. **Improper camshaft timing**
    - *Refer to CYLINDER HEAD.*

Symptom: ENGINE CANNOT REACH MAXIMUM RPM

1. **Low fuel pressure**
   - *Check fuel pump pressure output.*
2. **Jet pump related problem**
   - *Check propulsion components. Refer to JET PUMP.*
3. **Exhaust system blockage/muffler damage**
   - *Check and repair.*

Symptom: ENGINE CANNOT REACH MAXIMUM RPM (cont'd)

4. **Exhaust gases in bilge (leak)**
   - *Check exhaust system for leaks.*
5. **Defective supercharger**
   - *Check/repair, refer to SUPERCHARGER.*
6. **Dirt in supercharger due to vapor oil and salt contamination**
   - *Check and clean supercharger, refer to SUPERCHARGER.*
   - *Check engine oil level. Siphon excess of oil.*

Symptom: ENGINE OVERHEATS

1. **Coolant level low**
   - *Refill/check for leaks (coolant leaking out of leak indicator hole (PTO housing), hoses or clamps missing/defective, or cylinder head gasket leaks). Repair/replace.*
2. **Thermostat failure**
   - *Replace.*
3. **Water pump failure**
   - *Replace.*
4. **Internal passage blockage**
   - *Inspect and clean.*
5. **Damaged ride plate or hoses**
   - *Check, refer to COOLING SYSTEM and BODY AND HULL.*
6. **Exhaust system clogged**
   - *Flush exhaust system.*
7. **Temperature sensor defective**
   - *Check/replace. Refer to ELECTRONIC FUEL INJECTION.*

Symptom: ENGINE SMOKE IN THE EXHAUST (WHITE SMOKE)

1. **Coolant leak**
   - *Check/repair. Refer to COOLING SYSTEM.*
2. **Intercooler leak (215 and 255 models)**
   - *Check/repair. Refer to INTAKE MANIFOLD AND INTERCOOLER or INTERCOOLER (255).*
3. **Damaged cylinder head gasket**
   - *Check/replace cylinder head gasket.*
4. **Water ingestion**
   - *Inspect intake manifold for water infiltration.*

Symptom: ENGINE SMOKE IN THE EXHAUST (BLUE SMOKE)

1. **Oil level too high**
   - *Siphon excess of oil.*
2. **PTO oil scavenge port blocked or scavenge pump malfunction**
   - *Inspect and clean or replace pump.*

Symptom: ENGINE SMOKE IN THE EXHAUST (BLUE SMOKE AT ENGINE STARTING)

1. **Valve stem seals worn or damaged**
   - *Replace seals.*

Symptom: ENGINE SMOKE IN THE EXHAUST (BLUE SMOKE AT ENGINE STARTING) (cont'd)

2. **Oil rings worn out**
   - *Replace rings, refer to CYLINDER BLOCK.*

Symptom: ENGINE SMOKE IN THE EXHAUST (BLUE SMOKE WITH ENGINE UNDER LOAD)

1. **Oil rings**
   - *Replace oil rings, refer to CYLINDER BLOCK.*

Symptom: LOW OR NO ENGINE OIL PRESSURE

1. **Oil level too low**
   - *Refill. See LUBRICATION SYSTEM.*
2. **Leaking gasket**
   - *Replace.*
3. **Oil leaking out of leak indicator hole (PTO housing)**
   - *Replace oil seal on pump shaft.*
4. **Oil pressure sensor defective**
   - *Check/replace.*
5. **Oil pump malfunctioning**
   - *Clean rotor and check wear limits.*
6. **Oil regulator valve sticks open, or spring load too small**
   - *Clean/replace.*
7. **Heavy wear on plain bearings**
   - *Replace.*

Symptom: ENGINE OIL CONTAMINATION (MILKY)

1. **Oil seal and rotary seal on water pump shaft leaking**
   - *Replace both seals. Refer to PTO HOUSING AND MAGNETO. Change oil.*
2. **Cylinder head gasket leaking**
   - *Replace gasket. Refer to CYLINDER HEAD. Change oil.*
3. **Loose screws on cylinder head, PTO housing or oil separator**
   - *Retorque. Change oil.*
4. **Oil contamination due to metal or plastic particles**
   - *Replace possibly damaged parts. Change oil.*
5. **Water ingestion**
   - *Refer to SPECIAL PROCEDURES.*
6. **Leak indicator hole plugged**
   - *Check/clean leak indicator hole.*

Symptom: UNUSUAL ENGINE NOISE AND/OR VIBRATION

1. **Worn chain tensioner**
   - *Replace.*
2. **Worn chain guide**
   - *Replace.*

Symptom: UNUSUAL ENGINE NOISE AND/OR VIBRATION (cont'd)

3. **Stretched chain and/or worn out sprockets**
   - *Replace chain and sprockets.*
4. **Sprocket screws got loose**
   - *Retorque.*
5. **Hydraulic element inside rocker arm(s) is worn out (valve adjustment) or lifter damaged**
   - *Replace faulty rocker arm(s) and/or lifters.*
6. **Rocker arm screws not tightened**
   - *Retorque.*
7. **Heavy wear on crankshaft and/or balancer shaft bearings**
   - *Replace.*
8. **Crankshaft and balancer shaft not aligned**
   - *Check marks and readjust shafts.*
9. **Heavy wear on thrust washers, or thrust washers missing**
   - *Check/replace.*
10. **Defective supercharger (if so equipped)**
    - *Check/repair, refer to SUPERCHARGER.*

ELECTRICAL SYSTEM

Symptom: STARTER DOES NOT TURN

1. **2 short beeps are not heard when installing safety lanyard**
   - *Refer to DIGITALLY ENCODED SECURITY SYSTEM.*
2. **Burnt fuse**
   - *Check wiring condition and replace fuse.*
3. **Poor contact of battery terminal(s)**
   - *Clean and tighten terminal(s).*
4. **Poor battery ground cable connection**
   - *Clean and tighten.*
5. **Weak battery**
   - *Recharge or replace battery.*
6. **Poor contact of start/stop switch or solenoid**
   - *Check connectors and clean contacts. Check and replace defective parts.*
7. **Open circuit: start/stop switch or solenoid**
   - *Check. Replace if necessary.*

Symptom: STARTER TURNS, BUT STARTER DRIVE DOES NOT MESH WITH RING GEAR

1. **Worn starter drive gear**
   - *Replace drive.*
2. **Defective drive**
   - *Replace drive.*
3. **Poor movement of drive on splines**
   - *Clean and correct.*

Symptom: STARTER TURNS, BUT STARTER DRIVE DOES NOT MESH WITH RING GEAR (cont'd)

4. **Worn drive bushing**
   - *Replace clutch.*
5. **Worn ring gear**
   - *Replace ring gear.*

Symptom: STARTER KEEPS RUNNING

1. **Shorted solenoid winding**
   - *Replace solenoid.*
2. **Melted solenoid contacts**
   - *Replace solenoid.*
3. **Sticking or defective starter drive**
   - *Lubricate or replace.*

Symptom: DEPTH GAUGE OPERATIONAL PROBLEM

1. **Nothing is displayed in the information center**
   - *The depth gauge is not activated in the ECM. Activate the depth gauge in* Options *under* Setting *tab in B.U.D.S.*
2. **0.0 (ft or m) is displayed all the time**
   - *Connector of the depth gauge is not connected. Connect it properly.*
   - *There is not 12 V or ground is open at the depth gauge connector. Check fuses and wiring harness.*
   - *Check fuses and wiring harness. Check WHITE/BLACK and WHITE/RED wires.*
3. **- - - - (ft or m) is displayed and sensor is blinking after self test for 5 seconds**
   - *The watercraft is not in water. Launch watercraft in water and recheck.*
   - *There is air between the depth gauge and the bilge. Check silicone pad under depth gauge.*
   - *Depth gauge is defective. Try a new depth gauge.*

PROPULSION

Symptom: ABNORMAL NOISE FROM PROPULSION SYSTEM

1. **Weeds/debris caught in intake grate or impeller**
   - *Check and clean.*
2. **Damaged or bent drive shaft**
   - *Check and/or replace. Refer to DRIVE SYSTEM.*
3. **Broken engine mounts**
   - *Check and repair.*

STEERING SYSTEM

GTX and RXT Series

Symptom: O.P.A.S. SYSTEM FAULTS

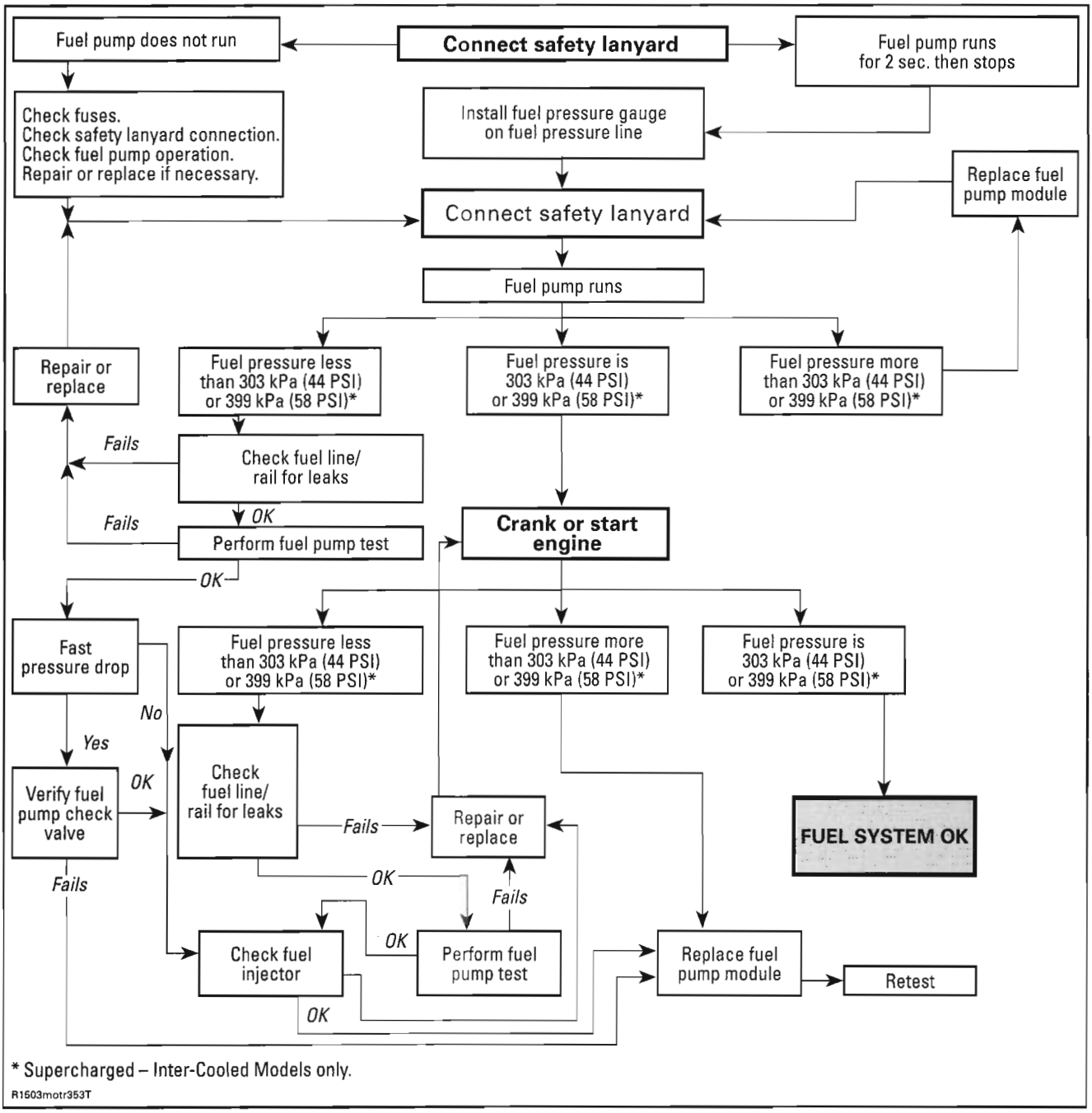
1. **Watercraft is more responsive than usual while turning**
   - *Side vanes do not go up while watercraft is at speed. Refer to OFF-POWER ASSISTED STEERING.*

Symptom: O.P.A.S. SYSTEM FAULTS (cont'd)

2. **Watercraft pull on one side**
   - *One side vane does not go up while watercraft is at speed.*
3. **Side vanes do not go up while watercraft is at speed**
   - *Clogged filter, square rings damaged, leakage in hoses or mechanical malfunction.*

DIAGNOSTIC FLOW CHART

FUEL SYSTEM



ENGINE REMOVAL/INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
alignment shaft	295 000 141	30
support plate kit	529 035 506	29
plate	529 035 507	29
engine alignment adapter	529 035 719	30

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	29
XP-S Lube	293 600 016	29
Loctite 243 (blue)	293 800 060	29, 31
pulley flange cleaner	413 711 809	29

GENERAL

During assembly/installation, use torque values and service products from exploded views in the appropriate sections.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

PROCEDURES

ENGINE

Engine Removal

Place vehicle at workstation that will have access to an engine-lifting hoist.

GTI Models

Remove seat.

GTX, WAKE and RXT Models

Remove:
- Seats
- Seat support
- Air vent tube.

RXP Models

Remove:
- Seat
- Engine cover.

All Models

Drain cooling system, refer to *COOLING SYSTEM* section.

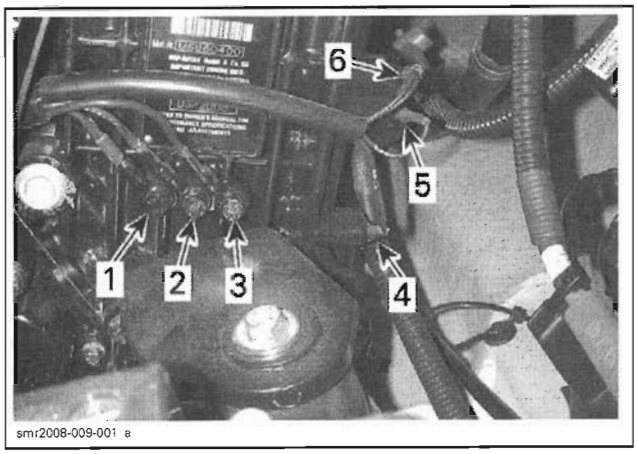
Using B.U.D.S., release fuel pressure from fuel system.

Disconnect battery cables from battery.

⚠ WARNING

Always disconnect battery cables exactly in the specified order, BLACK (–) cable first then the RED (+) battery cable last.

Disconnect ground wires from engine.



1. *ECM*
2. *ECM*
3. *Voltage regulator/rectifier*
4. *Gauge and diagnostic connector*
5. *TOPS*
6. *VTS switch and power*

RXP 255 and RXT 255 Models

Remove the both air hoses from the intercooler.

All Models except RXP

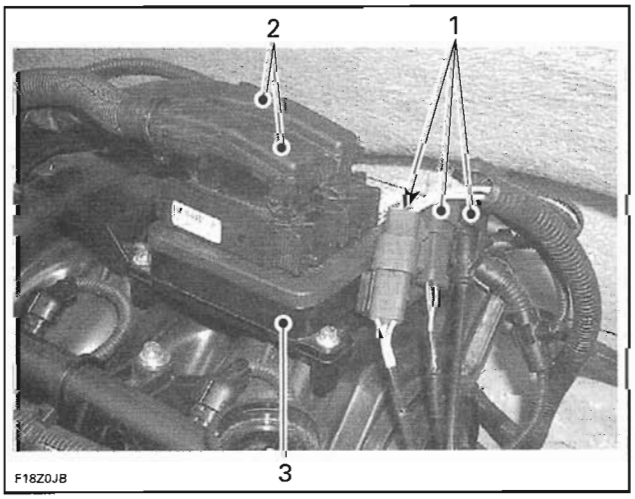
Disconnect magneto wiring harness.

Disconnect the throttle position sensor (TPS), manifold air pressure sensor (MAPS) and manifold air temperature sensor (MATS). Refer to *ENGINE MANAGEMENT* for location of sensors and connectors.

RXP Models

Unplug connectors beside ECM then remove connector housings from the support.

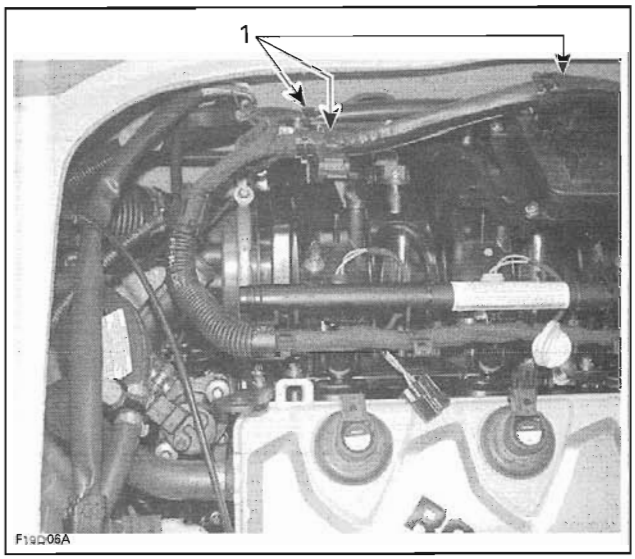
Disconnect ECM and remove from engine to prevent any possible damage while pulling engine out.



1. *Remove connectors*
2. *Disconnect ECM*
3. *Remove ECM*

On **RXP 215 and RXP 255**, unplug VTS connector.

Cut locking ties retaining vehicle wiring harness to engine.

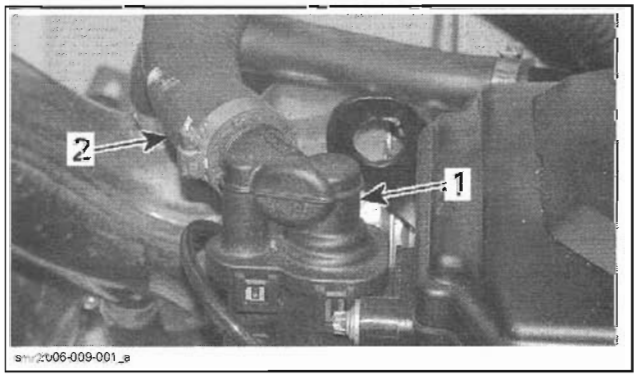


VEHICLE WIRING HARNESS
1. *Cut locking ties*

Move wiring harness forward to make room.

All Models

Disconnect TOPS valve hose.



1. *TOPS valve*
2. *TOPS valve hose*

Remove exhaust pipe, refer to *EXHAUST SYSTEM* section.

Withdraw jet pump, refer to *JET PUMP* section.

Withdraw drive shaft, refer to *DRIVE SYSTEM* section.

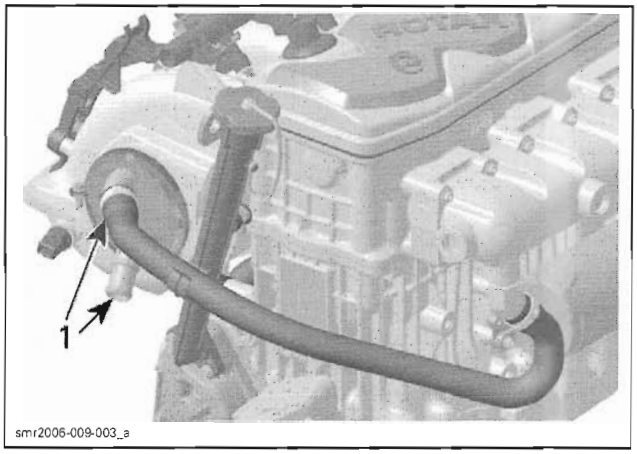
Disconnect cooling hoses at engine coming from ride plate and coolant expansion tank.

Except RXP models, remove the intake manifold. Refer to *INTAKE MANIFOLD AND INTERCOOLER* section.

All 215 Engines except RXP 215

Remove air inlet tube from supercharger and air duct.

Disconnect water hoses from intercooler.

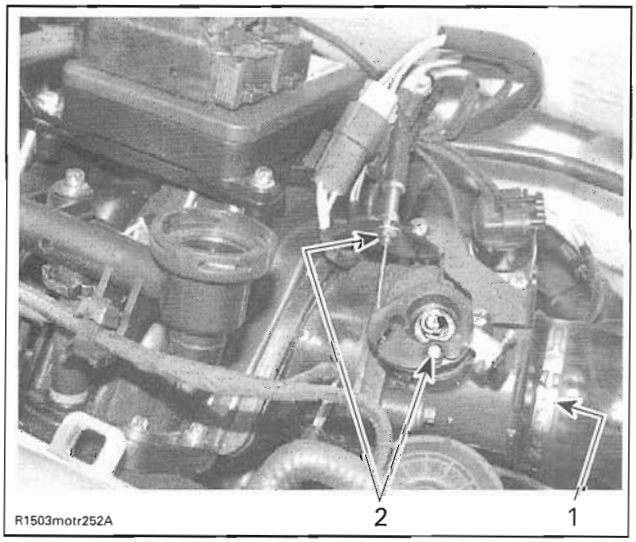


1. Disconnect hoses here

RXP 155 Model

Remove inlet hose from throttle body.

Disconnect throttle cable from throttle body.

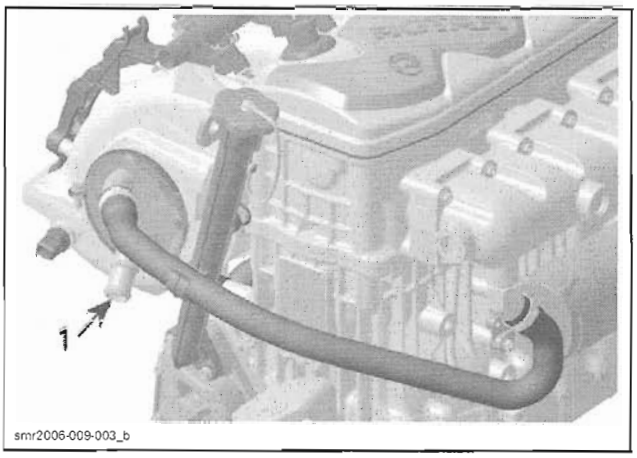


1. Detach hose
2. Disconnect cable

Disconnect fuel rail supply line.

RXP 215 Model

Disconnect water inlet hose coming from jet pump connected to the intercooler.

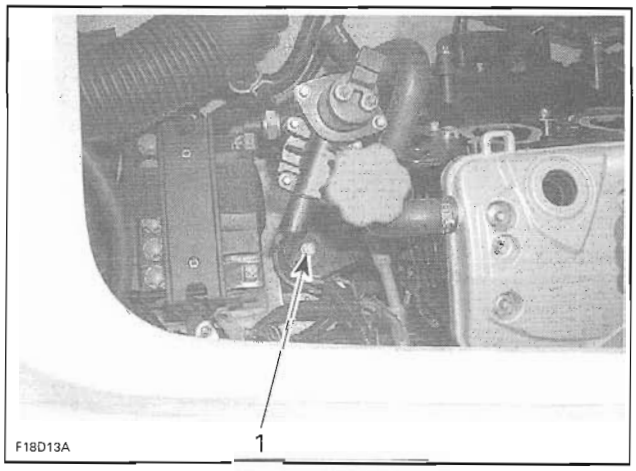


1. Disconnect hose here

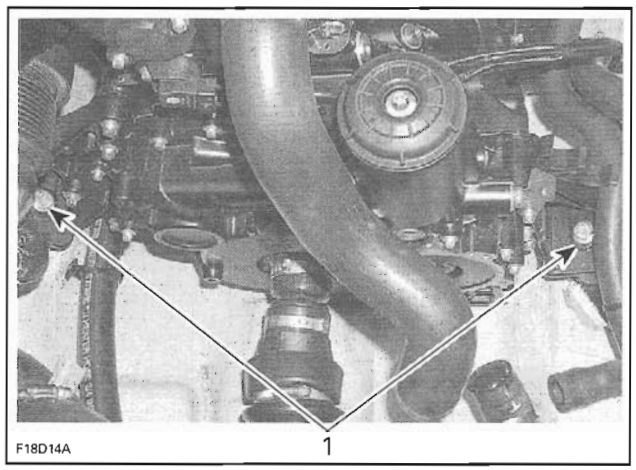
All Models

Remove engine support mount screws.

NOTE: Be careful when removing engine support(s) or rubber mount adapters, shims could have been installed underneath. Shims control engine/jet pump alignment. Always note position of shims for reinstallation, to avoid altering engine alignment.



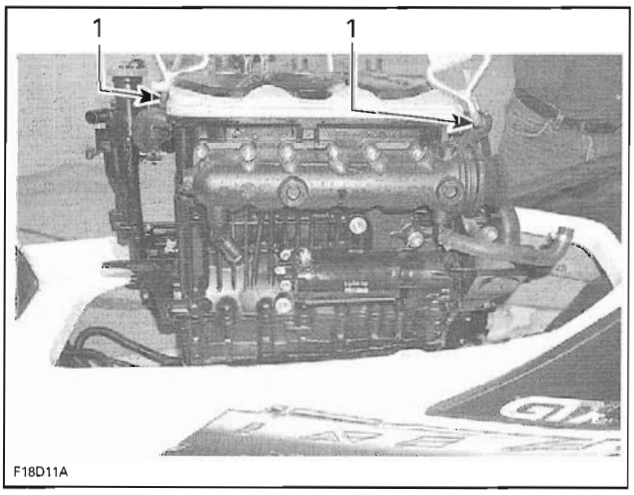
FRONT SUPPORT
1. Remove screw



REAR SUPPORT
1. Remove screws

Using a chain block, a hoist or other suitable equipment, slightly lift engine to ease the remaining component removal.

CAUTION: Take care not to damage cables.

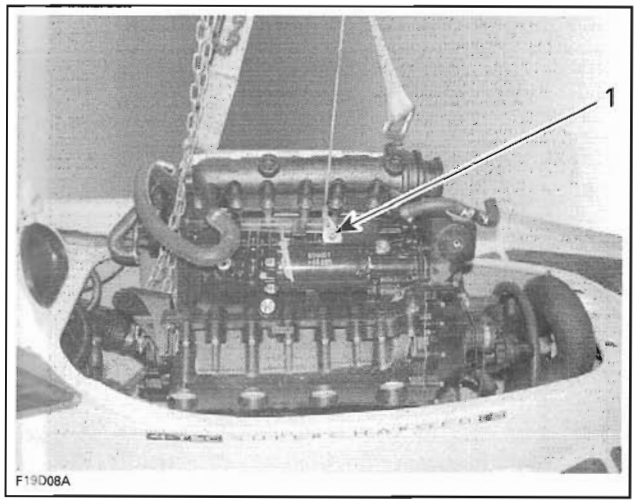


TYPICAL
1. Lifting brackets

RXP Models

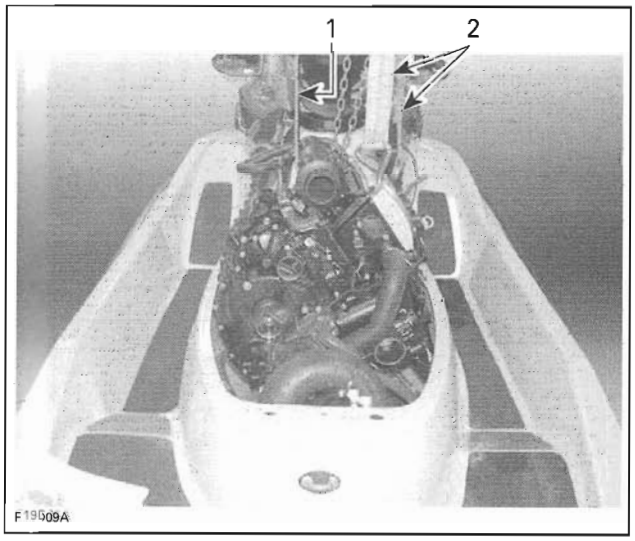
Slightly move engine rearward to take advantage of the larger opening.

The engine have to be hooked-up at an additional location. See illustration.



1. Hook-up a steel rope/chain here

Carefully lift engine by the side with the steel rope/chain and rotate engine so that it can be pulled out of vehicle.



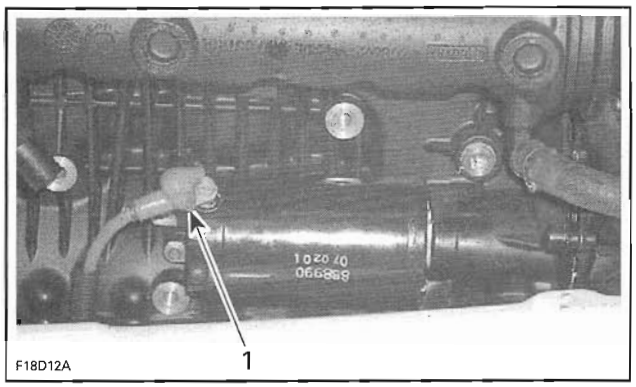
1. Lift steel rope/chain here to rotate engine
2. Usual lifting brackets

All Models

Carry on engine lifting to remove from the body opening.

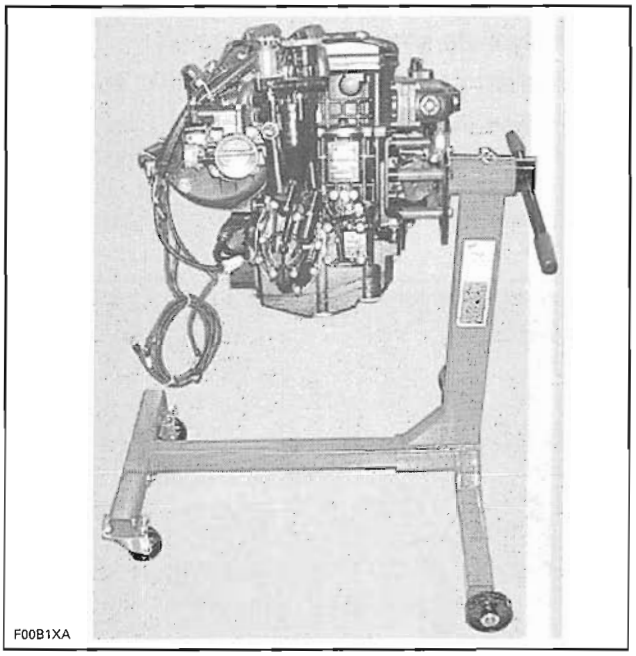
CAUTION: Be careful not to scratch body or to hit any component.

Disconnect RED (+) cable from starter post.



TYPICAL
1. Disconnect RED (+) cable

Install the engine on an engine stand.



NOTE: A special mounting plate is required to fix engine to support. This plate is not sold by BRP.

Engine Installation

CAUTION: Whenever engine is removed from watercraft, engine/jet pump alignment must be performed at reinstallation.

Installation of engine in watercraft is essentially the reverse of removal procedures. However pay particular attention to the following.

Wipe off any spillage in bilge. Clean with the pulley flange cleaner (P/N 413 711 809).

Clean external parts of engine.

Check tightness and condition of rubber mounts.

If they have been removed, apply Loctite 243 (blue) (P/N 293 800 060) on screw threads or use new screws with self-locking product.

Torque rubber mount screws to 25 N•m (18 lbf•ft).

CAUTION: Strict adherence to this torque is important to avoid damaging threads of aluminum insert in bilge.

Connect starter cable before lowering engine.

Torque nut of positive starter cable to 7 N•m (62 lbf•**in**).

Apply dielectric grease (P/N 293 550 004) on nut.

Ensure contact surface is perfectly clean then reconnect grounds wires/cable to engine.

Place engine into vehicle.

Install engine support screws. Do not apply threadlocker to engine support screws and do not torque yet.

Align engine. Refer to *ENGINE ALIGNMENT* at the end of this section for complete procedure.

Install and properly align exhaust pipe. Refer to *EXHAUST SYSTEM* section.

Reinstall all removed parts and connect all connectors.

Check throttle cable condition and lubricate it with XP-S Lube (P/N 293 600 016).

After its installation, properly adjust throttle cable then perform the TPS reset as specified in *ENGINE MANAGEMENT SYSTEM* section.

Check hose condition and pressure test fuel system, refer to *FUEL SYSTEM*.

⚠ WARNING

Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine.

Verify all electrical connections (ground wires and battery).

Run engine and ensure there is no leakage.

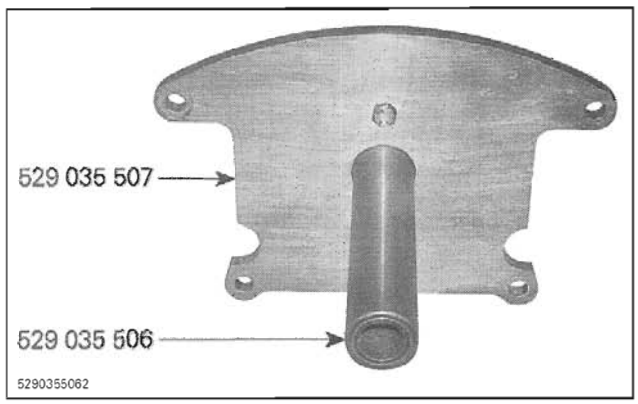
CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

Engine Alignment

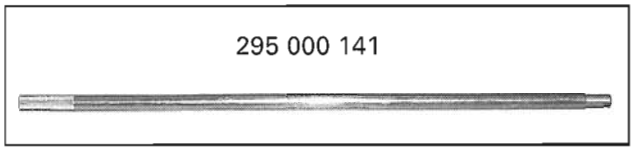
NOTE: To perform this procedure the jet pump and the drive shaft must be removed. Refer to *JET PUMP* and *DRIVE SYSTEM*.

Check alignment of engine using the following alignment tools:

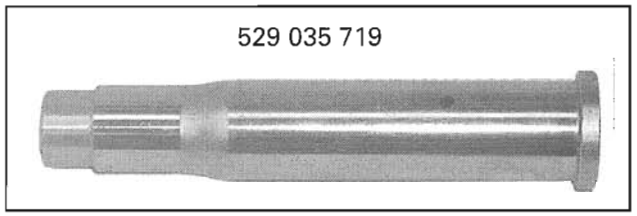
– The support plate kit (P/N 529 035 506) and the plate (P/N 529 035 507)



– The alignment shaft (P/N 295 000 141)

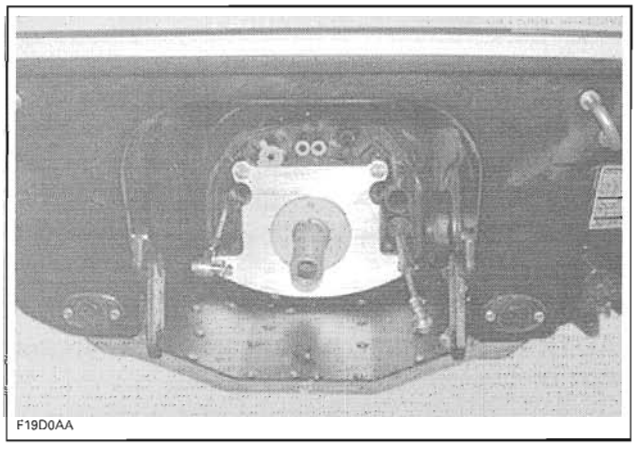


– The engine alignment adapter (P/N 529 035 719).

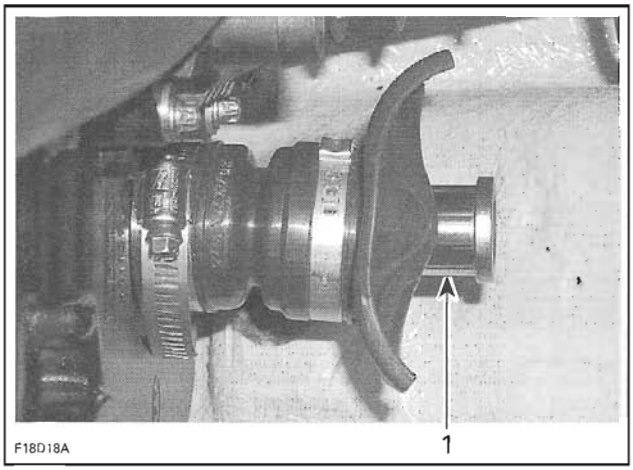


To verify alignment proceed as follows:

- Secure plate and support to hull with four nuts or screws.



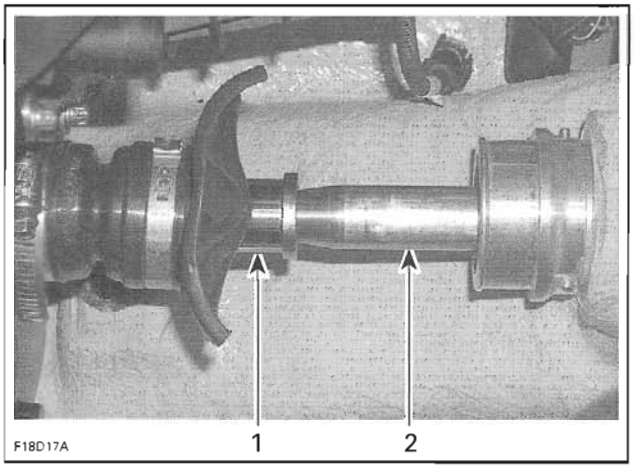
- Install the engine alignment adapter (P/N 529 035 719) in engine PTO housing.



1. Engine alignment adapter

- Carefully slide shaft through support.
- Insert shaft end into engine alignment adapter.

NOTE: Ensure the protective hose and carbon ring is removed to check engine alignment. If the alignment is correct, the shaft will slide easily without any deflection in engine alignment adapter.

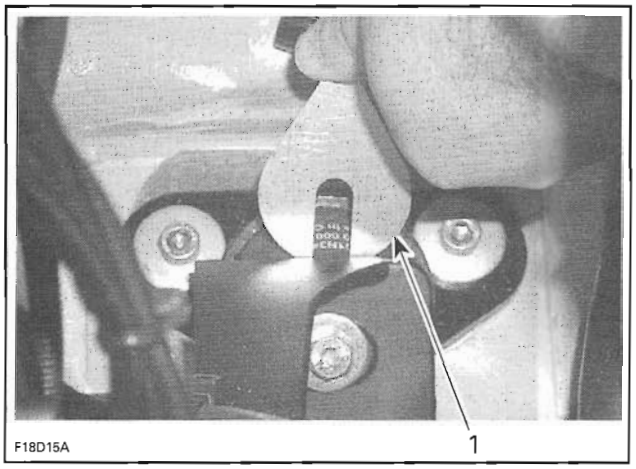


TYPICAL
1. Engine alignment adapter
2. Alignment shaft

If the alignment is incorrect loosen engine support screws to enable to align engine alignment adapter with shaft end.

NOTE: Use shim(s) (P/N 270 000 024) or (P/N 270 000 025) between engine supports and rubber mounts to correct alignment.

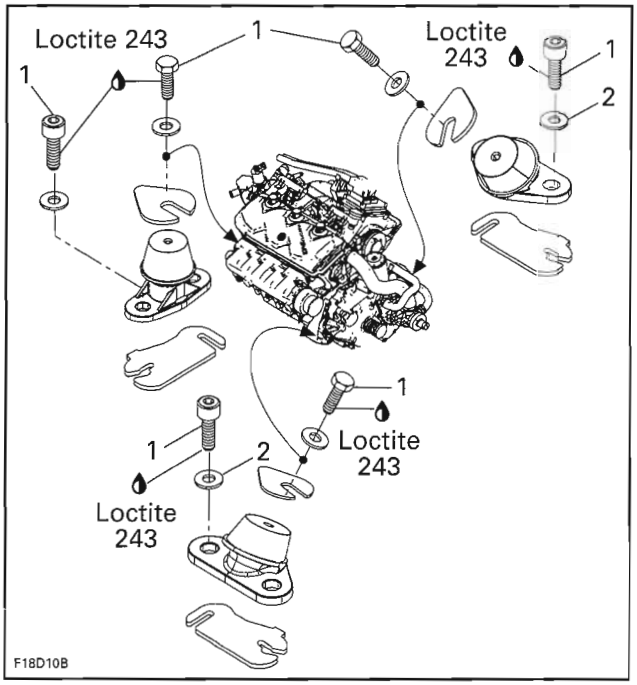
CAUTION: Whenever shims are used to correct alignment, never install more than 5 mm (0.196 in) shim thickness.



TYPICAL
1. Shim

Remove engine support screws and apply Loctite 243 (blue) (P/N 293 800 060) on screw threads.

Torque engine support screws to 25 N•m (18 lbf•ft) when procedure is completed.



1. Torque to 25 N•m (18 lbf•ft)
2. Position washer to have the "T" mark on top

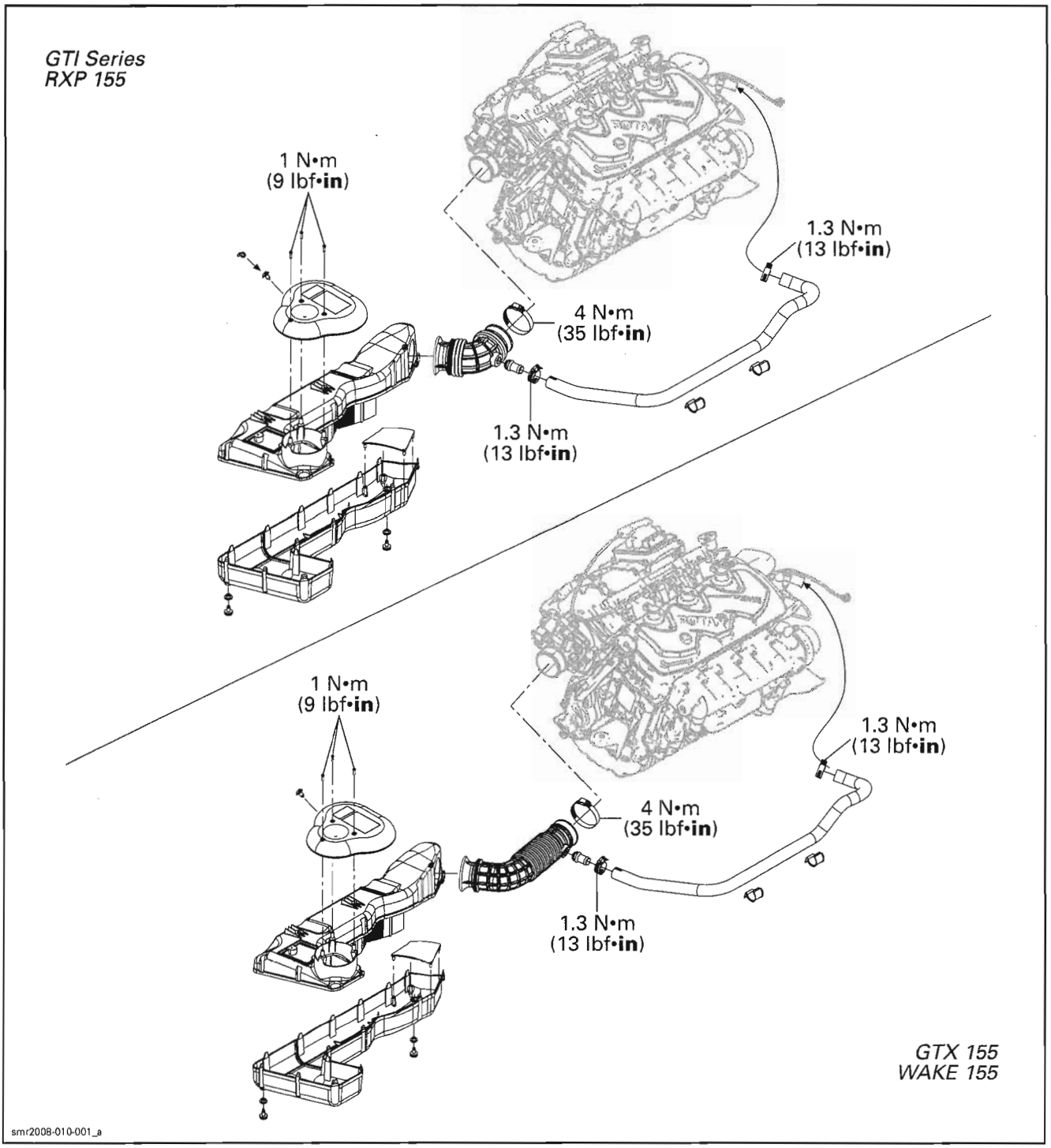
Remove alignment tools.

AIR INTAKE SYSTEM

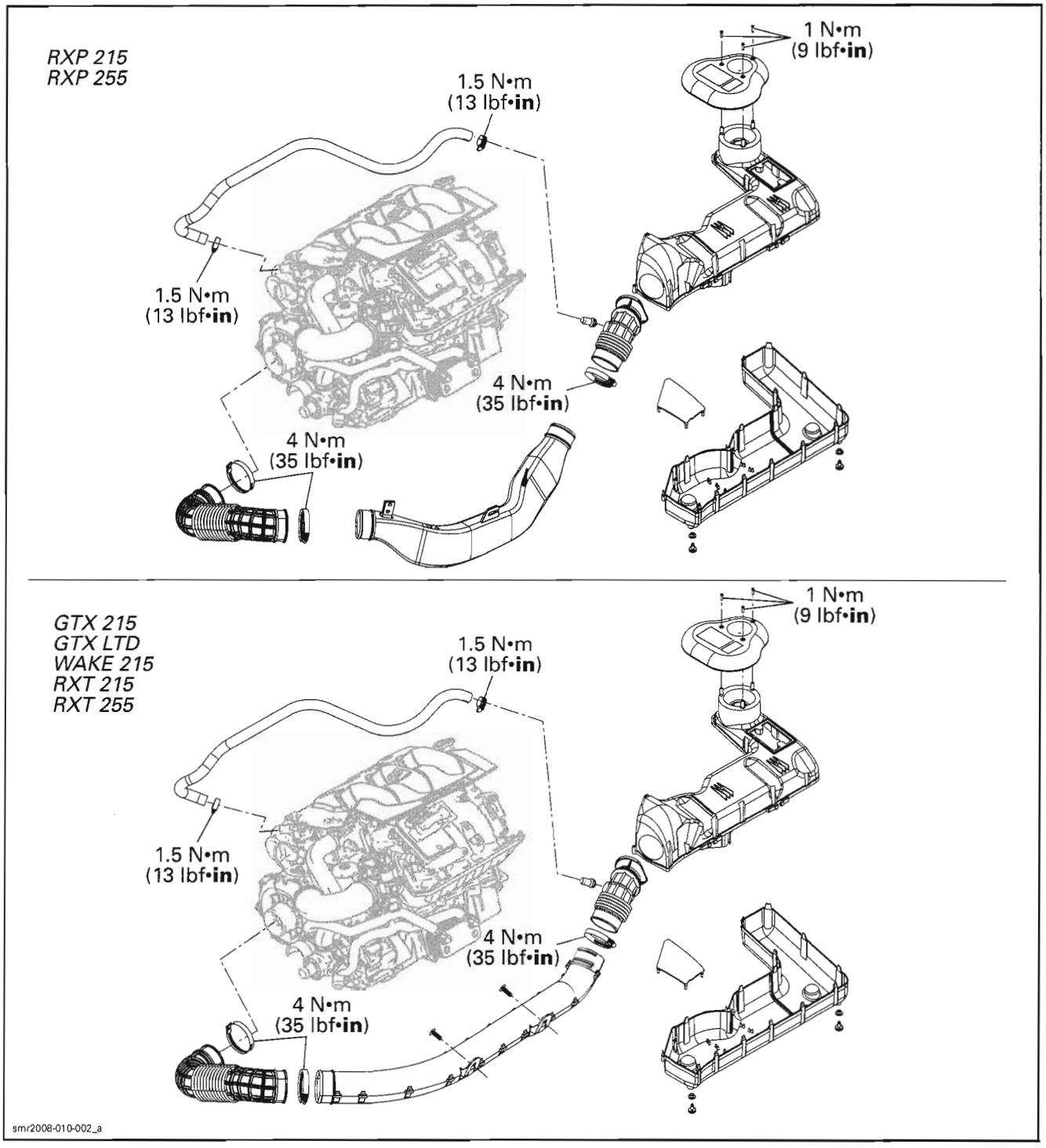
SERVICE TOOLS

Description	Part Number	Page
small spring removal tool	529 035 989	36

130/155 Engines



215/255 Engines



GENERAL

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

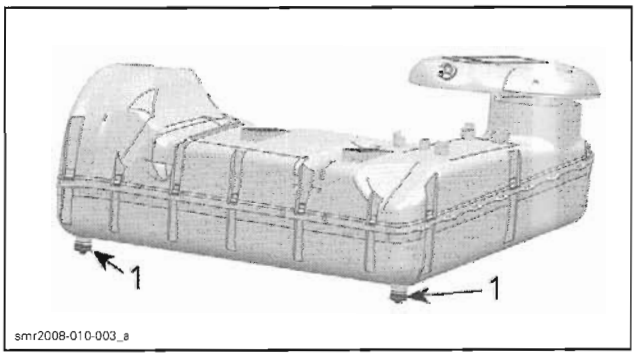
CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

PROCEDURES

AIR INTAKE SILENCER

Air Intake Silencer Inspection

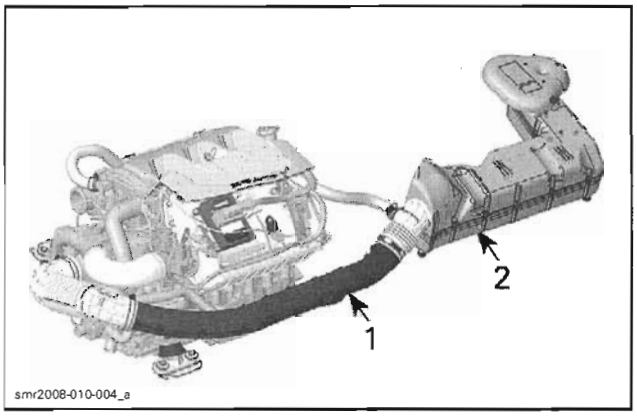
Check for water in air silencer. If so, replace check valves.



1. Check valves

Check collars tightness.

On **215 and 255 engines**, ensure there is no water trapped in intake tube.



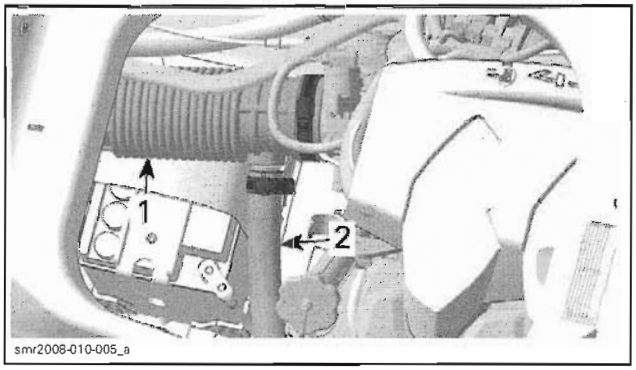
1. Intake tube
2. Intake silencer

Inspect silencer, tube and hose condition. Replace any damaged part.

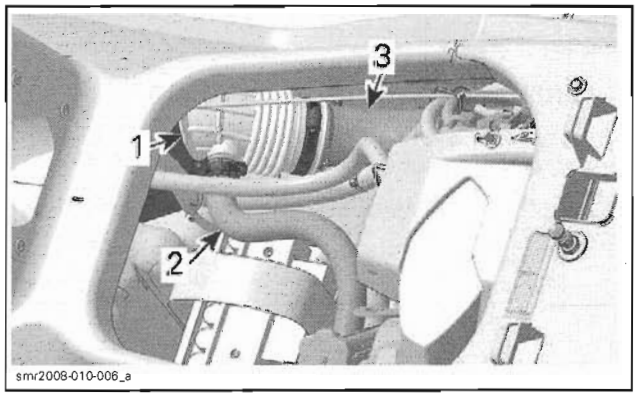
Air Intake Silencer Removal

Remove seat(s).

Loosen clamps securing the front intake hose and the vent hose.



TYPICAL — 130/155 ENGINES
1. Front intake hose
2. Vent hose



TYPICAL — 215/255 ENGINES
1. Front intake hose
2. Vent hose
3. Intake tube

Open the front storage cover and remove basket.

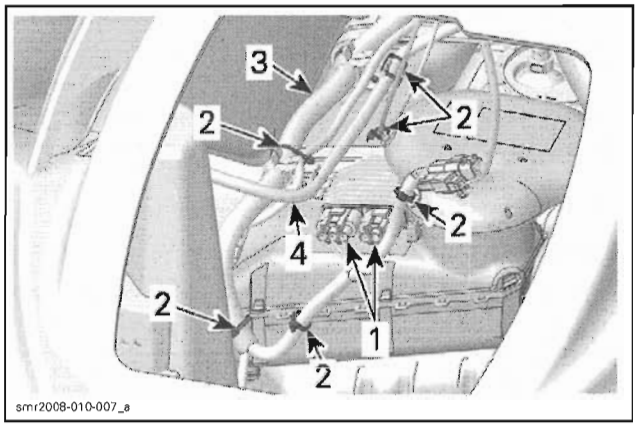
On **RXP series** only, cut locking ties securing front vent tubes and move them aside to make room.

Unplug the voltage regulator/rectifier connectors.

Cut locking ties securing throttle cable and multi-function switch harness on air intake silencer cover.

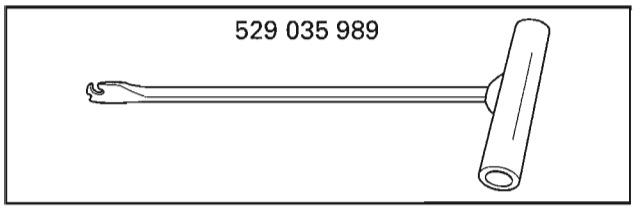
Release wiring harness and fuel feed hose from their retaining devices.

NOTE: Mark the fuel feed hose to reinstall it at the same place in the retaining device.



1. *Voltage regulator/rectifier connectors*
2. *Locking ties*
3. *Wiring harness*
4. *Fuel feed hose*

Using the small spring removal tool (P/N 529 035 989), detach fuel tank straps.



Pull air intake silencer out.

Air Intake Silencer Installation

Reverse removal operation order and pay attention to the following.

Ensure that tubes are well secured with hoses and there is a tight fit.

INTAKE MANIFOLD/INTERCOOLER

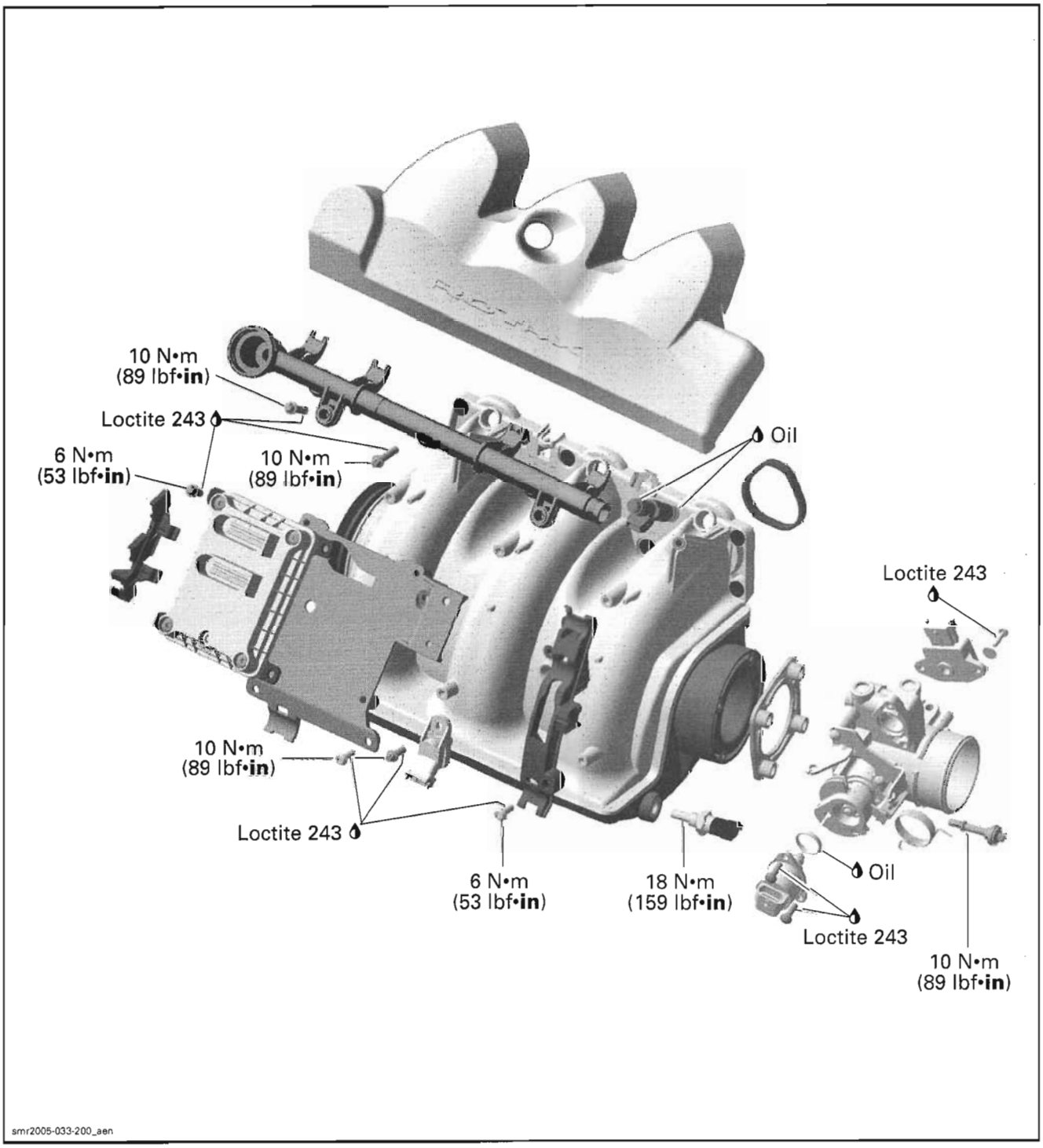
SERVICE TOOLS

Description	Part Number	Page
vacuum/pressure pump	529 021 800	46

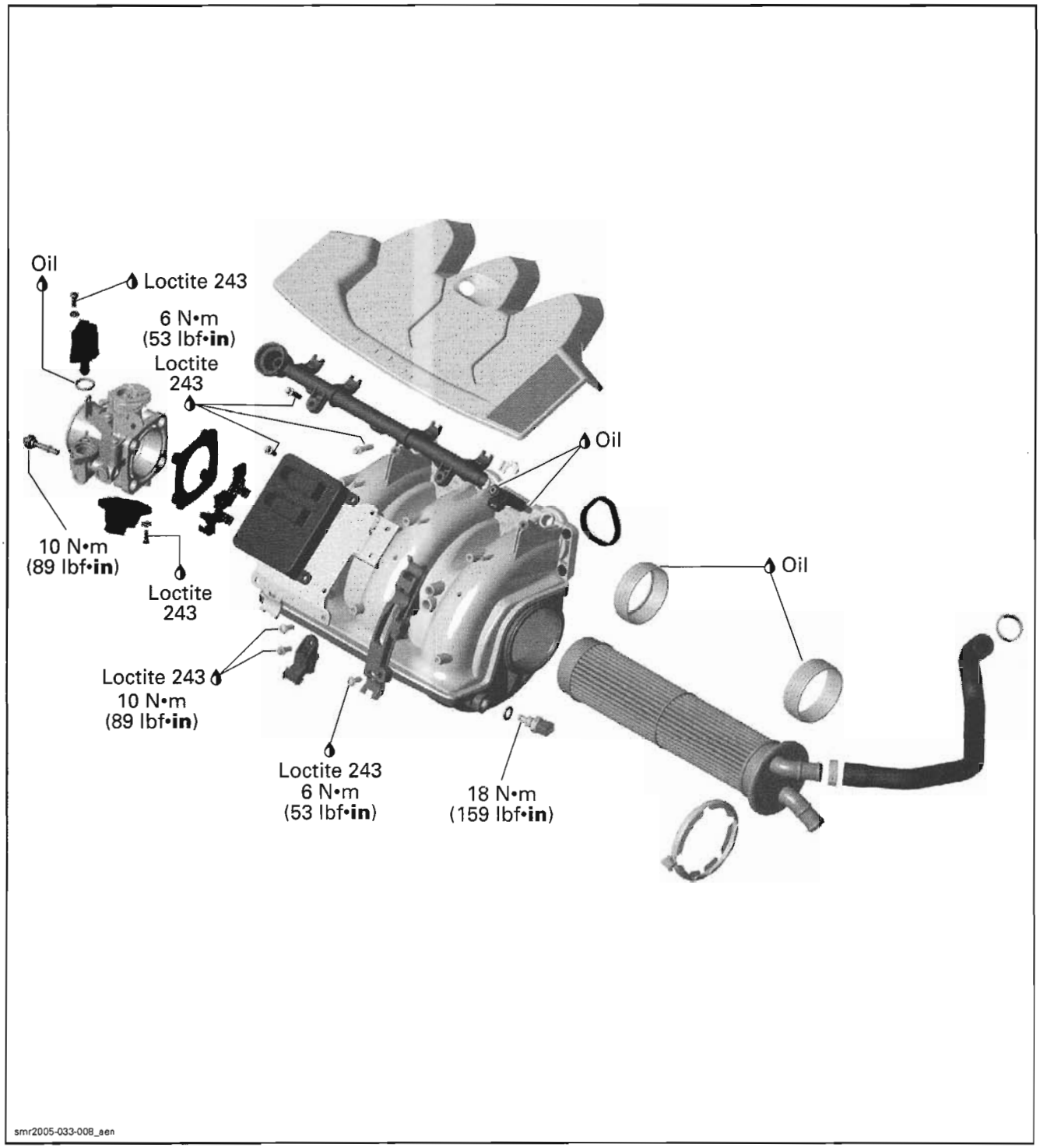
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	45

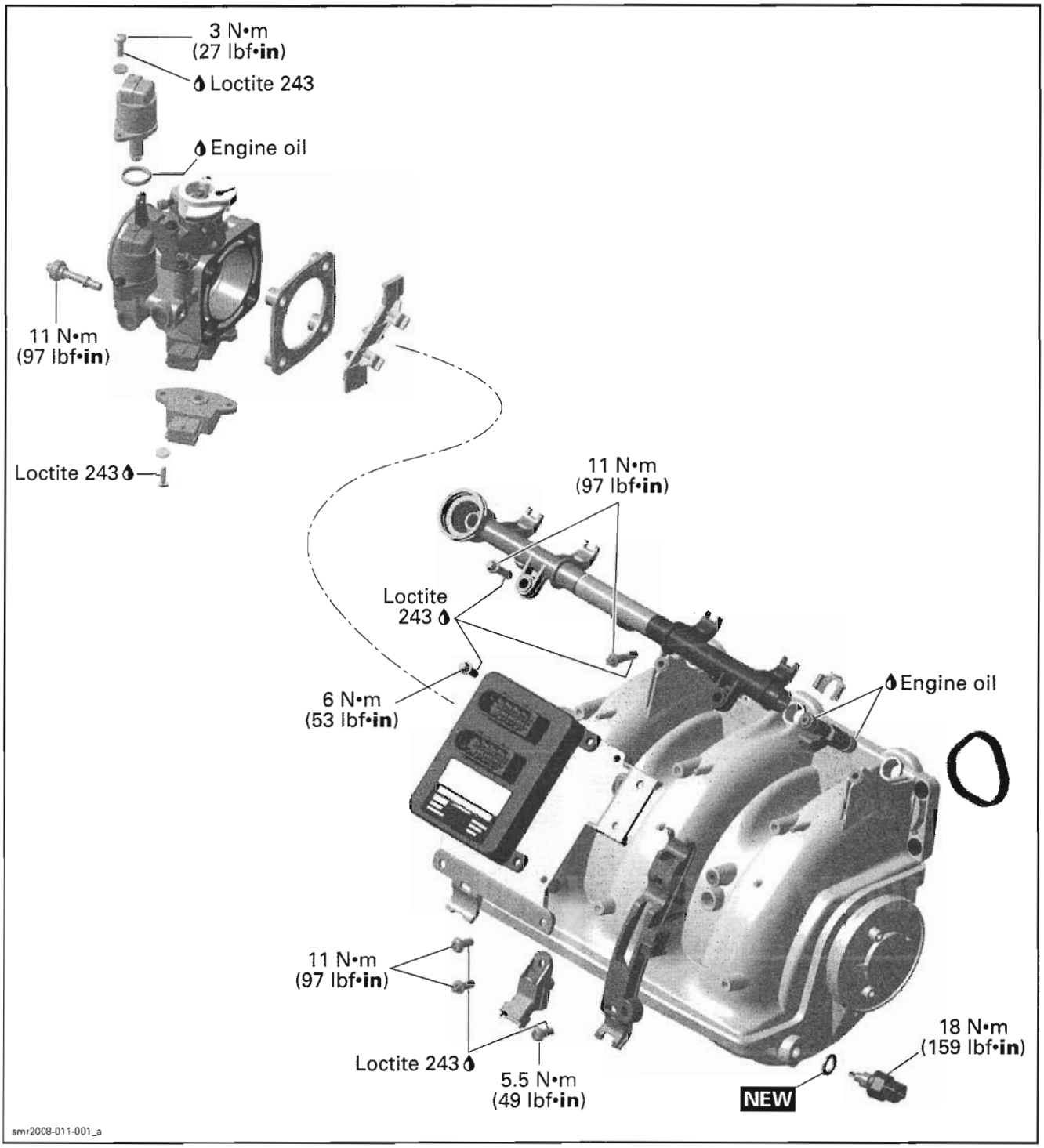
130/155 Naturally Aspirated Engines



215 Supercharged Intercooled Engines



255 Supercharged Intercooled Engines



GENERAL

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

PROCEDURES

INTAKE MANIFOLD

Intake Manifold Removal

Remove seat(s).

On **GTX, WAKE and RXT models**, remove the seat support.

255 Engines

Remove intercooler air inlet and outlet hoses.

Remove exhaust hose.

215/255 Engines

Remove the supercharger air outlet hose.

All Models

Move the coolant expansion tank aside to make room.

Remove oil dipstick.

Pull engine cover out.

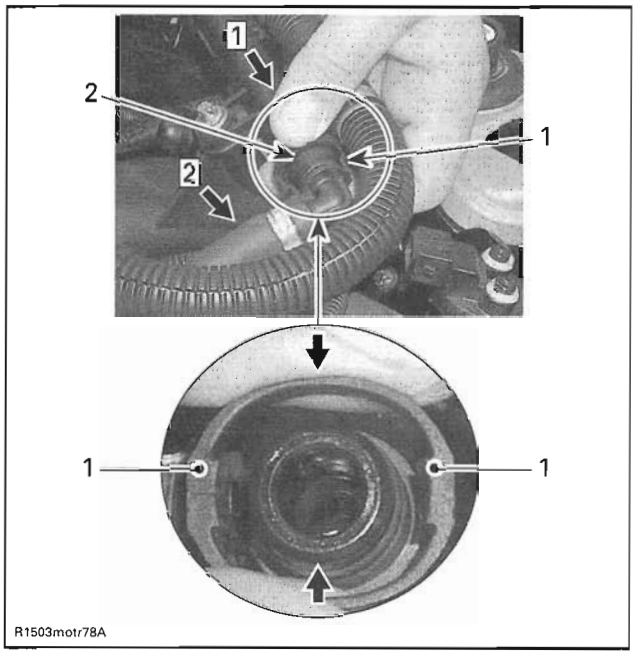
Release the fuel pressure.

Disconnect battery cables from battery.

⚠ WARNING

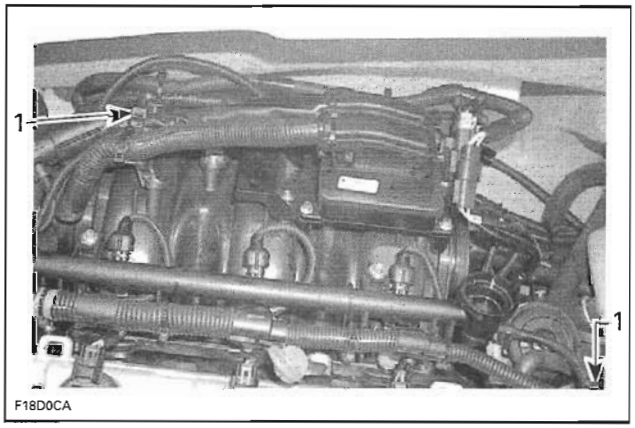
Always disconnect battery cables exactly in the specified order, BLACK negative cable first then the RED positive battery cable last.

Disconnect fuel hose connector at fuel rail.

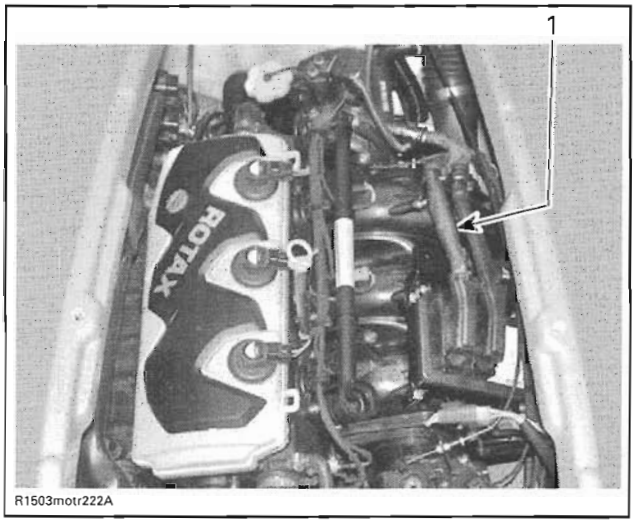


Step 1: Squeeze
Step 2: Pull out
1. Supporting tabs
2. Squeeze in middle of supporting tabs, hold and pull out

Cut locking ties securing harness to intake manifold.



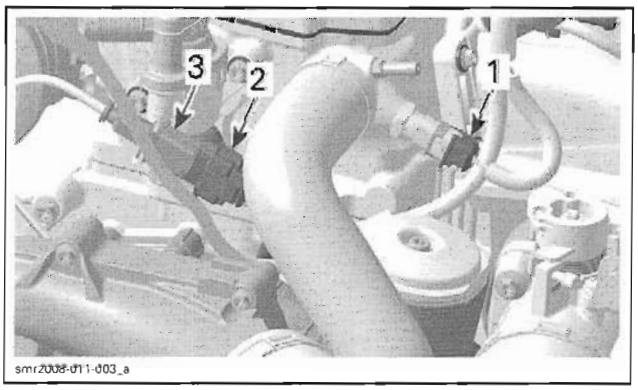
130/155 ENGINES
1. Cut locking ties to release harness



215/255 ENGINES
1. *Cut locking ties to release harness*

Unplug the exhaust gas temperature sensor (EGTS) from muffler.

Unplug the coolant temperature sensor. (CTS), the crankshaft position sensor (CPS) and the camshaft position sensor (CAPS) connectors.



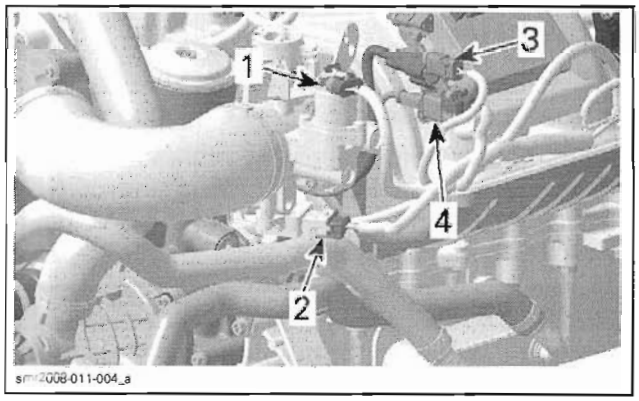
1. *CTS connector*
2. *CAPS connector*
3. *CPS connector*

NOTE: The CAPS connector is hidden behind the water hose. Slightly pry locking tab of connector to unlock.

Unplug the idle bypass valve and the TPS connectors from the throttle body.

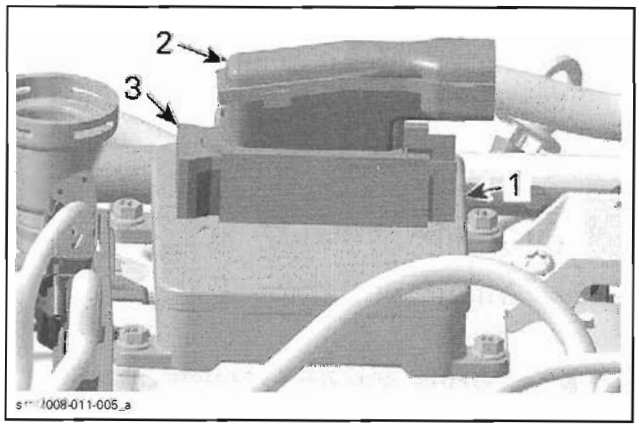
Pull the connectors for the knock sensor (KS) and magneto out of the ECM support. For more details, refer to *ELECTRICAL CONNECTORS*.

Unplug knock sensor (KS) and magneto connectors.



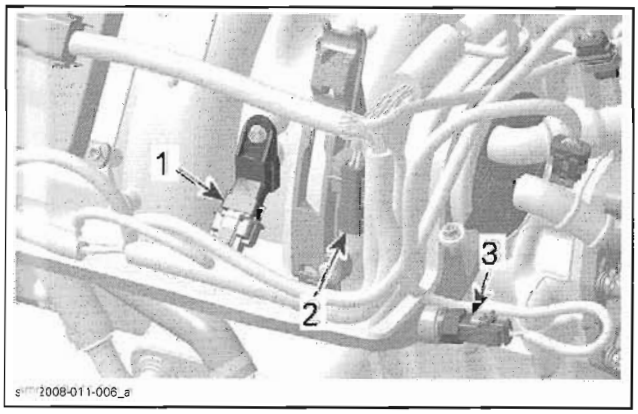
1. *Idle bypass valve connector*
2. *TPS connector*
3. *Magneto connector*
4. *KS connector*

Unplug the B connector from the ECM by pulling the lock.



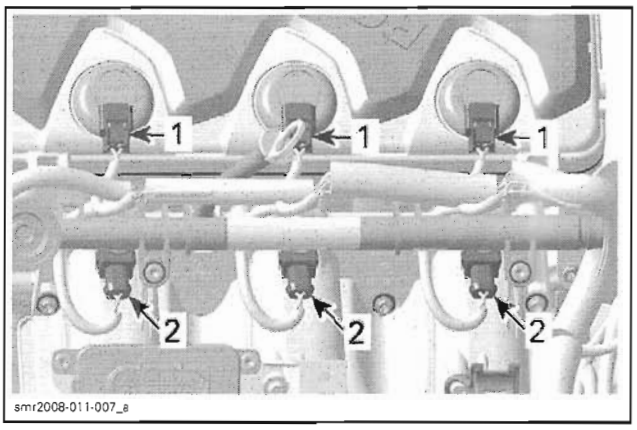
1. *ECM*
2. *B connector*
3. *Lock*

Unplug the manifold air pressure sensor (MAPS), the engine connector and the manifold air temperature sensor (MATS).



1. *MAPS connector*
2. *Engine connector location*
3. *MATS connector*

Unplug ignition coils and fuel injectors.



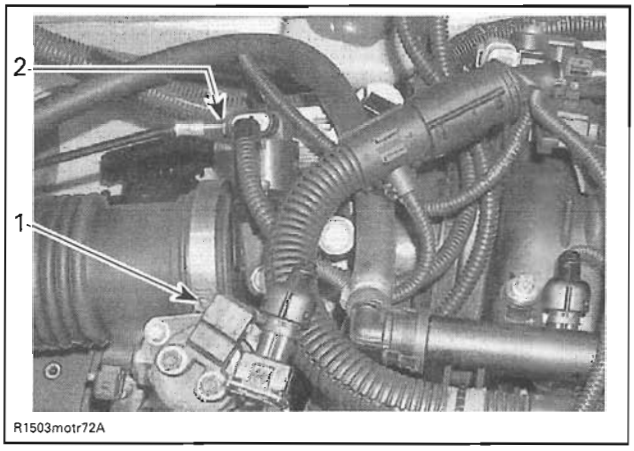
1. *Ignition coil connectors*
2. *Fuel injector connectors*

Cut locking ties as necessary and pull wiring harness away from intake manifold.

130/155 Engines

Loosen air intake silencer collar.

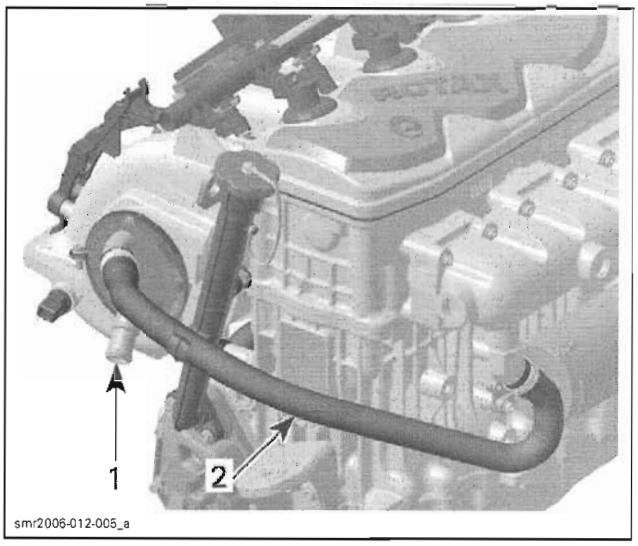
Unlock throttle cable housing from throttle body. Cable is to be detached later on.



1. *Air intake silencer collar*
2. *Unlock throttle cable housing*

215 Engines

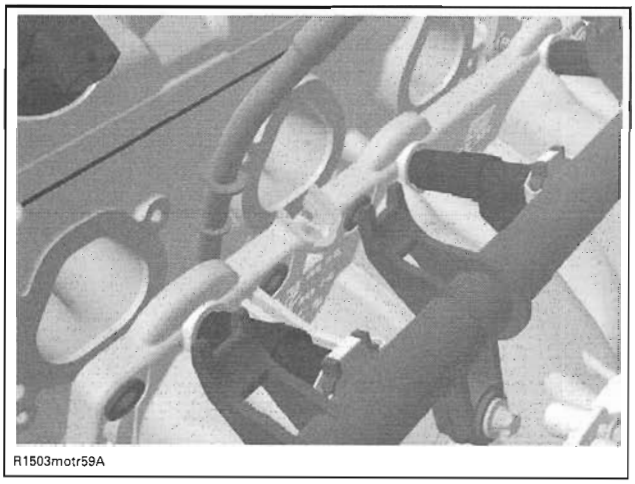
Remove the hoses connected to the intercooler.



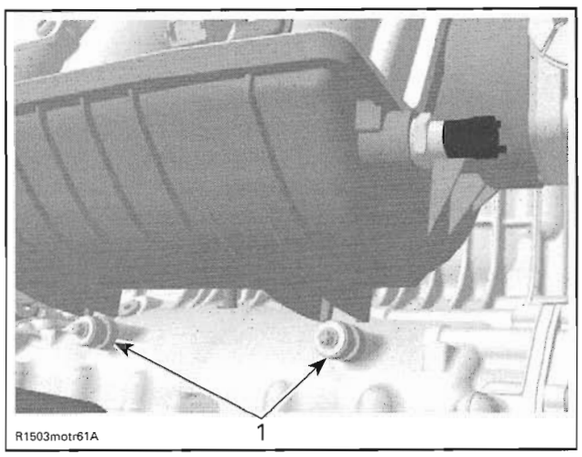
1. *Hose from intercooler to exhaust manifold (outlet nipple)*
2. *Hose from jet pump*

All Engines

Remove manifold retaining screws and push the oil dipstick tube out of the manifold slot.



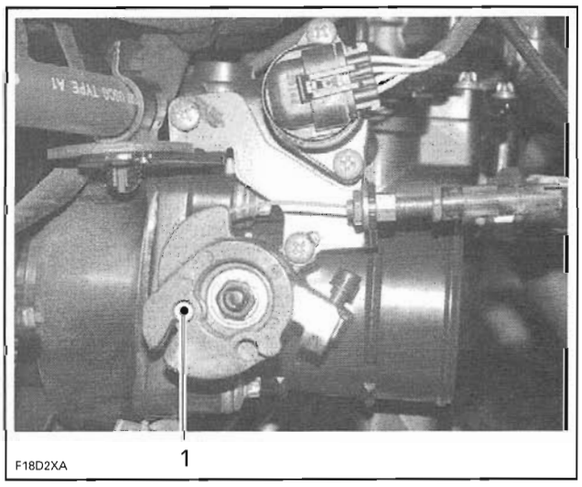
Lift intake manifold up to pull it out of the mounting brackets just enough to reach throttle cable end.



1. Mounting brackets

130/155 Engines

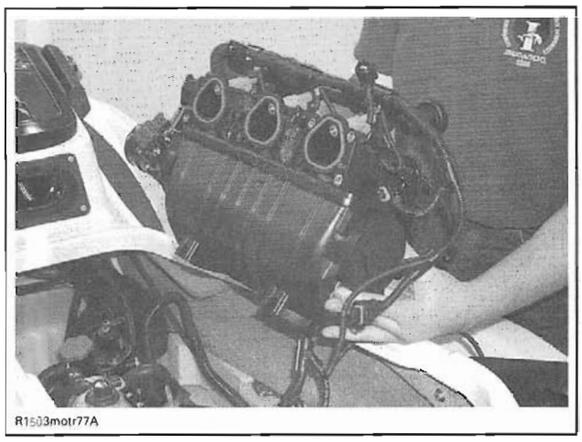
Detach throttle cable end from throttle body.



1. Detach cable end from throttle body

All Engines

Pull intake manifold out.

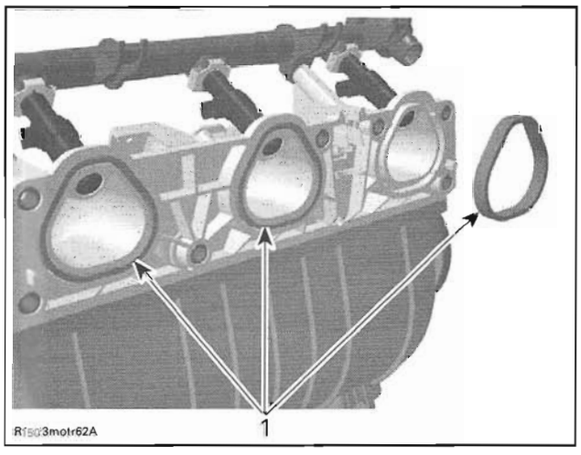


TYPICAL

NOTE: The flame arrester and the intercooler (if so equipped) in the intake manifold are maintenance free.

Intake Manifold Installation

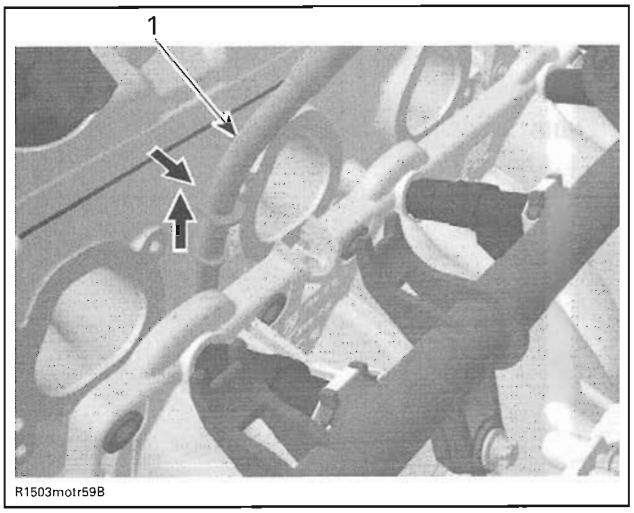
Ensure that all gaskets are properly installed and in a good condition.



INTAKE MANIFOLD
1. Gaskets

First, position intake manifold on front mounting bracket then push manifold toward engine to then proceed with rear mounting bracket.

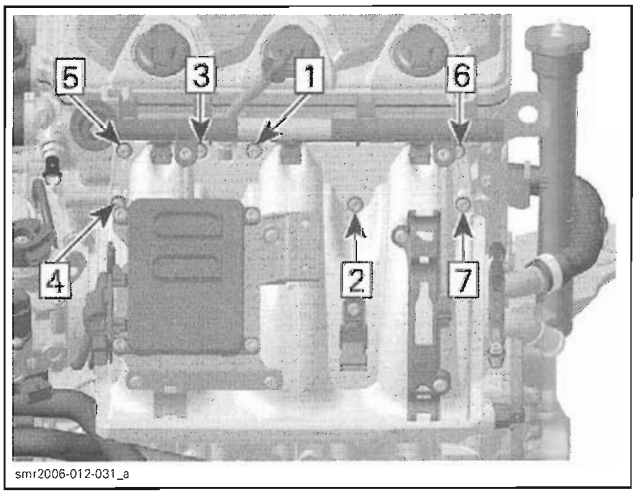
When installing the intake manifold, lift up the oil dipstick tube a little bit to fit in the slot of the manifold.



1. Oil dipstick tube

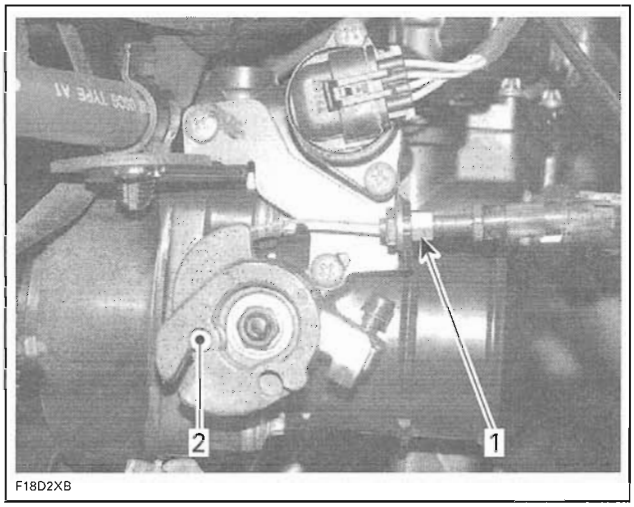
Apply Loctite 243 (blue) (P/N 293 800 060) on the intake manifold screws.

Torque them to 10 N•m (89 lbf•**in**) following the tightening sequence shown.

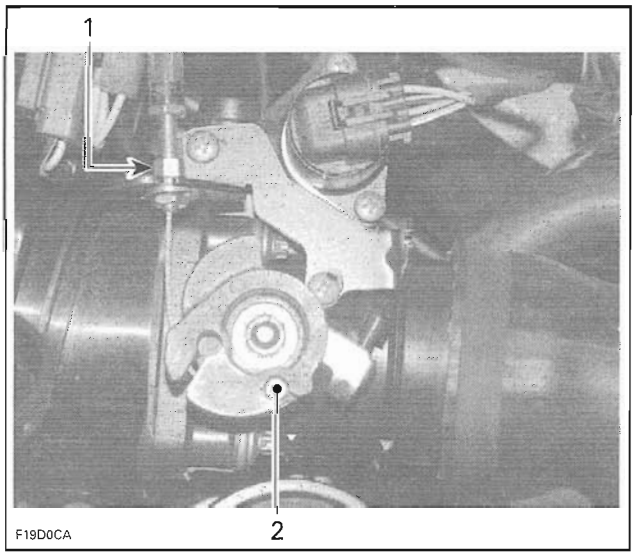


Ensure to properly route and resecure wiring harness with locking ties.

When installing throttle cable, ensure cable is in the proper position of bracket and that cable barrel is in the proper position of throttle cam.



130/155 ENGINE
1. Cable position in bracket
2. Cable barrel position in cam

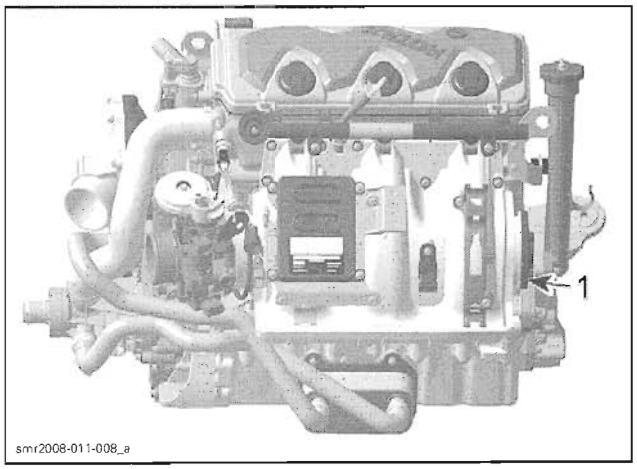


215/255 ENGINES
1. Cable position in bracket
2. Cable barrel position in cam

Readjust throttle cable and reset the TPS using the B.U.D.S. software. Refer to *ENGINE MANAGEMENT.*

255 Engines

The 255 engine is equipped with an external intercooler, therefor the intake manifold is equipped with a flame arrester.

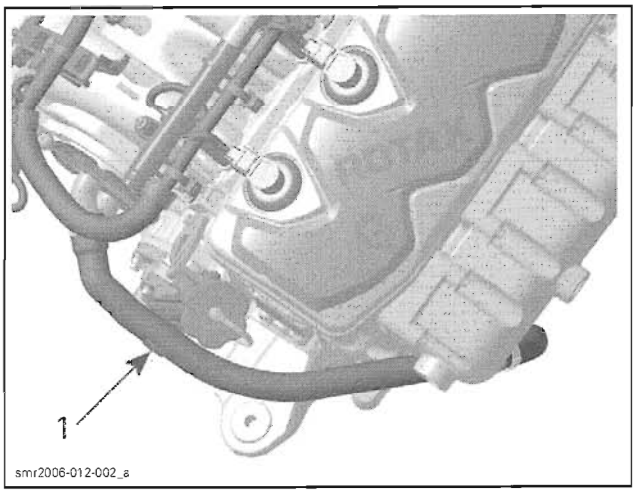


1. Flame arrester

NOTE: The flame arrester in the intake manifold is maintenance free.

215 Engines

Make sure the outlet hose of the intercooler is installed in the holding device otherwise the hose will scuff on the engine block.



1. Intercooler outlet hose holding device

INTERCOOLER

215 Engines

Intercooler Leak Test

Perform intercooler leak test when engine looses performance, when there is white exhaust smoke or when temperature in exhaust system is to high.

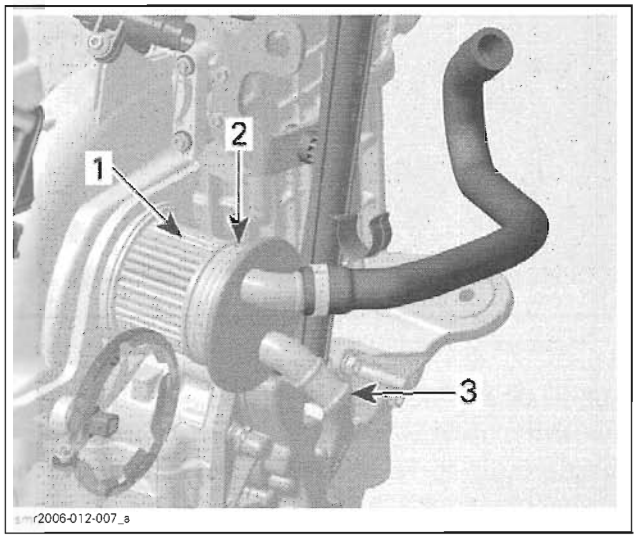
⚠ WARNING

Let engine cool down prior to perform leak test. Direct contact with hot engine may result in skin burn.

NOTE: The inspection can be done while intercooler remains installed in intake manifold.

Remove:

- Outlet hose from exhaust manifold
- Inlet hose from intercooler.



INTERCOOLER PULLED OUT FOR CLARITY PURPOSE ONLY
1. Intercooler
2. Outlet hose
3. Inlet nipple

Plug intercooler inlet nipple.

Install an adapter on the outlet hose to connect the vacuum/pressure pump (P/N 529 021 800).

Pressurize the intercooler as follows:

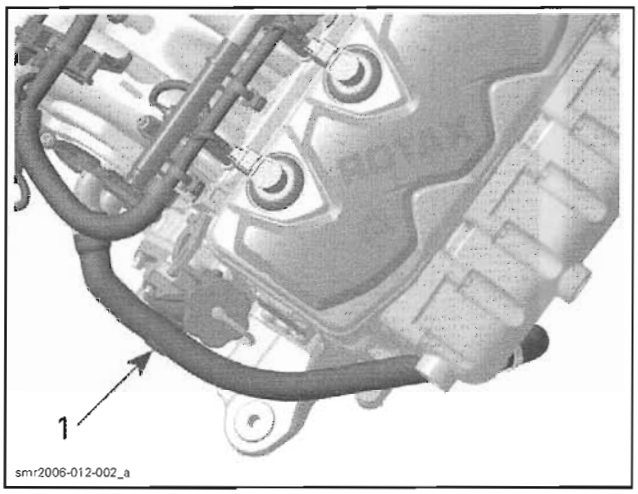
PRESSURE TEST
69 kPa (10 PSI) for 10 minutes min.

If there is a pressure drop, first spray hoses and adapters with a soapy solution to ensure they are not leaking.

Otherwise, remove intercooler from manifold to spray soapy water on it. If air bubbles are present, replace the intercooler. Refer to procedures farther in this section.

Properly reinstall removed parts.

Make sure the intercooler outlet hose is installed in the holding device otherwise the hose will scuff on the engine block.

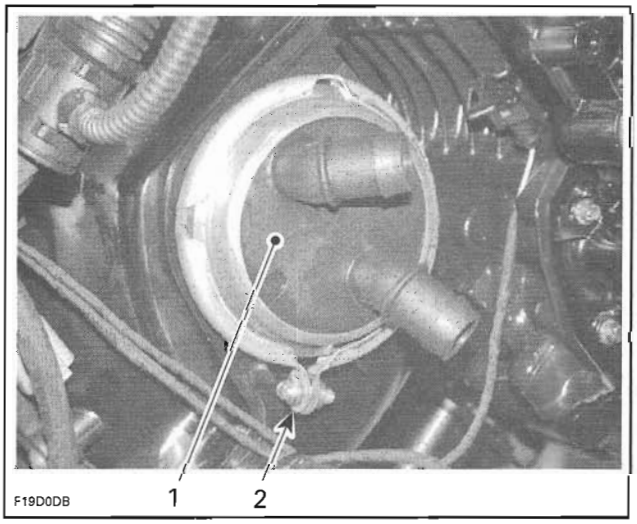


1. Intercooler outlet hose holding device

Intercooler Removal

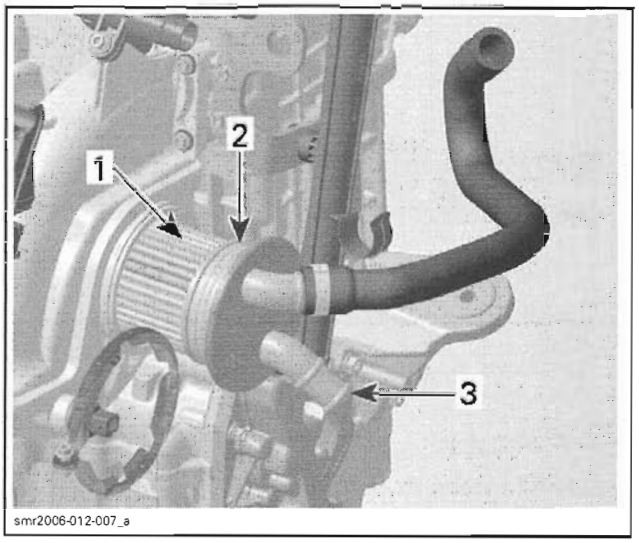
Remove intake manifold.

Remove collar from intercooler.



TYPICAL
1. Intercooler
2. Collar

Carefully pull intercooler out of intake manifold.



1. Intercooler
2. Profile ring
3. Collar

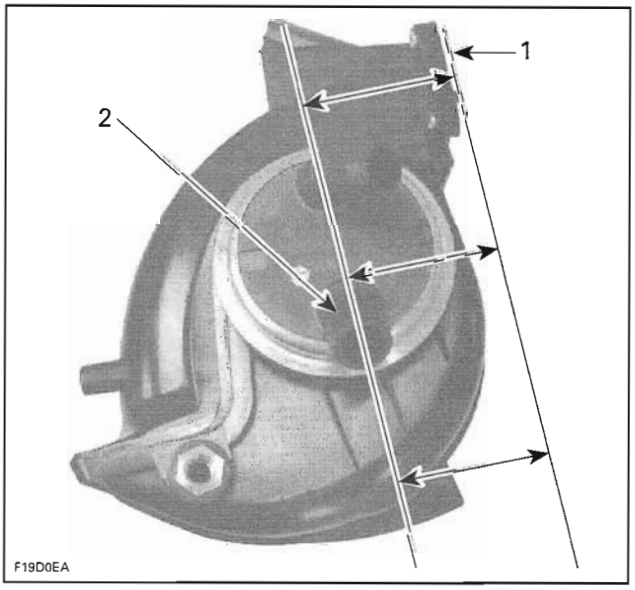
Intercooler Installation

Installation is essentially the reverse of removal procedures. However pay particular attention to the following.

Ensure profile rings are properly installed on intercooler and apply engine oil on them to ease installation.

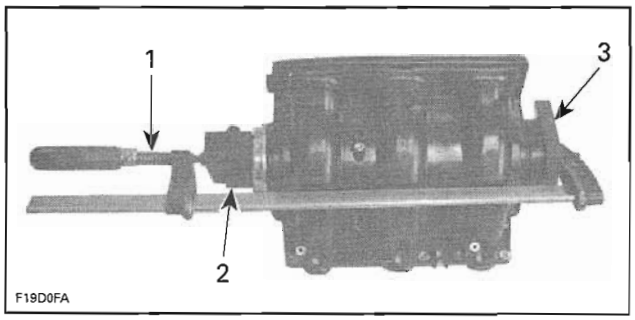
While properly aligning the inner end of intercooler in intake manifold, gently push intercooler until it bottoms.

Rotate intercooler to position nipples as shown.



1. Intake manifold flange
2. Nipple parallel with manifold flange

NOTE: If intercooler is hard to push in, a clamp can be used to press intercooler in.



1. *Clamp*
2. *Plastic block between nipples*
3. *Plastic block*

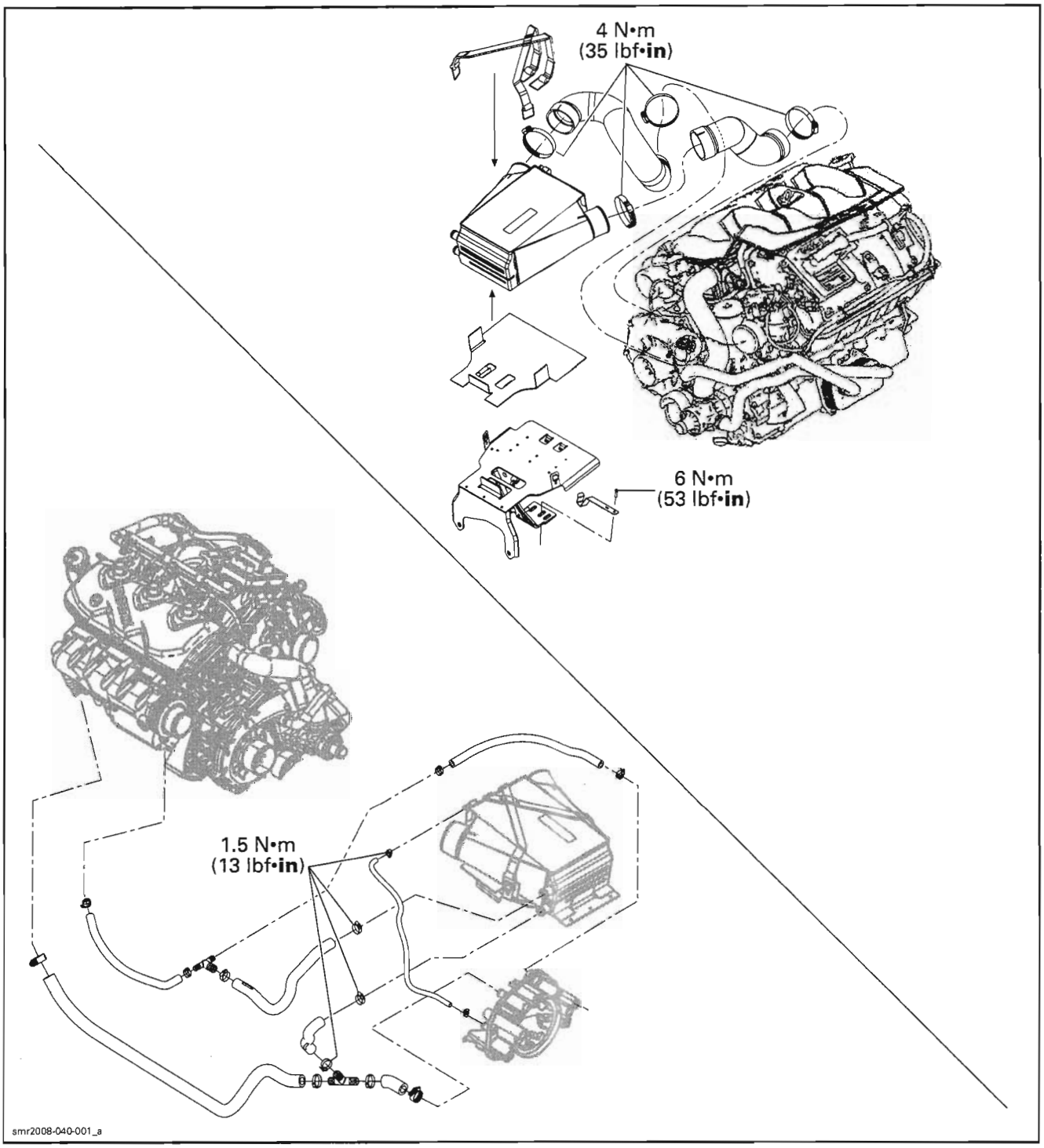
Reinstall collar.

Reinstall intake manifold.

INTERCOOLER (255 ENGINE)

SERVICE TOOLS

Description	Part Number	Page
large hose pincher	295 032 500	52
vacuum/pressure pump	529 021 800	52



GENERAL

Hoses or cables removed or disconnected must be installed and routed at the same place.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

CAUTION: Locking ties that had to be removed during a procedure, must be replaced and installed at the same place.

MAINTENANCE

Flushing the intercooler with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in intercooler.

NOTE: Intercooler is flushed with the exhaust system, as they are on the same circuit.

Exhaust system and intercooler should be flushed each time:

- Watercraft is used in salt water and is not expected to be used further the same day.
- Watercraft is used in foul water.
- Watercraft is stored for any extended time.

Refer to *EXHAUST SYSTEM* section for flushing procedure.

CAUTION: Failure to flush the system, when necessary, will severely damage engine intercooler and/or exhaust system.

PROCEDURES

INTERCOOLER

⚠ WARNING

Let engine cool down prior to work on or near intercooler.

Intercooler Cleaning

If temperature in intake manifold is too high or if engine is down in performance, intercooler may require to be cleaned.

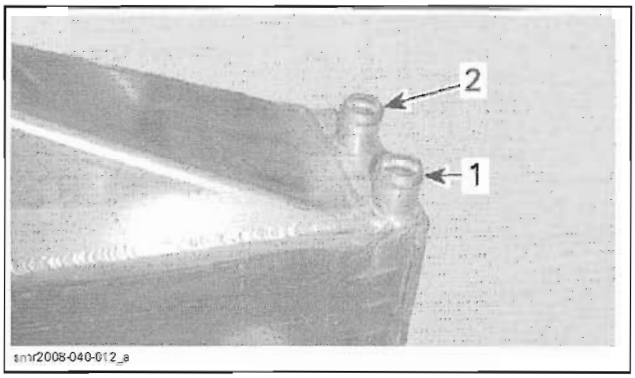
The exhaust system should be flushed first, as it may unclogged the intercooler. If not, then proceed with the intercooler cleaning procedure as detailed here.

NOTE: The exhaust temperature will decrease when the intercooler is clogged because more water is rerouted through the exhaust system.

To clean the intercooler, do the following:

CAUTION: Never try to clean the intercooler with chemical products. Only use fresh water. Chemical products will permanently damage the internal parts of intercooler.

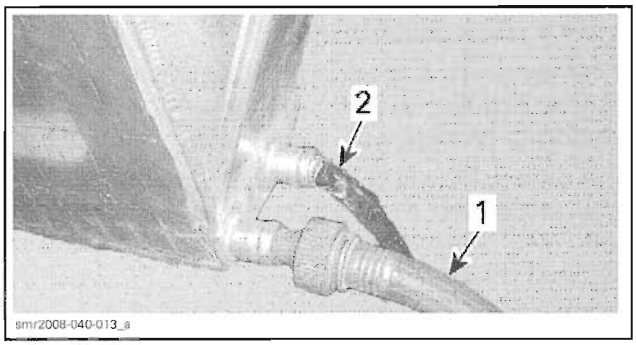
- Remove the *INTERCOOLER* from the watercraft. See procedure further in this section.
- Poor fresh water into the water outlet fitting.



1. Intercooler water outlet fitting
2. Intercooler water inlet fitting

- Let water into intercooler for many hours. Occasionally, shake the intercooler to soak off deposits.
- Rinse the intercooler using a garden hose installed on water outlet.
- Let water flows out of intercooler a few minutes to evacuate internal deposits.
- Check water flow.

WATER FLOW	
Low or erratic	1. Repeat cleaning procedure. 2. Replace the intercooler.
High and regular	Intercooler is not clogged.

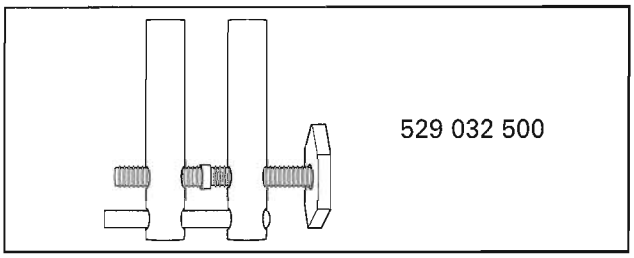


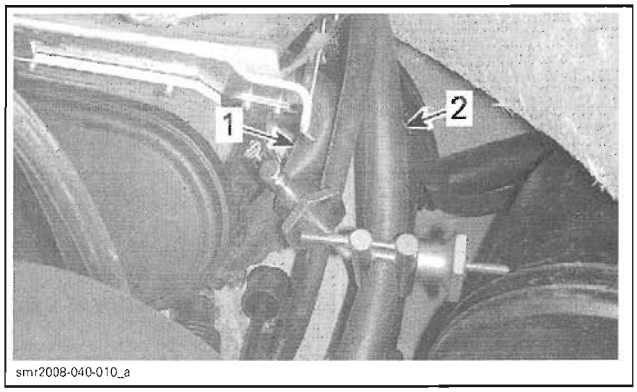
1. *Garden hose installed on water outlet*
2. *High and regular water flow*

- Perform a leak test before installing the intercooler in the watercraft.

Intercooler Leak Test

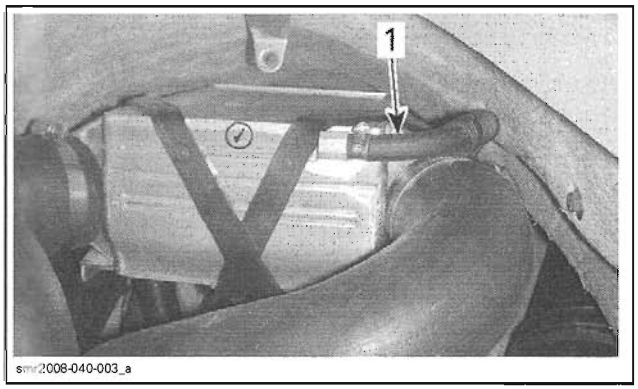
Using a large hose pincher (P/N 295 032 500), block intercooler water inlet and outlet hoses.





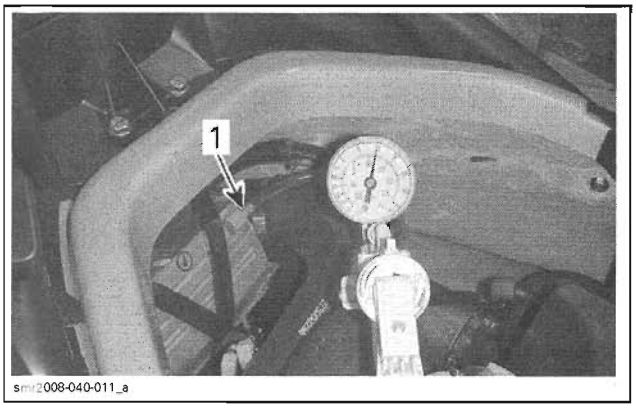
1. *Intercooler water inlet hose*
2. *Intercooler water outlet hose*

Disconnect the bleed hose from intercooler.



1. *Bleed hose*

Install the vacuum/pressure pump (P/N 529 021 800) on bleed hose fitting.



1. *Bleed hose fitting*

Pressurize the intercooler.

PRESSURE TEST
69 kPa (10 PSI) for 10 minutes min.

If there is a pressure drop, first spray tool, hoses and adapters with a soapy water solution to ensure they are not leaking.

Otherwise, replace the intercooler.

Intercooler Removal

Refer to *BODY* section to remove the following parts:

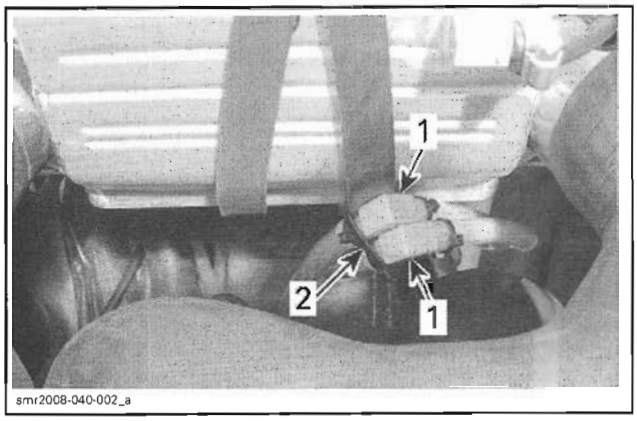
RXP 255 Model
- Seat
- Engine cover.

RXT 255 Model
- Seats
- Seat support
- Air vent tube.

All Models

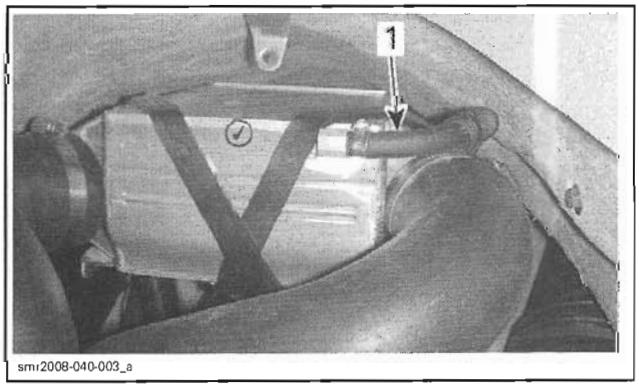
Remove exhaust hose.

Cut locking tie securing bailer hoses to intercooler strap.



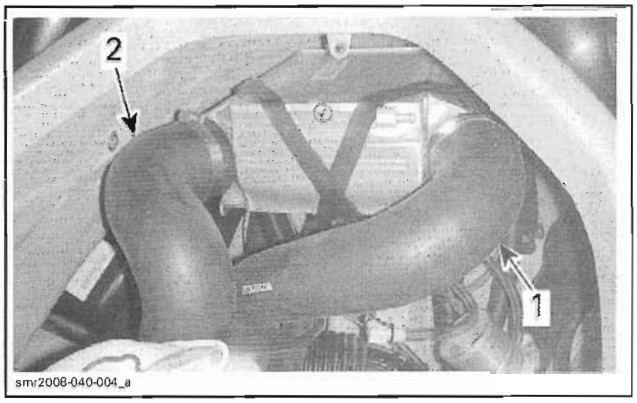
1. *Bailer hoses*
2. *Locking tie*

Disconnect the bleed hose from intercooler.



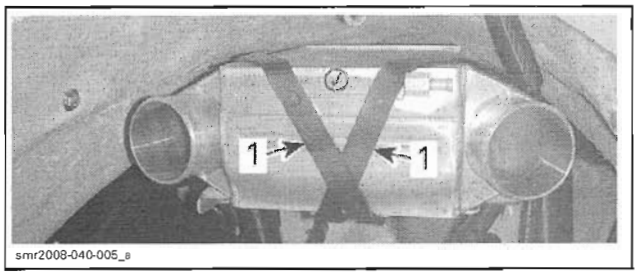
1. *Bleed hose*

Disconnect or remove both air hoses.



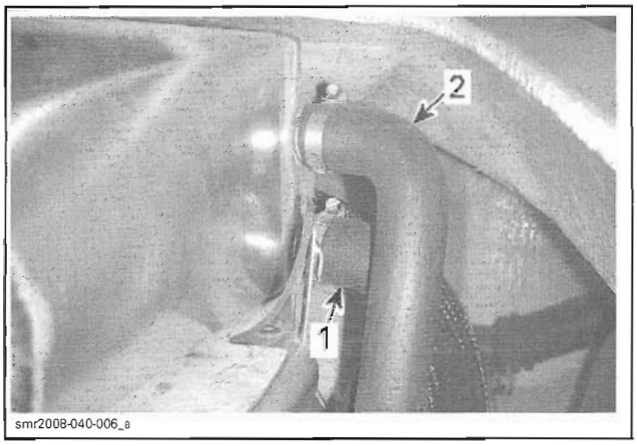
1. *Intercooler air inlet hose*
2. *Intercooler air outlet hose*

Detach both intercooler straps.



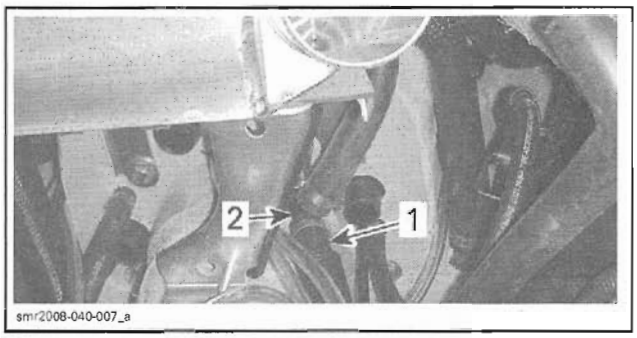
1. *Intercooler straps*

Disconnect water hoses from the rear left side of intercooler.



RXP 255 SHOWN
1. *Intercooler water inlet hose*
2. *Intercooler water outlet hose*

On **RXT 255 models**, disconnect the intercooler water inlet hose from the T-fitting.



VTS REMOVED FOR CLARITY
1. *Engine water supply hose*
2. *T-fitting*

Remove the intercooler from vehicle.

Intercooler Installation

The installation is the reverse of the removal procedure.

NOTE: Ensure hoses are routed correctly and locking ties are positioned at proper locations.

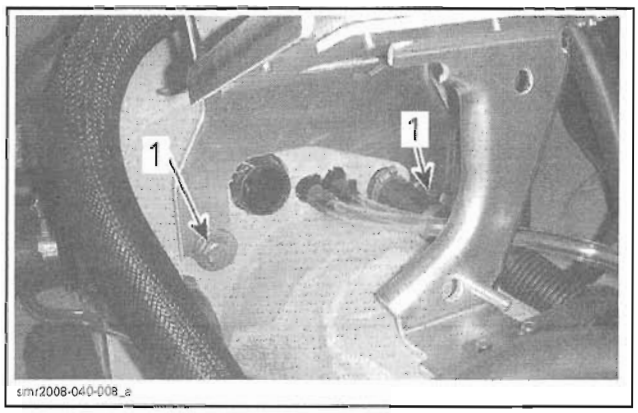
INTERCOOLER SUPPORT

Intercooler Support Removal

Remove *INTERCOOLER*, see procedure in this section.

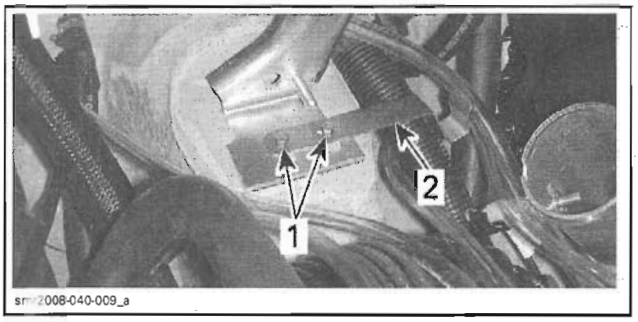
Remove the VTS. Refer to *VARIABLE TRIM SYSTEM (VTS)* section.

Remove pump support upper screws securing intercooler support.



1. *Screws securing intercooler support*

Remove screws retaining hose bracket and intercooler support.



1. *Hose bracket screws*
2. *Hose bracket*

Remove intercooler support from bilge.

Intercooler Support Installation

To install the intercooler support, reverse the removal procedure.

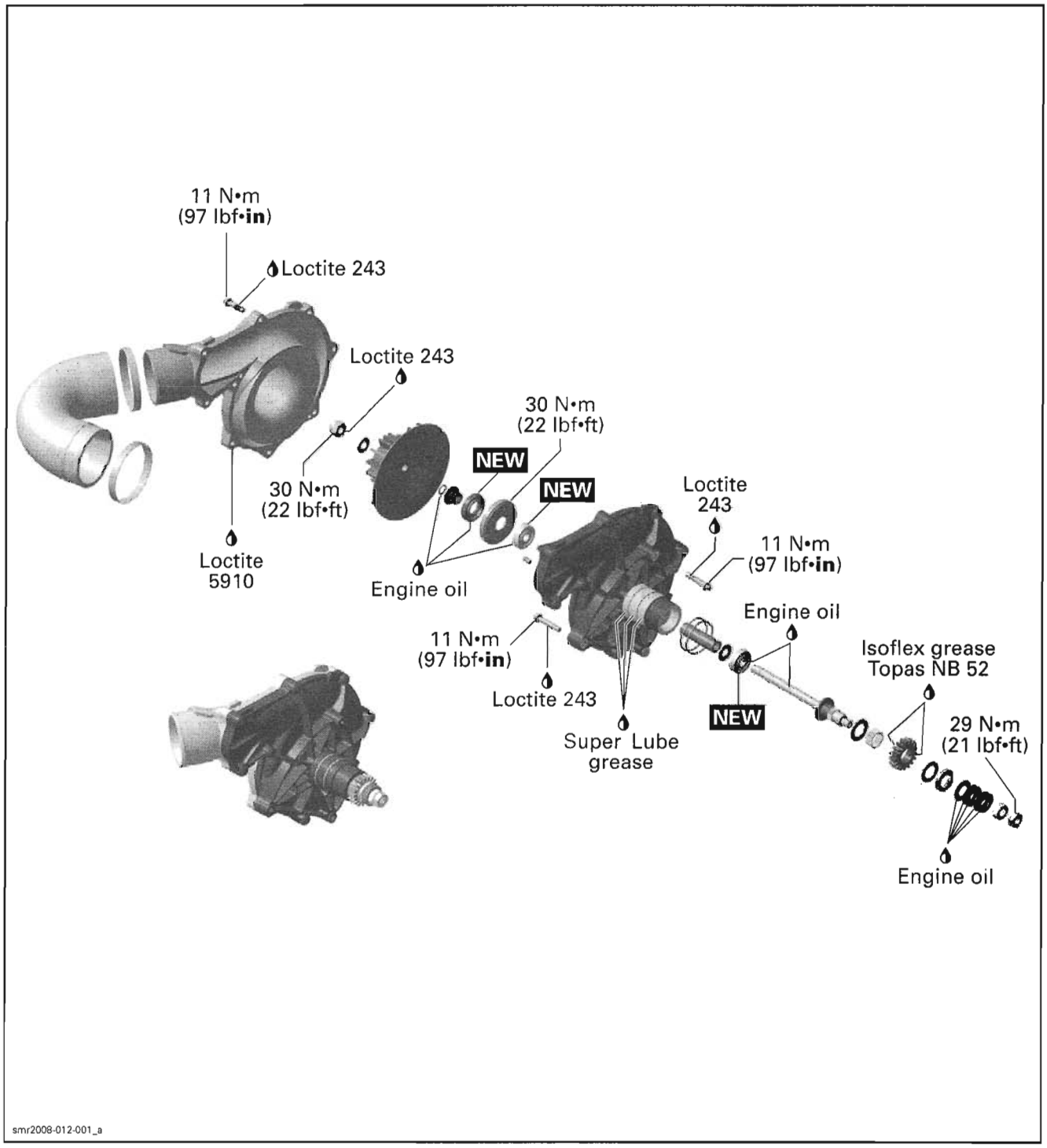
SUPERCHARGER

SERVICE TOOLS

Description	Part Number	Page
camshaft locking tool	529 035 839	59
Torx adapter	529 035 938	61, 69
support plate	529 035 947	59, 65–66
4-pin socket	529 035 948	64, 66
bearing support/pusher	529 035 950	65–66
gear holder	529 036 025	59
retaining key	529 036 027	62–63, 68

SERVICE PRODUCTS

Description	Part Number	Page
Isoflex grease Topas NB 52	293 550 021	67
Super Lube grease	293 550 030	69
Loctite 243 (blue)	293 800 060	66–69
Loctite 5910	293 800 081	68



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

INSPECTION

SUPERCHARGER INLET CLEANLINESS

NOTE: A lower than usual maximum RPM at full throttle might be caused by a dirty supercharger inlet.

All RXP Supercharged Models

Remove the engine cover. Refer to *BODY* section.

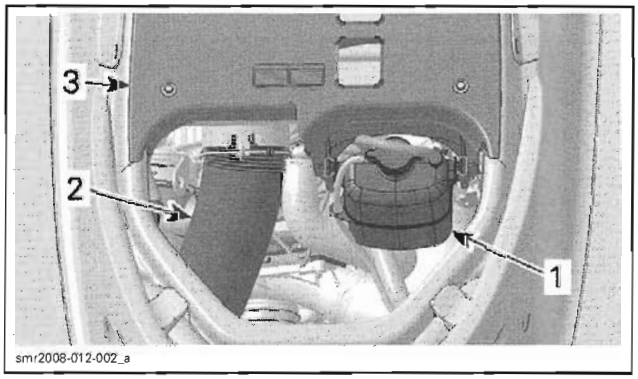
Move the coolant tank aside.

All Supercharged Models (except RXP)

Detach the vent tube.

Move the coolant tank aside.

Remove the vent tube support.

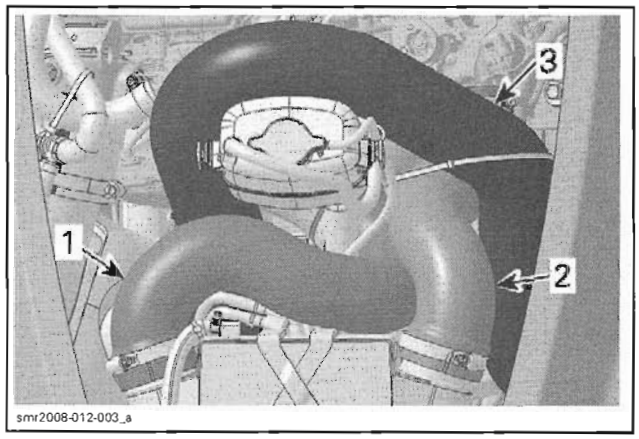


1. *Coolant tank*
2. *Vent tube*
3. *Vent tube support*

All RXP Supercharged Models

Disconnect intercooler air hoses.

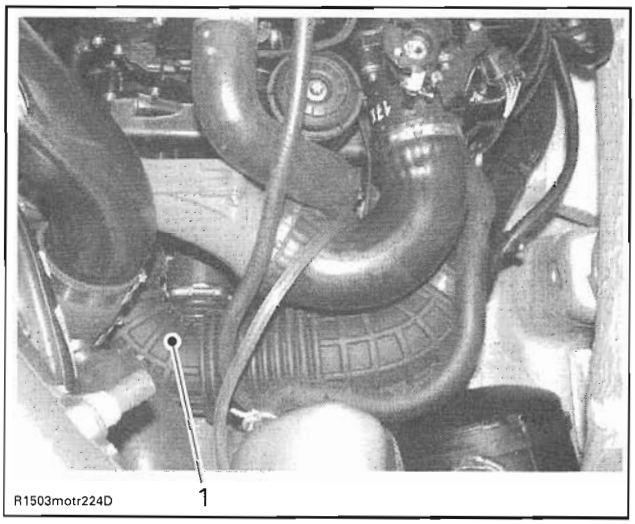
Remove the exhaust inlet hose.



1. *Intercooler air inlet hose*
2. *Intercooler air outlet hose*
3. *Exhaust inlet hose*

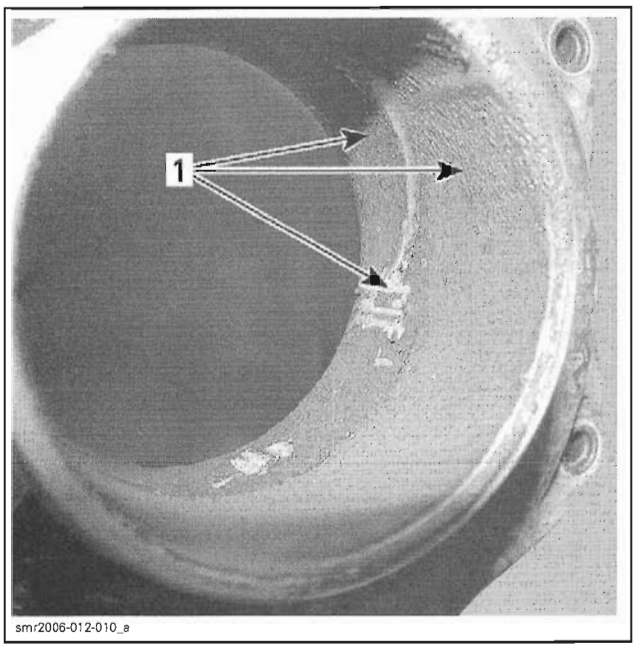
All Supercharged Models

Remove supercharger air inlet hose.



TYPICAL
1. *Air inlet hose*

Visually inspect supercharger inlet side for oil, salt or any other deposits.



1. Dirt here

If dirt is found, proceed as follows.

Remove supercharger and perform the clutch slipping moment test. Inspect bearings and friction clutch. Replace bearings/clutch components as necessary.

Separate supercharger housing.

NOTE: Since supercharger is disassembled, it is recommended to completely inspect it.

Clean internal housing and turbine using a brush and cleaning solvent to get rid of oil deposits.

Blow dry with compressed air.

CAUTION: Do not let turbine spin when using compressed air.

Complete usual assembly procedures as described in this section.

SUPERCHARGER CLUTCH SLIPPING MOMENT (ON ENGINE)

All RXP Supercharged Models

Remove the engine cover. Refer to *BODY* section.

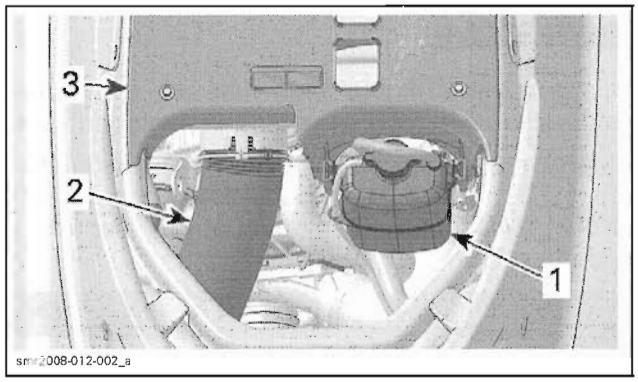
Move the coolant tank aside.

All Supercharged Models (except RXP)

Detach the vent tube.

Move the coolant tank aside.

Remove the vent tube support.

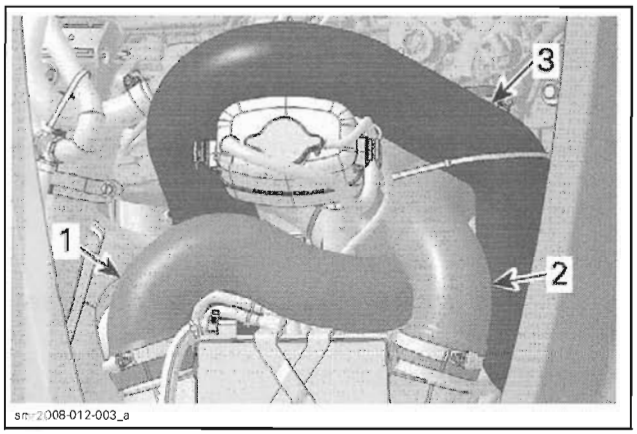


1. Coolant tank
2. Vent tube
3. Vent tube support

All RXP Supercharged Models

Disconnect intercooler air hoses.

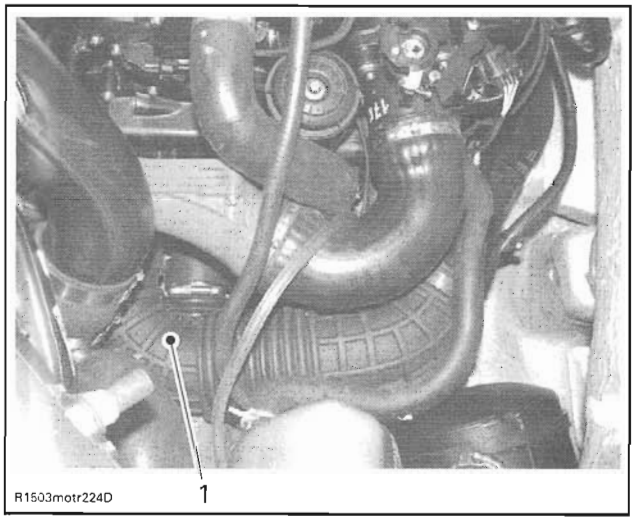
Remove the exhaust inlet hose.



1. Intercooler air inlet hose
2. Intercooler air outlet hose
3. Exhaust inlet hose

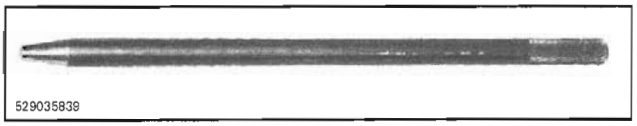
All Supercharged Models

Remove air inlet hose from supercharger.

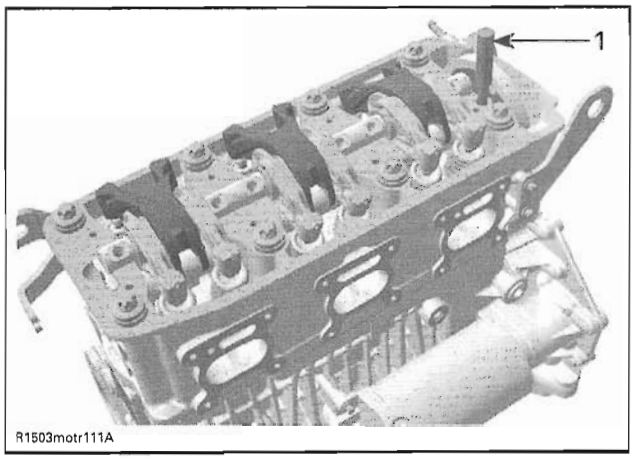


1. Inlet hose

Remove valve cover and install camshaft locking tool (P/N 529 035 839) to prevent camshaft rotation while checking slipping moment of supercharger. Refer to *CYLINDER HEAD* section.

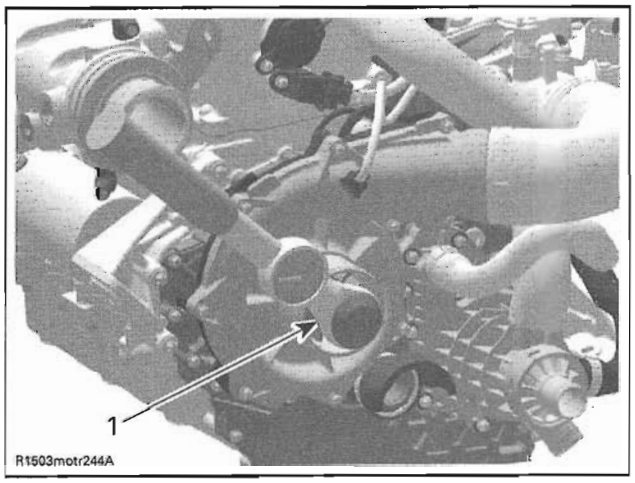


NOTE: Rotate supercharger nut counterclockwise to align camshaft holes and to allow insertion of the locking tool.



1. Camshaft locking tool

Check slipping moment counterclockwise by using a torque wrench with actual torque viewer. A mirror is useful to see the viewer.



TYPICAL
1. Torque wrench

NOTE: Before checking the supercharger slipping moment it is recommended to turn the clutch a minimum of 10 revolutions. This will dissipate the grease on the titanium shims and gear enough to get a proper reading.

Supercharger should start to turn at a torque within the specified values.

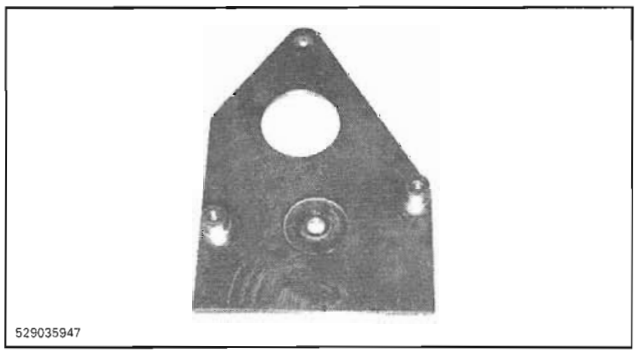
SLIPPING MOMENT	NEW SUPERCHARGER	BREAK-IN SUPERCHARGER
Torque value applied	10 to 17 N•m (89 to 150 lbf•in)	8 to 11 N•m (71 to 97 lbf•in)

NOTE: After supercharger ran for a few hours, the parts break-in and this brings a reduced slipping moment.

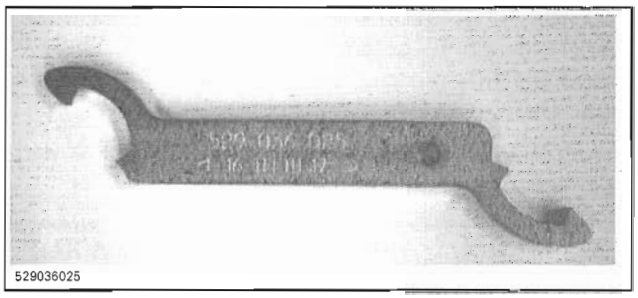
If the torque is not within specifications, repair supercharger clutch. Verify supercharger clutch components as per *SUPERCHARGER INSPECTION)* further in this section.

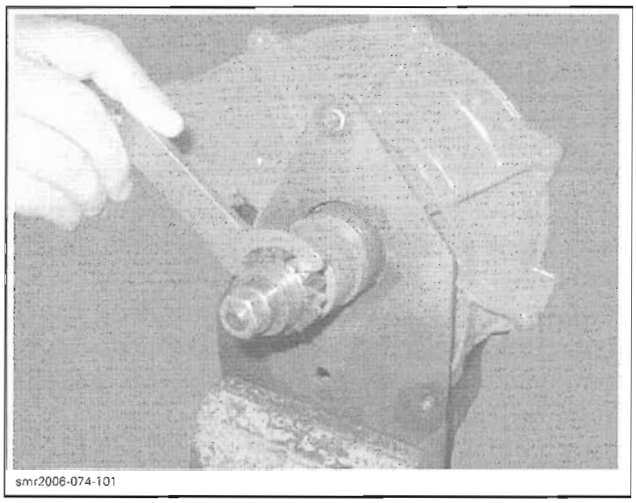
SUPERCHARGER CLUTCH SLIPPING MOMENT (BENCH TEST)

Mount supercharger on the support plate (P/N 529 035 947).

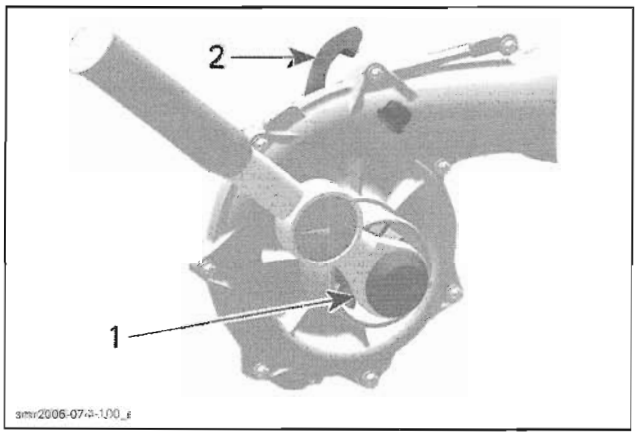


Use the gear holder (P/N 529 036 025) to retain supercharger gear while measuring slipping moment.




smr2006-074-101

Check slipping moment counterclockwise by using a torque wrench with a viewer.



1. *Torque wrench*
2. *Gear holder*

NOTE: Before checking the supercharger slipping moment it is recommended to turn the clutch a minimum of 10 complete revolutions. This will dissipate the grease on the titanium shims and gear enough to get a proper reading.

Supercharger should start to turn at a torque within the specified values.

SLIPPING MOMENT	NEW SUPERCHARGER	BREAK-IN SUPERCHARGER
Torque value applied	10 to 17 N•m (89 to 150 lbf•**in**)	8 to 11 N•m (71 to 97 lbf•**in**)

NOTE: After supercharger ran for a few hours, the parts break-in and this brings a reduced slipping moment.

If the torque is not within specifications, check single components of supercharger clutch.

PROCEDURES

SUPERCHARGER

Supercharger Removal

All RXP Supercharged Models

Remove the engine cover. Refer to *BODY* section.

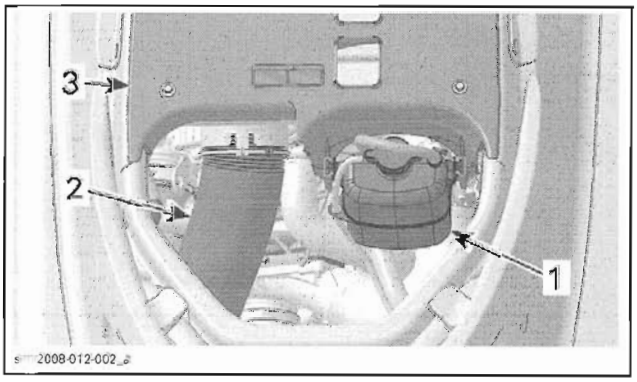
Move the coolant tank aside.

All Supercharged Models (except RXP)

Detach the vent tube.

Move the coolant tank aside.

Remove the vent tube support.



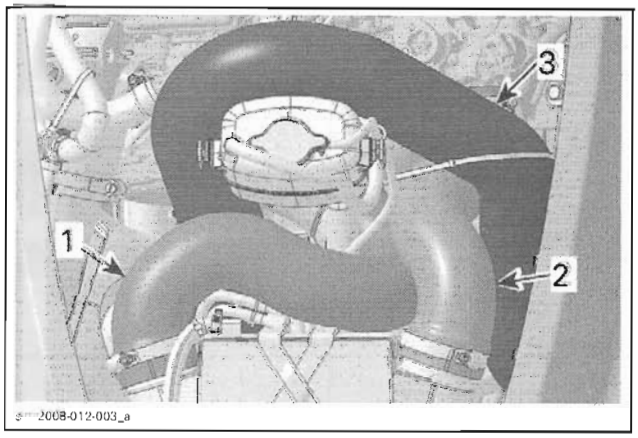
2008-012-002_a

1. *Coolant tank*
2. *Vent tube*
3. *Vent tube support*

All RXP Supercharged Models

Disconnect intercooler air hoses.

Remove the muffler hose.

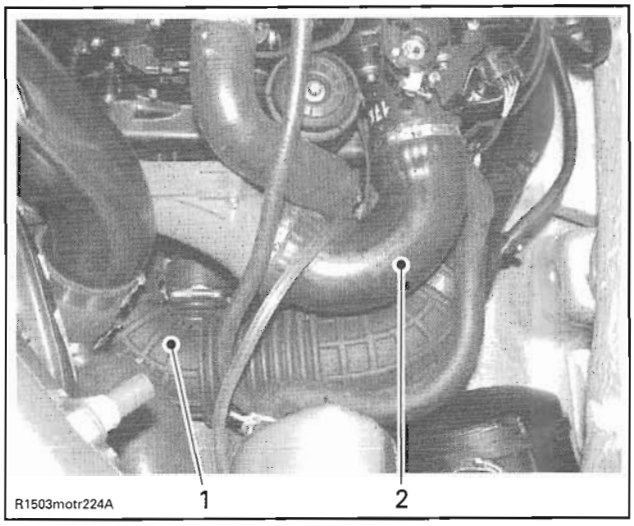


2008-012-003_a

1. *Intercooler air inlet hose*
2. *Intercooler air outlet hose*
3. *Muffler hose*

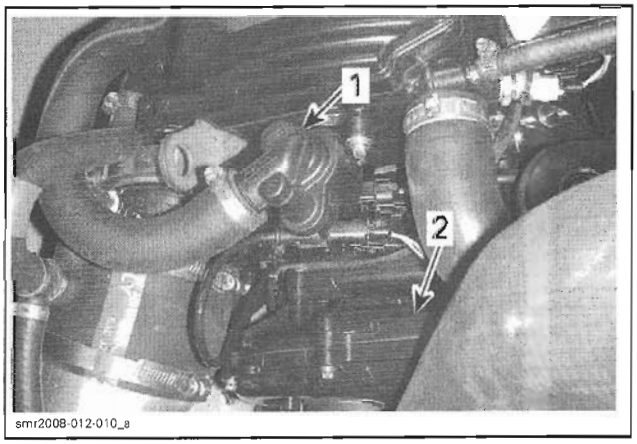
All Supercharged Models

Remove air inlet and outlet hoses from supercharger.



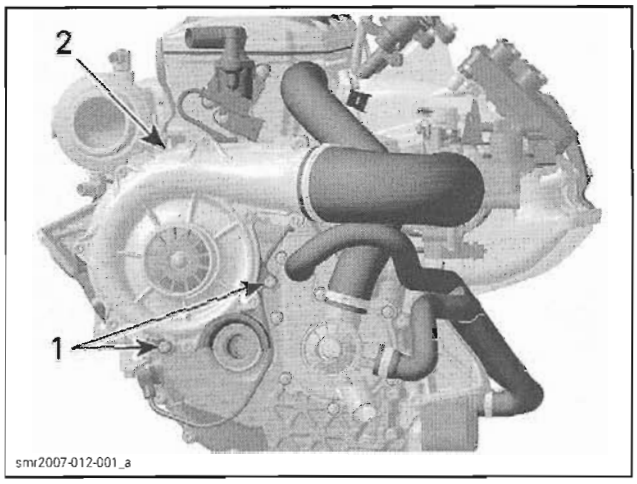
1. *Air inlet hose*
2. *Air outlet hose*

Unscrew TOPS valve screws and move it aside to make room.



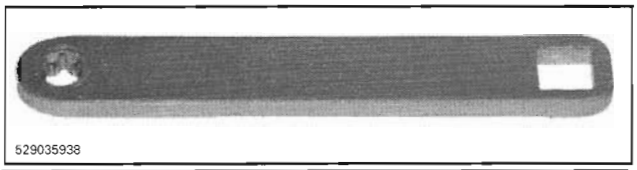
1. *TOPS valve*
2. *Supercharger*

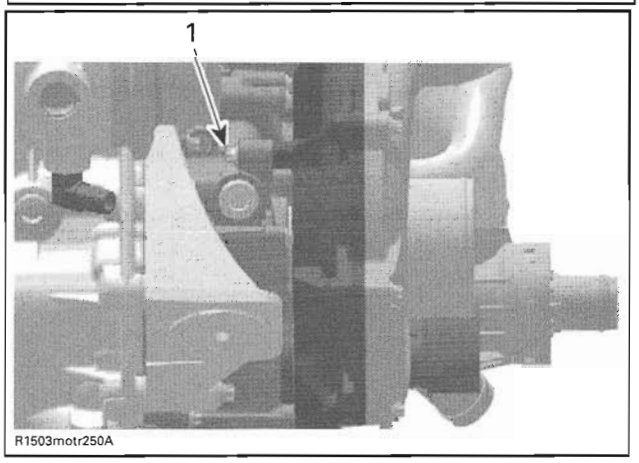
Remove retaining screws and pull out the supercharger.



1. *Retaining screws*
2. *Upper retaining screw (hidden behind the supercharger)*

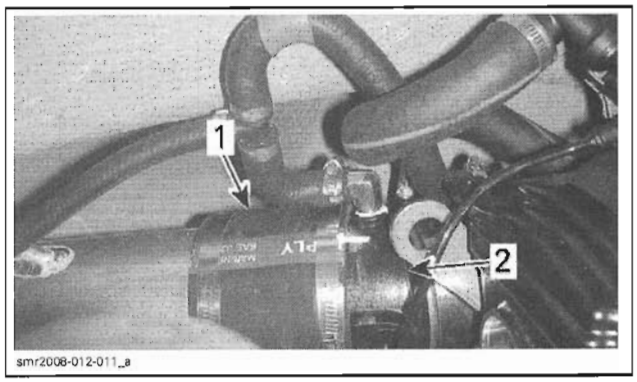
To remove the upper retaining screw, use the Torx adapter (P/N 529 035 938).





1. *Upper retaining screw*

Using a marker, trace a mark on rubber adaptor and exhaust pipe.



1. *Rubber adaptor*
2. *Exhaust pipe*

Loosen clamp securing rubber adaptor to exhaust pipe.

Detach muffler strap.

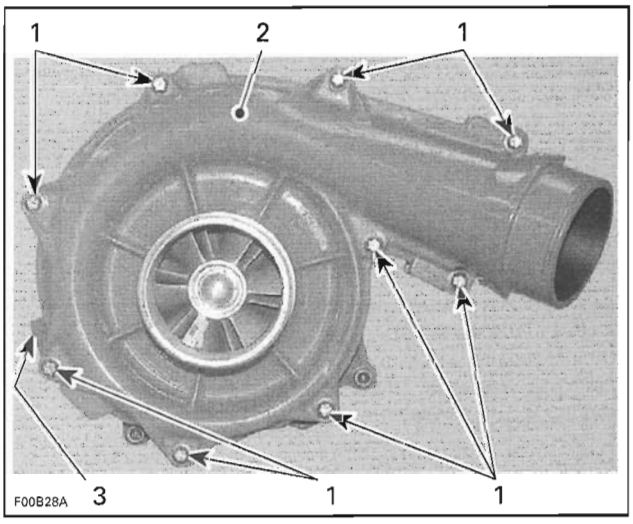
Move muffler back (± 5 cm (2 in)).

Pull supercharger out of engine to remove it.

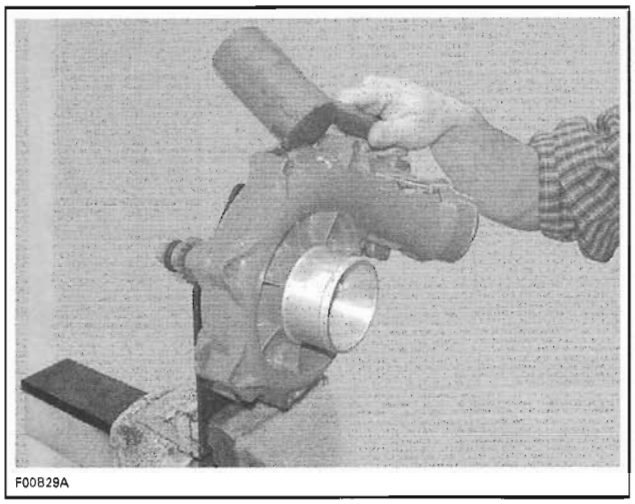
Supercharger Disassembly

CAUTION: Be scrupulous when working on supercharger parts. Supercharger rotation reaches 45 000 RPM. Any modification, improper repair/assembly or damage on the parts, may result in damage of the supercharger. Strictly follow the described procedures.

Take apart supercharger housing.

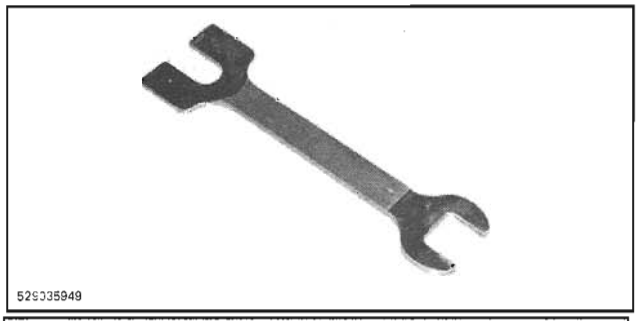


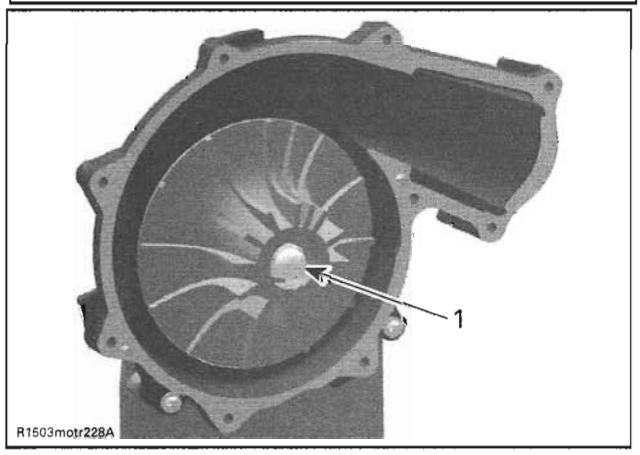
1. *Retaining screws*
2. *Housing half (intake side)*
3. *Housing half (engine side)*



PLASTIC HAMMER

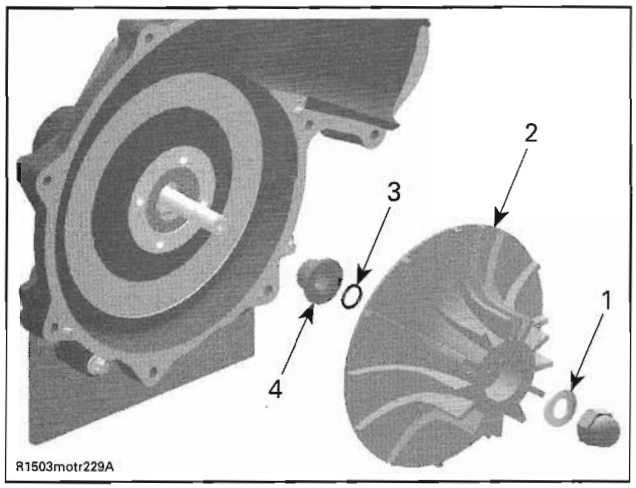
Loosen cap nut (turn **clockwise**) on supercharger shaft turbine side while holding shaft with the retaining key (P/N 529 036 027).





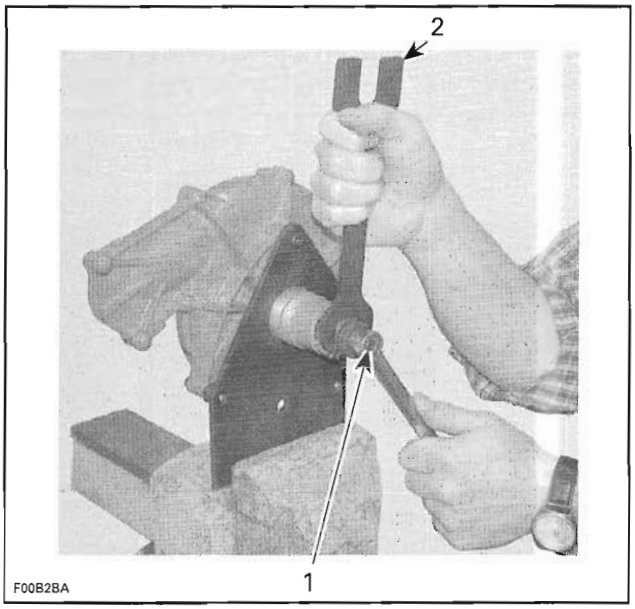
1. *Cap nut (left-handed thread)*

Remove washer, turbine, O-ring and step collar from supercharger shaft.



1. *Washer*
2. *Turbine*
3. *O-ring*
4. *Step collar*

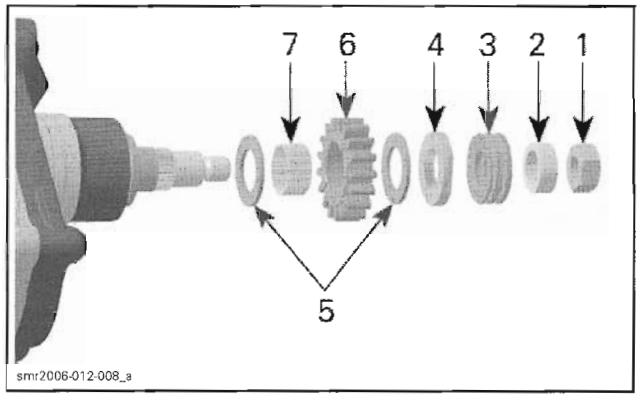
Loosen nut on supercharger shaft engine side while holding shaft with the retaining key (P/N 529 036 027).



1. *Nut*
2. *Retaining key*

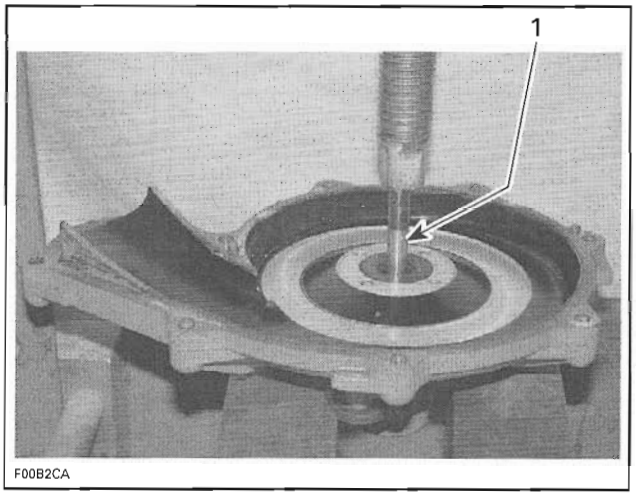
NOTE: There are 40 loose needle bearings under the gear. Do not reuse.

Remove L-ring, spring washers, lock washer, drive gear and needle pins by turning the supercharger upside down.



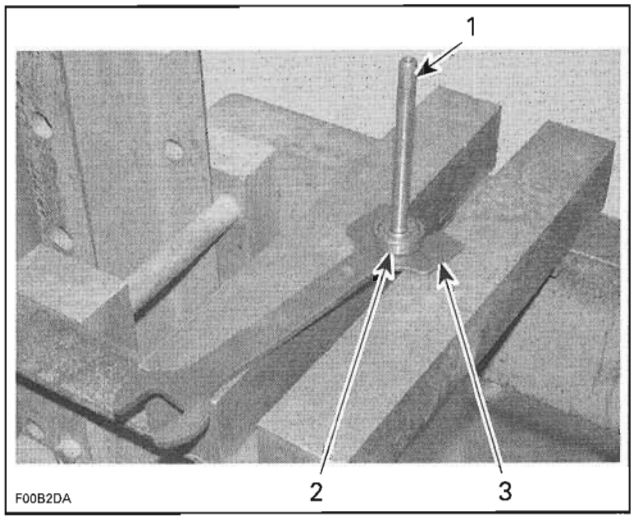
1. *Nut*
2. *L-ring*
3. *Spring washers*
4. *Lock washer*
5. *Titanium shims*
6. *Drive gear*
7. *Needle bearings*

Carefully push out supercharger shaft towards engine side by using a press.



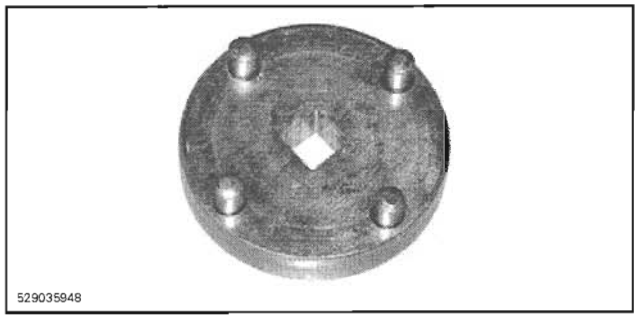
1. *Supercharger shaft*

Remove and discard ball bearing from supercharger shaft by using a press and the retaining key (P/N 529 036 027).

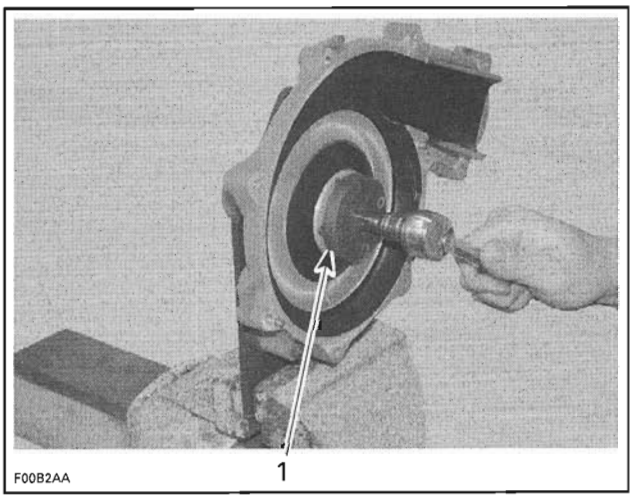


1. *Supercharger shaft*
2. *Ball bearing*
3. *Retaining key*

Screw out retaining disc with seal from housing half (engine side) by using the 4-pin socket (P/N 529 035 948).



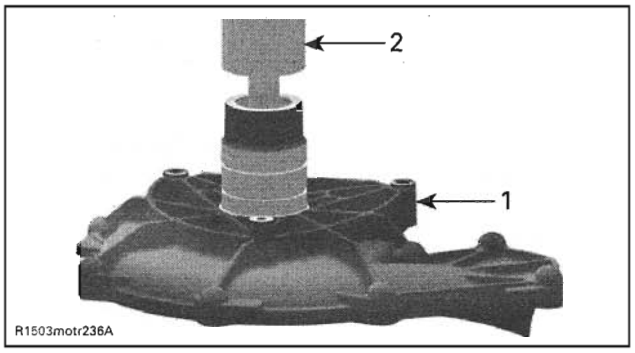
NOTE: It may be necessary to heat the housing with a heat gun to release the retaining disc.



1. *4-pin socket*

Discard the oil seal.

Remove and discard ball bearing from supercharger housing half (engine side) by using a press and a suitable bearing pusher.



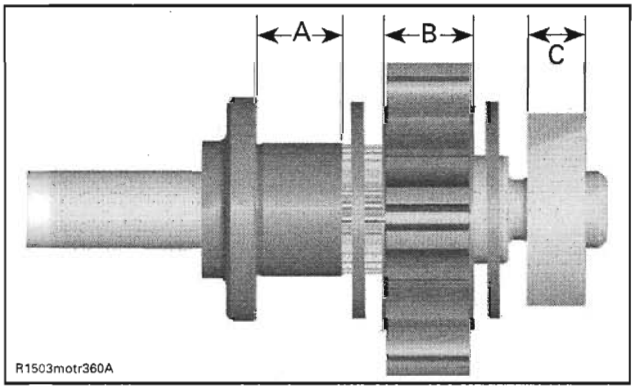
1. *Supercharger housing half (engine side)*
2. *Bearing pusher*

Supercharger Inspection

Supercharger Clutch Components and Gear

Check the wear limit on drive gear, lock washer and driven plate on supercharger shaft. Check drive gear for cracks.

NOTE: If parts are worn out or damaged, repair supercharger only by using supercharger repair kit.



A. *Driven plate journal depth*
B. *Drive gear thickness*
C. *Lock washer thickness*

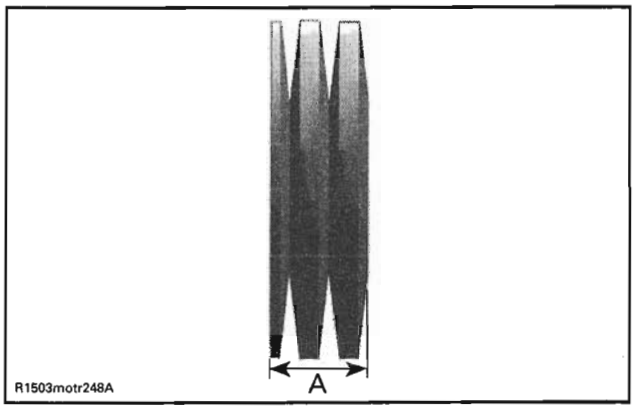
DRIVEN PLATE JOURNAL DEPTH	
NEW	14.460 to 14.500 mm (.5692 to .5708 in)
SERVICE LIMIT	14.600 mm (.5748 in)

DRIVE GEAR THICKNESS	
NEW	11.000 to 11.050 mm (.4331 to .4350 in)
SERVICE LIMIT	10.900 mm (.4291 in)

LOCK WASHER THICKNESS	
NEW	4.050 to 4.150 mm (.1594 to .1633 in)
SERVICE LIMIT	3.950 mm (.1555 in)

Spring Washer

Put spring washer package together as it is assembled on the supercharger shaft. Measure the height of the unloaded spring washer package.



A. Spring washer package height

SPRING WASHER PACKAGE HEIGHT	
NEW	10.7 to 10.9 mm (.4213 to .4291 in)
SERVICE LIMIT	10.2 mm (.4012 in)

Supercharger Assembly

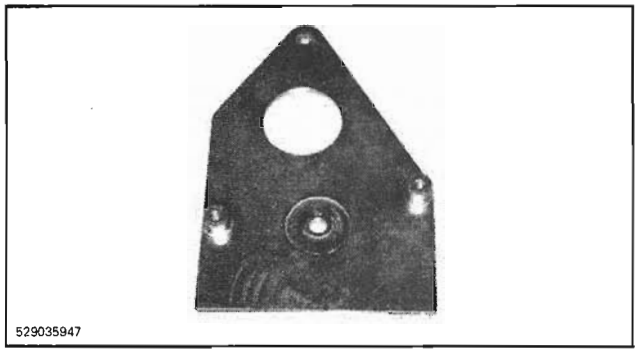
Assembly is essentially the reverse of removal procedures. However pay particular attention to the following.

CAUTION: Every time when supercharger shaft has been removed, both ball bearings have to be replaced.

CAUTION: Both ball bearings have to be installed with cages facing turbine side.

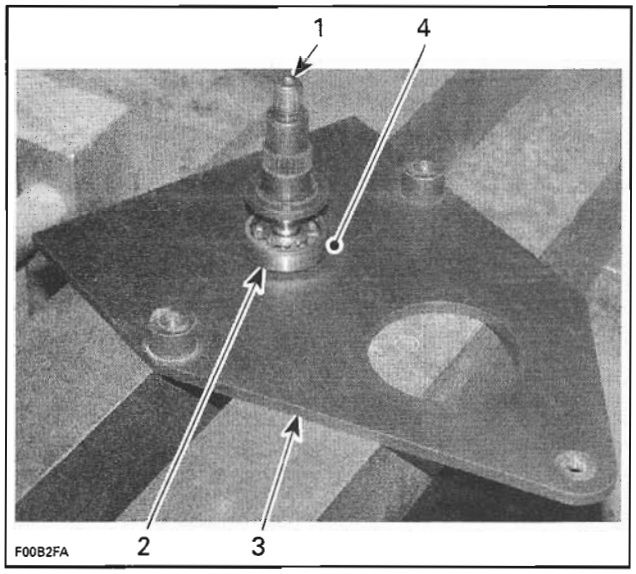
Apply enough engine oil on NEW ball bearing.

Install ball bearing on supercharger shaft by using the support plate (P/N 529 035 947) to hold bearing.



CAUTION: Ensure to position ball bearing against protrusion of support plate for the installation. This way, the installation pressure will be applied to the inner race and will not be transmitted to the bearing balls which would otherwise shorten the bearing life.

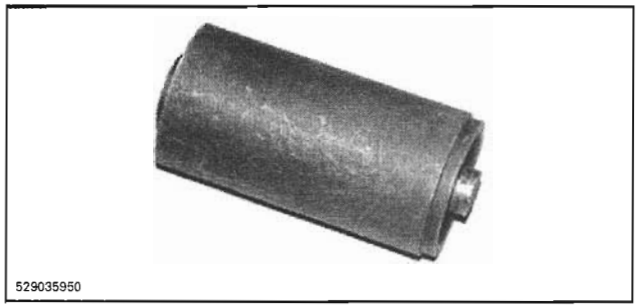
CAUTION: To install ball bearings and supercharger shaft always use a press, never use any beating force like a hammer.

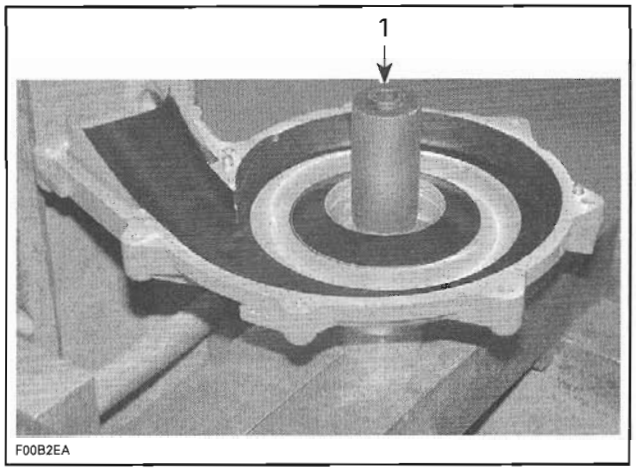


1. *Supercharger shaft*
2. *Ball bearing*
3. *Bearing support plate*
4. *Protrusion of support plate on this side (underneath inner race)*

Apply enough engine oil on NEW ball bearing.

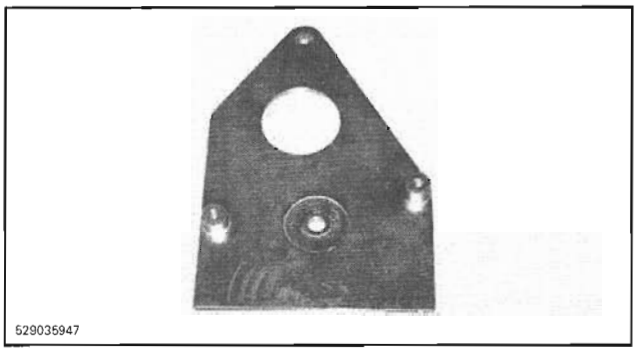
Press in the ball bearing in supercharger housing half (engine side), by using bearing support/pusher (P/N 529 035 950).





1. Bearing support/pusher

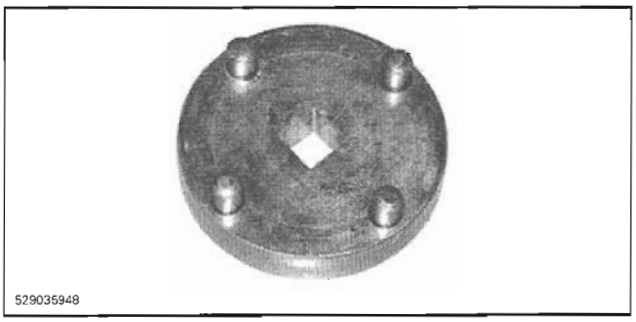
Mount supercharger housing half (engine side) on the support plate (P/N 529 035 947).

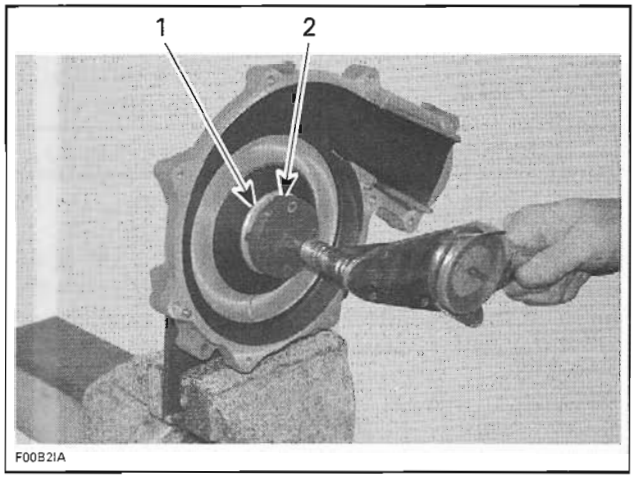


Apply Loctite 243 (blue) (P/N 293 800 060) on retaining disc. If a new retaining disc is used, the threads are coated with a self-locking product.

Install the retaining disc in supercharger housing half by using the 4-pin socket (P/N 529 035 948).

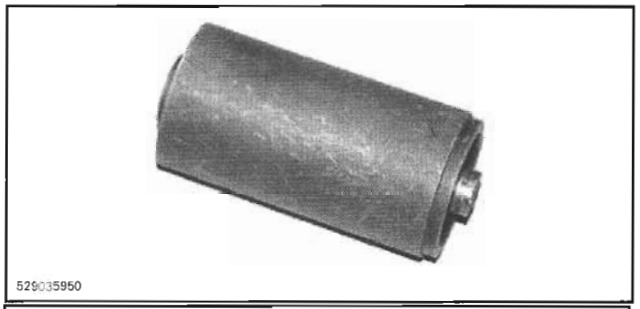
Torque retaining disc to 30 N•m (22 lbf•ft).

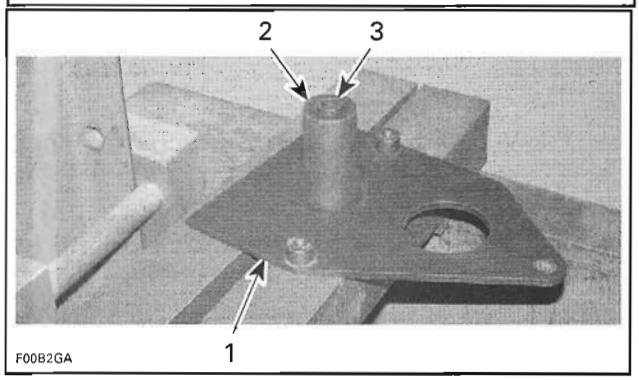




1. Retaining disc
2. 4-pin socket

To press supercharger shaft in housing half (engine side), properly support bearing using the support plate (P/N 529 035 947) and bearing support/pusher (P/N 529 035 950) under supercharger housing half.



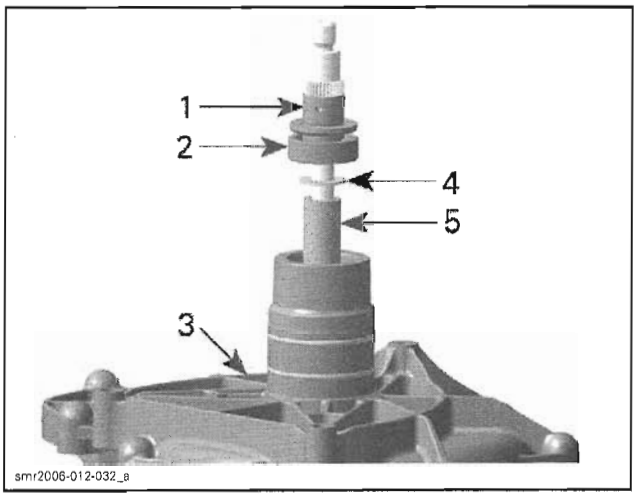


1. Support plate
2. Bearing support/pusher
3. Protrusion here

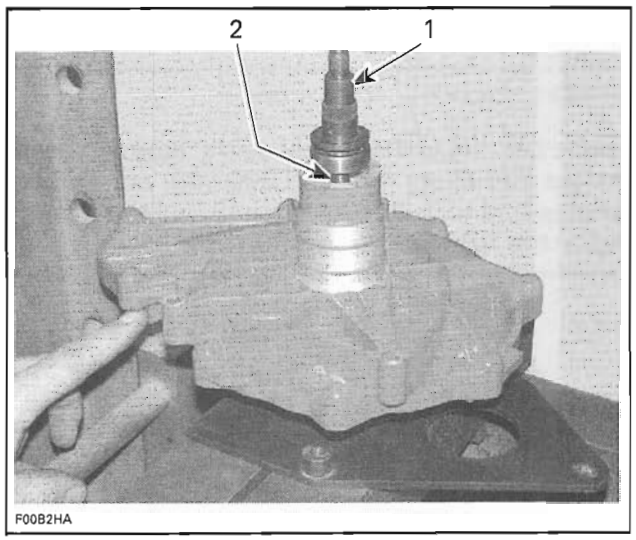
CAUTION: Before pressing in the supercharger shaft, be sure to properly support the inner race of ball bearing in supercharger housing half with the recommended tool. This way, the installation pressure will be applied to the inner race and will not be transmitted to the bearing balls which would otherwise shorten the bearing life.

Apply heat outside of the housing with a heat gun to expand its diameter prior to inserting the shaft. Ensure there is no O-ring on the housing half prior to heating.

Apply engine oil on supercharger shaft. Press shaft with thrust washer and distance sleeve together in supercharger housing half.



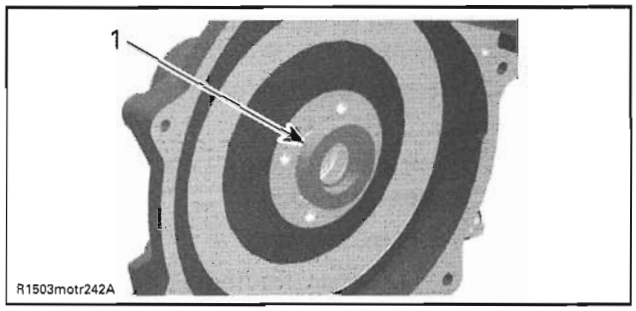
1. *Compressor shaft*
2. *Ball bearing*
3. *Supercharger housing half*
4. *Thrust washer*
5. *Distance sleeve*



1. *Supercharger shaft*
2. *Distance sleeve*

Apply engine oil on seal and push into retaining disc by hand.

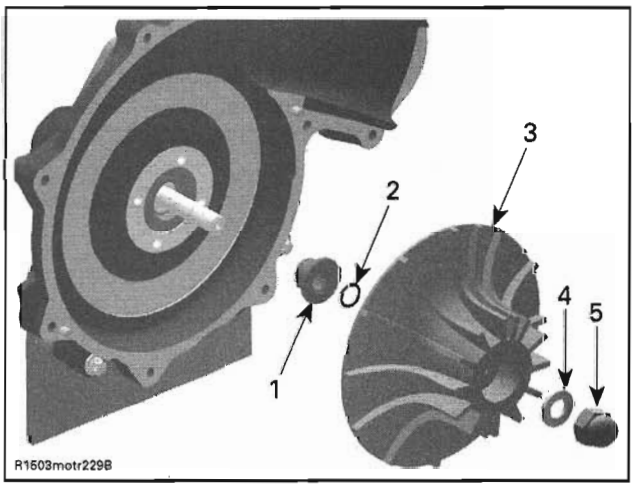
NOTE: Always use a NEW oil seal when assembling the supercharger.



1. *Oil seal*

Install step collar, O-ring, turbine and washer on supercharger shaft. Apply Loctite 243 (blue) (P/N 293 800 060) on cap nut and temporary finger tight cap nut.

NOTE: The cap nut on the supercharger shaft has a left-handed thread. The Loctite has to be applied in a small dose into the nut.



1. *Step collar*
2. *O-ring*
3. *Turbine*
4. *Washer*
5. *Cap nut*

Complete installation of supercharger shaft, engine side as follows:

CAUTION: It is of the utmost importance that all parts be absolutely clean. The compressor shaft spins at up to 45 000 RPM and any debris could cause a failure.

Install the first titanium shim.

NOTE: The titanium shims have the same inner diameter.

CAUTION: Manipulate titanium shims with care, those parts are sensitive.

IMPORTANT: Apply Isoflex grease Topas NB 52 (P/N 293 550 021) to the inner diameter of the gear thrust surface on the shaft, titanium shims, needle bearings, shaft surface and lock washer.

CAUTION: No other grease can be used, otherwise damage to bearings will occur.

Install the 40 needle bearings on the compressor shaft.

NOTE: The 40 needle bearings comes in a wax strip with an adhesive backing.

Remove the adhesive backing.

Install the drive gear over the needle bearings.

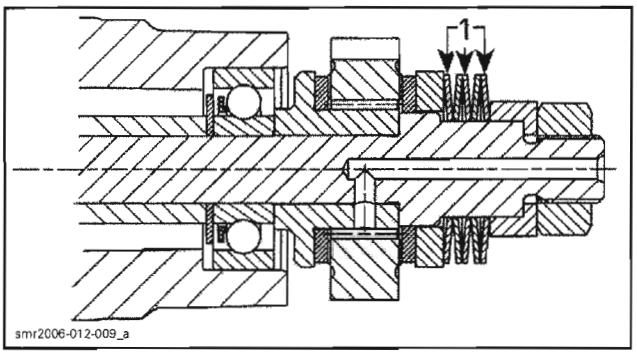
Install the second titanium shim.

Install the lock washer.

Apply engine oil to the spring washers.

Position the spring washers as per illustration.

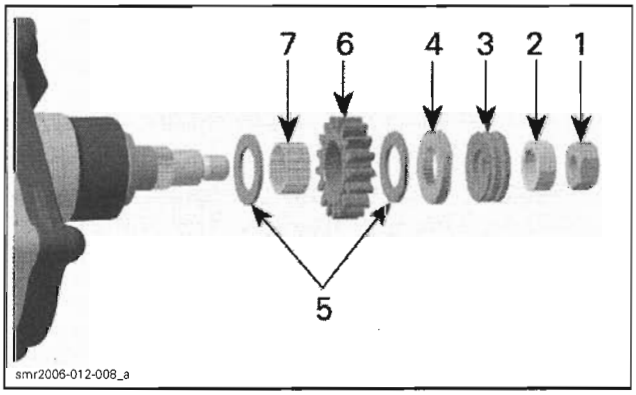
CAUTION: When installing the spring washers, take care of the exact installation direction of the washers.



1. Spring washers

Install the L-ring on the compressor shaft.

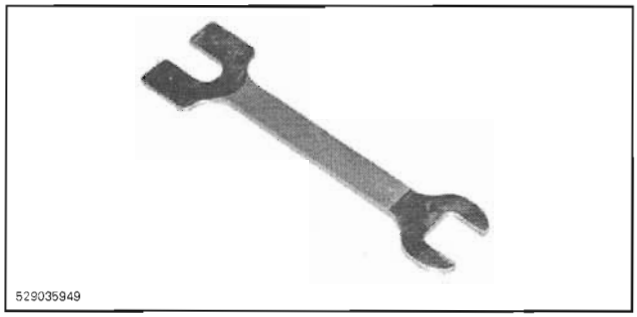
Apply Loctite 243 (blue) (P/N 293 800 060) on the hexagonal nut threads. Torque to 30 N•m (22 lbf•ft).



1. Nut
2. L-ring
3. Spring washers
4. Lock washer
5. Titanium shims
6. Drive gear
7. Needle bearings

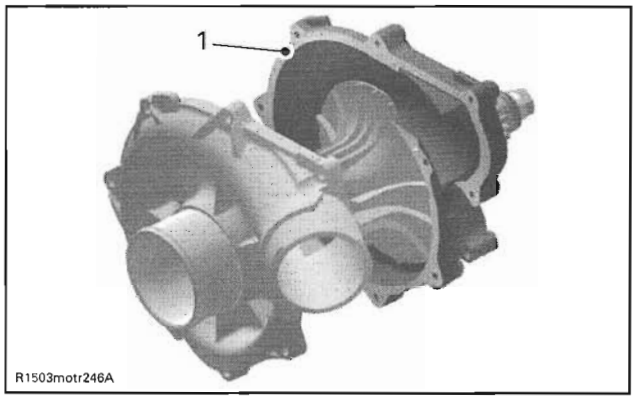
NOTE: The L-ring will preload the spring washers.

Hold the lock washer of the supercharger shaft (engine side) using the retaining key (P/N 529 036 027).



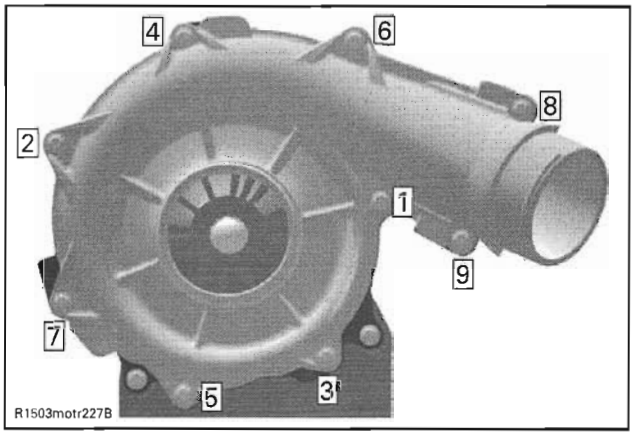
Tighten the cap nut to 30 N•m (22 lbf•ft).

Apply Loctite 5910 (P/N 293 800 081) on supercharger housing sealing surface.



1. Apply Loctite 5910 on sealing surface

Assemble supercharger housing halves. Apply Loctite 243 (blue) (P/N 293 800 060) on retaining screws and torque to 11 N•m (97 lbf•**in**) according to the following sequence.



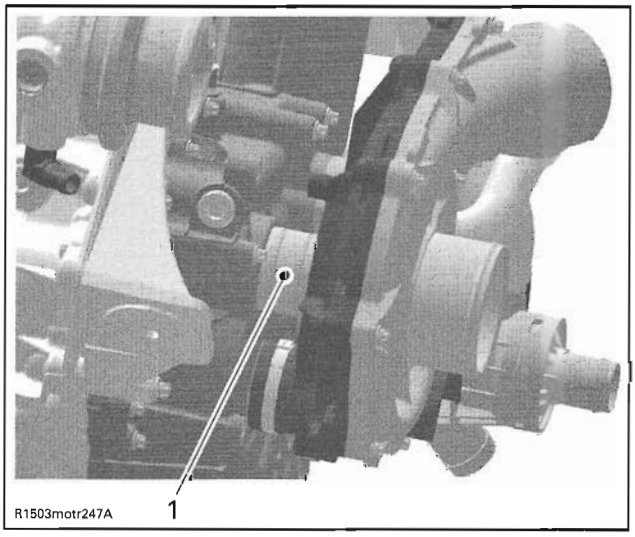
SUPERCHARGER TIGHTENING SEQUENCE

Perform the clutch slipping moment test. Refer to *SUPERCHARGER CLUTCH SLIPPING MOMENT (BENCH TEST)* in this section.

Supercharger Installation

Sealing surface between supercharger and PTO housing has to be greased with Super Lube grease (P/N 293 550 030).

NOTE: Ensure O-rings are installed.



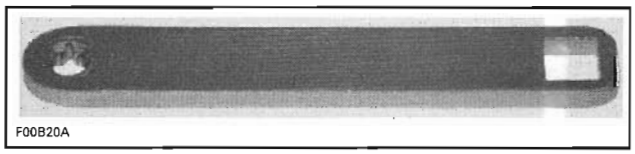
1. Super Lube grease

Install supercharger on PTO housing.

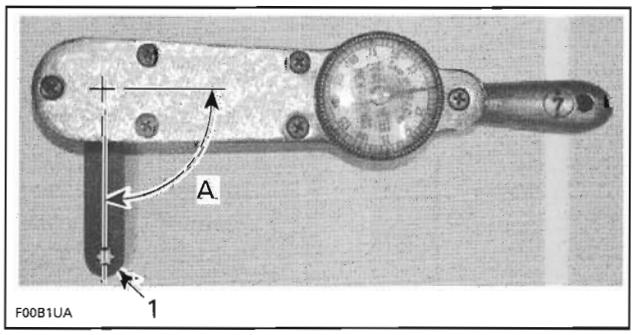
Apply Loctite 243 (blue) (P/N 293 800 060) on the retaining screws.

Torque screws to 11 N•m (97 lbf•**in**).

To tighten and torque the upper retaining screw, use the Torx adapter (P/N 529 035 938).



Ensure to install the tool perpendicularly (90°) to torque wrench to apply the proper torque to the screw.



1. Tool perpendicular (90°) to torque wrench
A. 90°

CAUTION: Not installing the tool as shown will change the torque applied to the screw. Proper torque and tightening sequence are important.

After complete installation of the supercharger, the slipping moment has to be rechecked. Refer to *SUPERCHARGER CLUTCH SLIPPING MOMENT (ON ENGINE)* at the beginning of this section.

EXHAUST SYSTEM

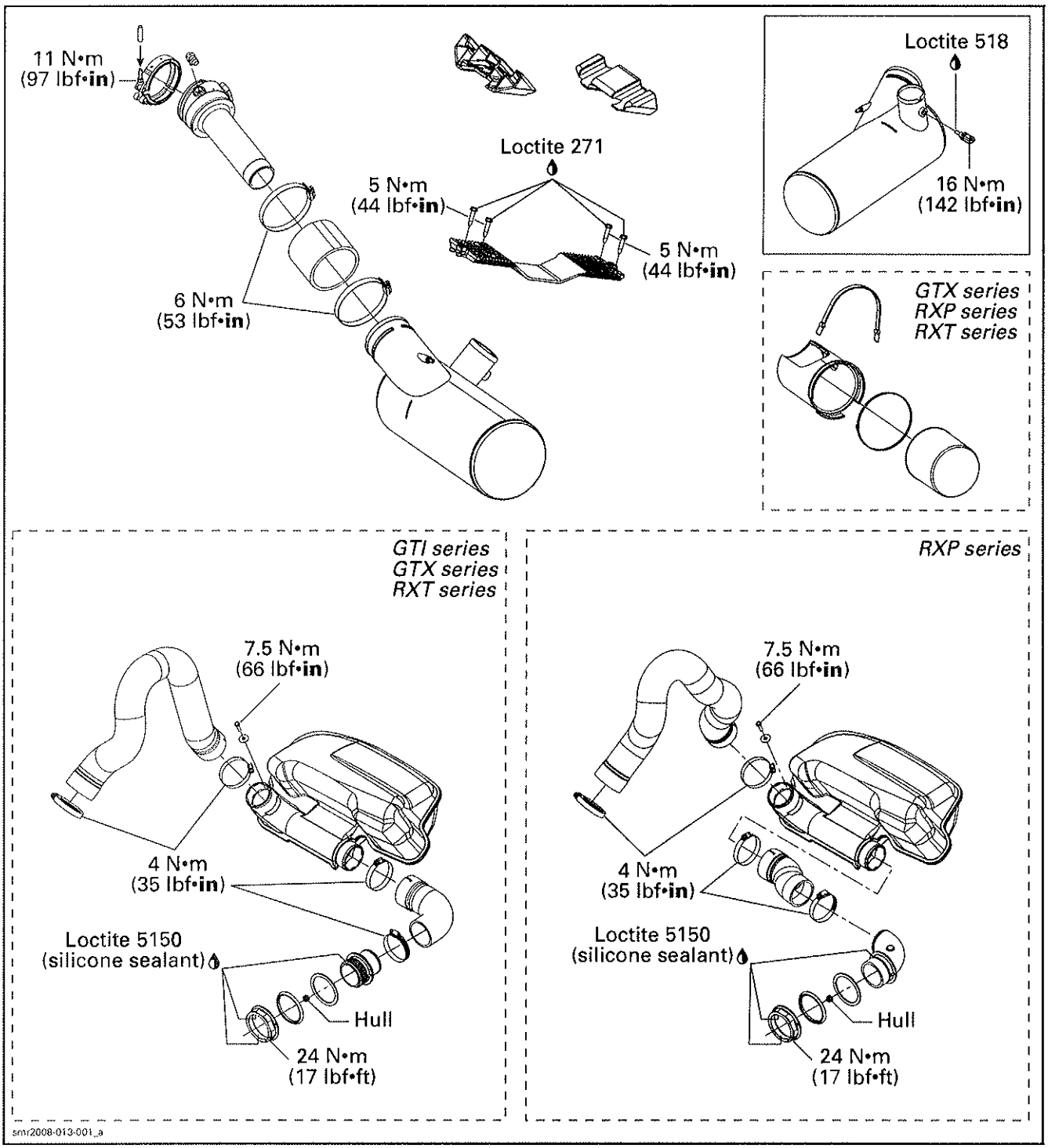
SERVICE TOOLS

Description	Part Number	Page
flushing connector adaptor	295 500 473	76
muffler strap tool	529 036 126	79–80, 82

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 518	293 800 038	86
Loctite 243 (blue)	293 800 060	83
Loctite 5150 (silicone sealant)	293 800 086	85

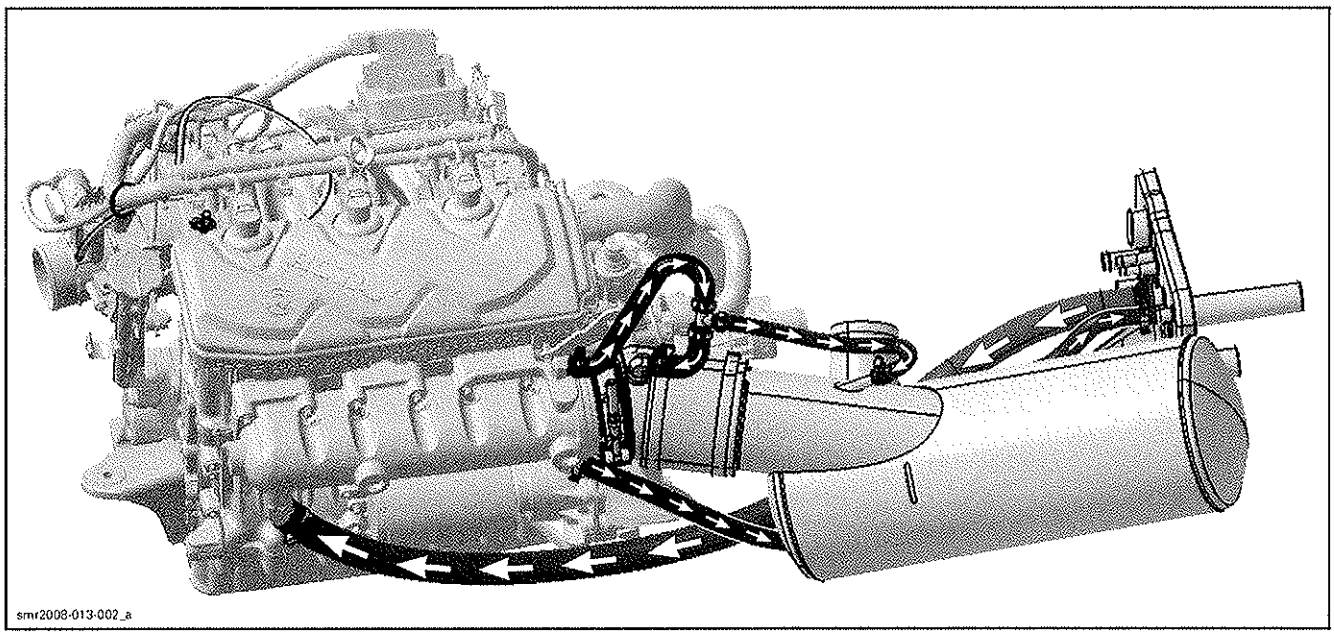
COMPONENTS



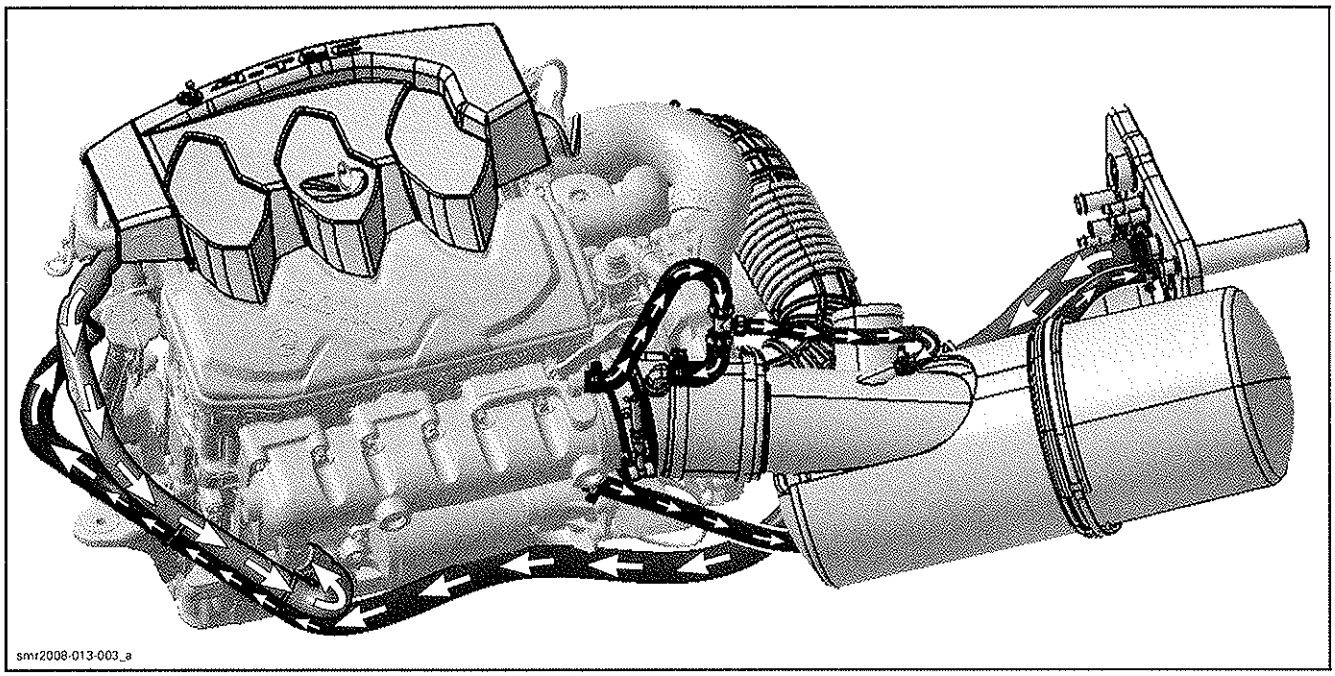
EXHAUST COOLING SYSTEM

Water Flow in the Exhaust System

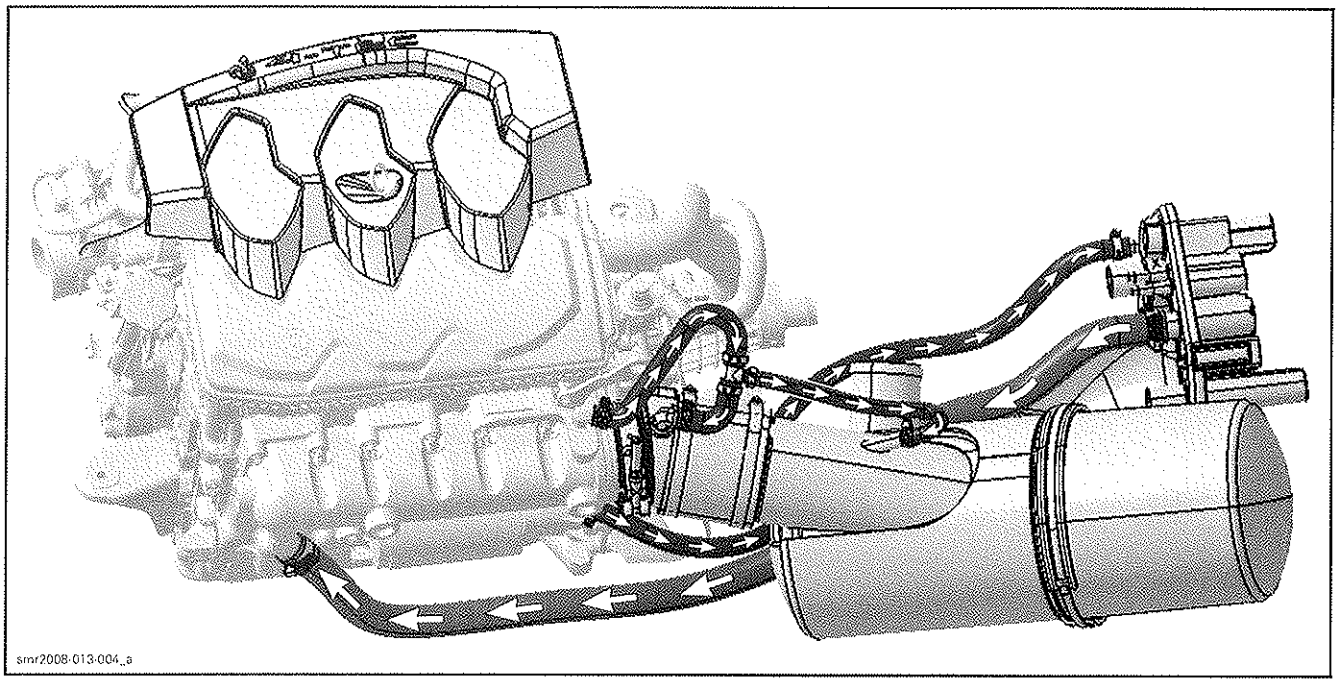
130/155/255 Engines (except RXP Models)



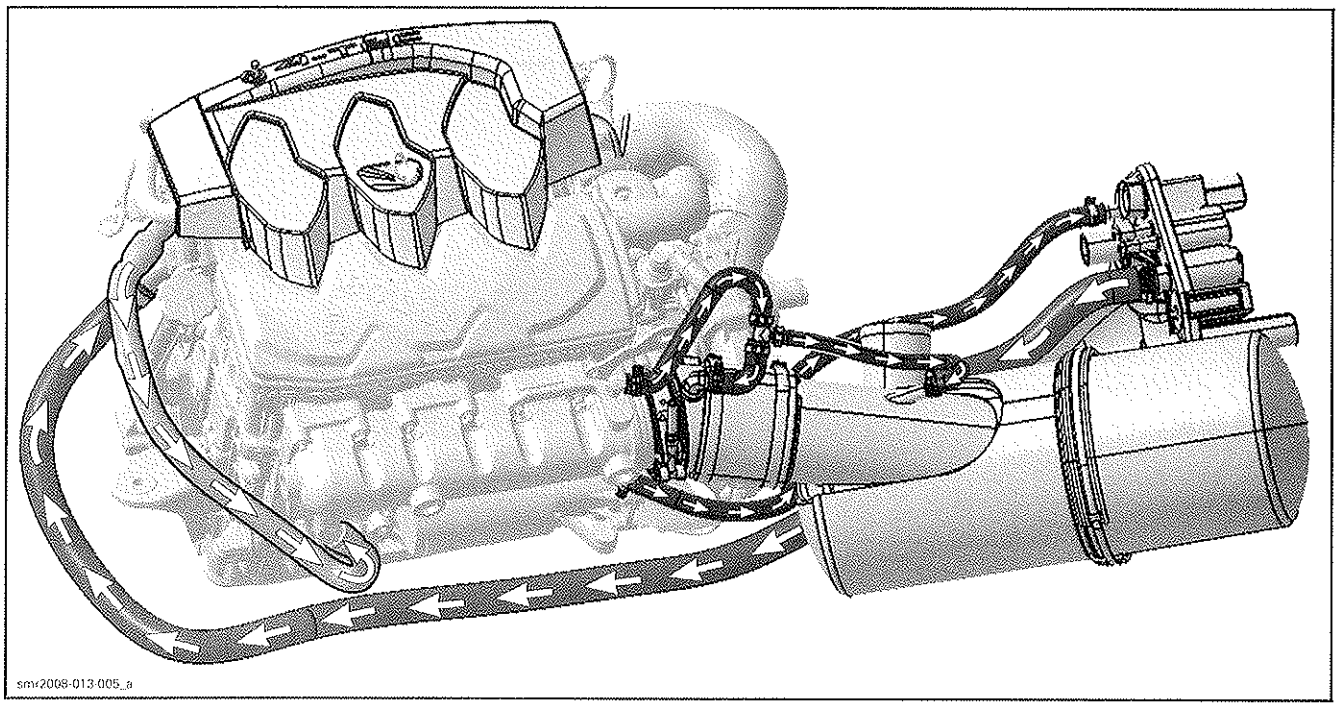
215 Engines (except RXP Models)



155/255 Engines (RXP Models)



215 Engines (RXP Models)



GENERAL

Hoses or cables removed or disconnected must be installed and routed at the same place.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

CAUTION: Locking ties that had to be removed during a procedure, must be replaced and installed at the same place.

SYSTEM DESCRIPTION

The exhaust system is protected by its own cooling system, an opened loop type.

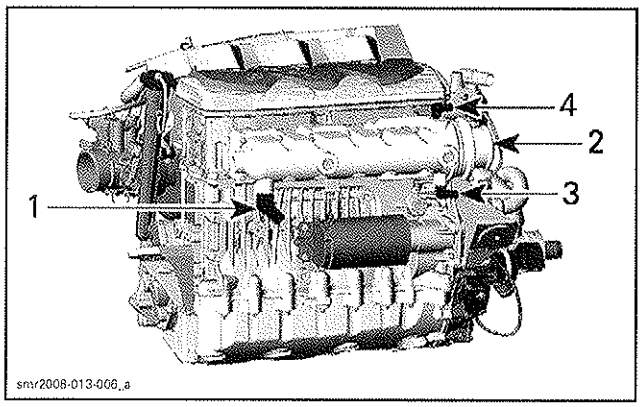
The water supply is provided by a pressurized area in the jet pump between the impeller and venturi.

The water flow is controlled by a reducer located between the jet pump support and the jet pump on the inlet side. The reducer is color coded according to watercraft model. Refer to *JET PUMP*.

Water is directed first through the intercooler (215 engines) or to the exhaust manifold fitting located at front of manifold (130/155/255 engines).

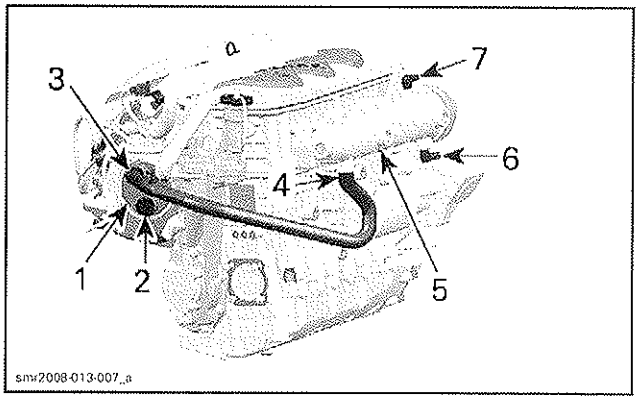
Water enters the manifold end and is directed to water jackets of exhaust manifold.

130/155/215 Engines



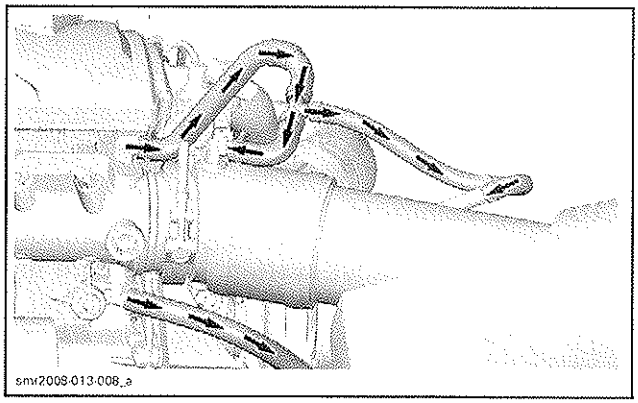
TYPICAL
1. *Exhaust manifold water inlet*
2. *Exhaust manifold*
3. *Exhaust manifold water outlet (to pump support)*
4. *Exhaust manifold water outlet (to exhaust pipe and muffler)*

215 Engines

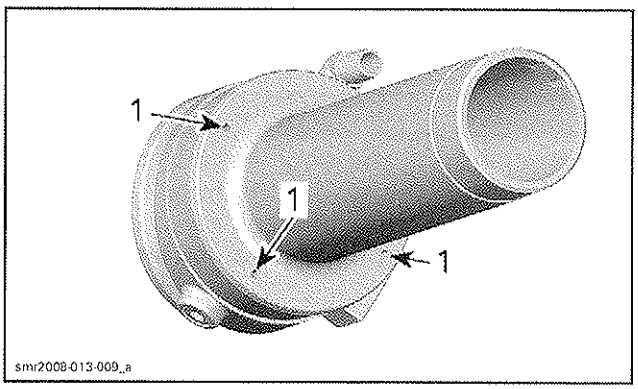


TYPICAL
1. *Intercooler*
2. *Intercooler water inlet*
3. *Intercooler water outlet*
4. *Exhaust manifold water inlet*
5. *Exhaust manifold*
6. *Exhaust manifold water outlet (to pump support)*
7. *Exhaust manifold water outlet (to exhaust pipe and muffler)*

Water exits exhaust manifold through 2 hoses at rear manifold.



Water exits exhaust pipe through holes at the end of the water jacket and mixes with exhaust gas in the muffler.



1. *Water packet holes*

Water is evacuated from mufflers then through the exhaust outlet in transom area.

Exhaust System Technical Specifications

TYPE	Total Loss Cooling System (TLCS)
WATER FLOW	Flow from jet pump (no water pump)
TEMPERATURE CONTROL	Calibrated outlet fittings (no thermostat)
SYSTEM BLEEDING	Self-bleed type
SYSTEM DRAINING	Self-drain type

MAINTENANCE

EXHAUST SYSTEM FLUSHING

Flushing the exhaust system with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in water jackets (exhaust system and intercooler (if so equipped)) and/or hoses.

Exhaust system flushing should be performed when the watercraft is not expected to be used further the same day or when the watercraft is stored for any extended time.

CAUTION: Failure to flush the system, when necessary, will severely damage engine intercooler and/or exhaust system. Make sure engine operates during entire procedure.

⚠ WARNING

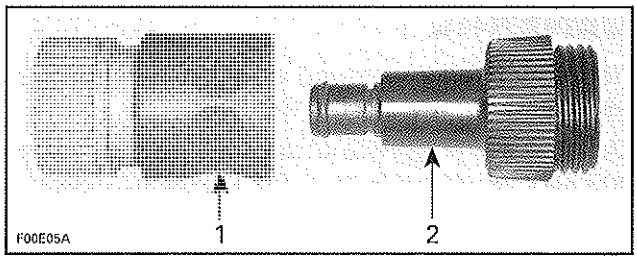
Perform these operations in a well ventilated area. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn. Do not touch any electrical part or jet pump area when engine is running.

⚠ WARNING

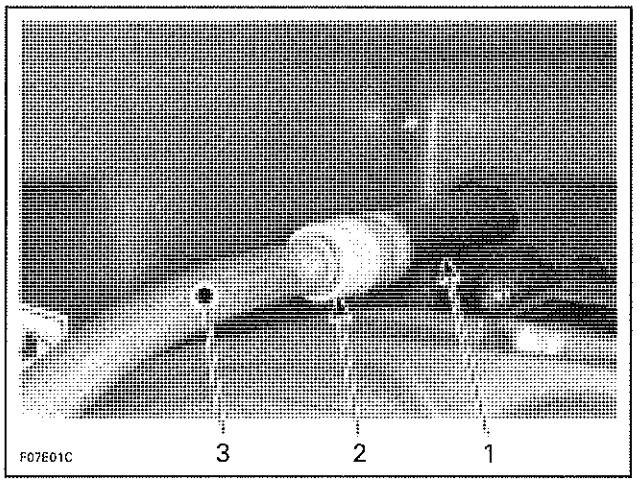
When operating the engine while the watercraft is out of the water, the heat exchanger in the ride plate may become very hot. Avoid any contact with ride plate as burns may occur.

Connect a garden hose to connector located at the rear of watercraft on jet pump support. Do not open water tap yet.

NOTE: The optional flushing connector adaptor (P/N 295 500 473) can be used with a quick connect adapter to ease garden hose installation.



1. Quick connect adapter
2. Flushing connector adapter



TYPICAL
1. Flushing connector
2. Quick connect adapter and flushing connector adapter (optional)
3. Garden hose

To flush the exhaust system, start the engine then immediately open the water tap.

CAUTION: Always start the engine before opening the water tap. Open water tap immediately after engine is started to prevent overheating. Never run engine without supplying water to the exhaust system when watercraft is out of water.

Run the engine about 20 seconds at a fast idle between 4000 - 5000 RPM.

CAUTION: Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

Ensure water flows out of jet pump while flushing.

Close the water tap, then stop the engine.

CAUTION: Always close the water tap before stopping the engine.

Disconnect the garden hose.

CAUTION: Remove flushing connector adapter after operation (if used).

PROCEDURES

MUFFLER

Muffler Removal

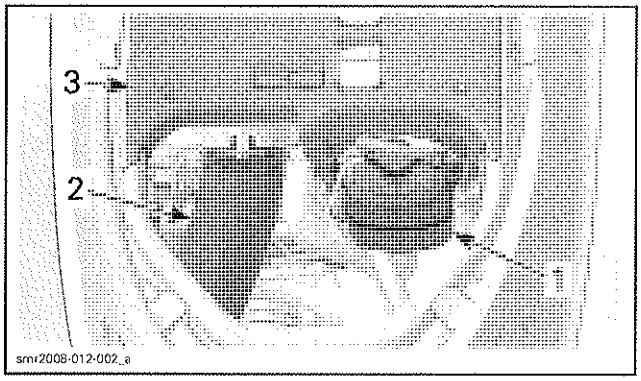
⚠ WARNING

Certain components in the engine compartment may be very hot. Direct contact may result in skin burn. Let exhaust system cool down prior to removing parts.

Remove seat(s).

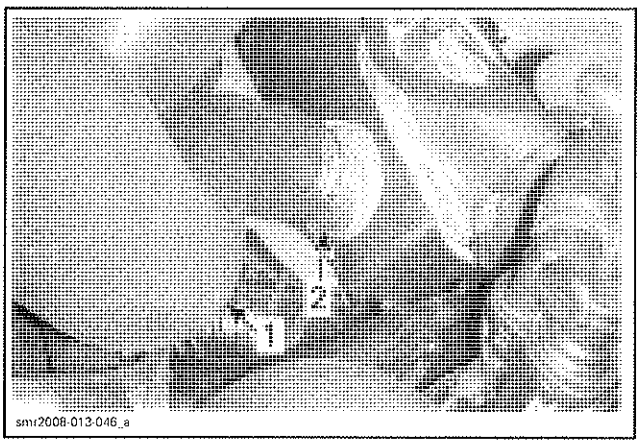
GTX Series and RXT Series

Remove seat support. Refer to *BODY* section.



1. *Coolant expansion tank*
2. *Vent tube*
3. *Seat support*

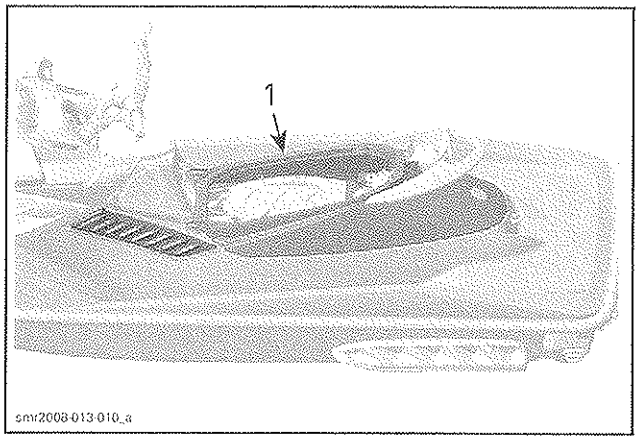
Disconnect the exhaust hose from muffler outlet.



1. *Exhaust hose*
2. *Muffler*

RXP Series

Remove the engine cover. Refer to *BODY* section.



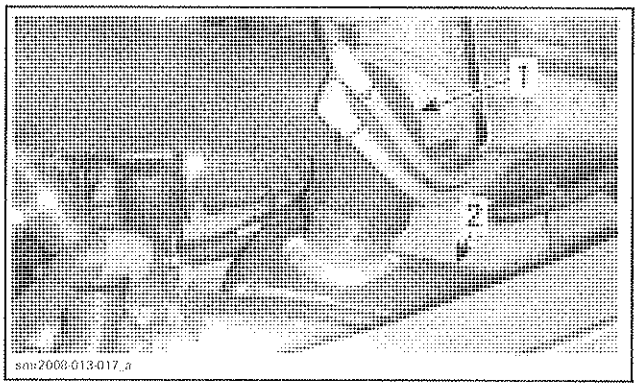
1. *Engine cover*

RXP 255 and RXT 255 Models

Remove the intercooler and intercooler air hoses from vehicle. Refer to *INTERCOOLER (255 HP)* section.

RXP 255 Models

Disconnect the exhaust hose from muffler outlet.

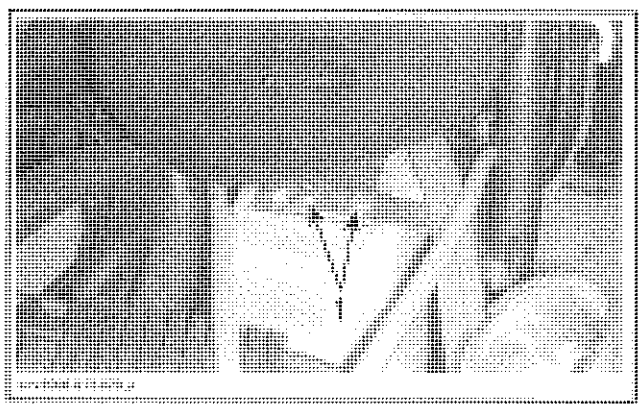


1. *Exhaust hose*
2. *Muffler*

RXP 255 and RXT 255 Models

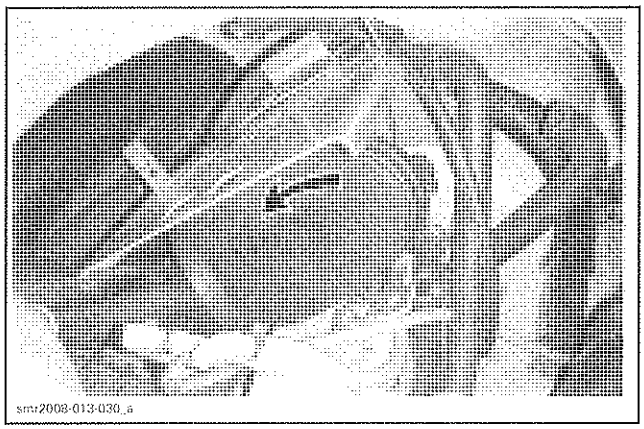
Unscrew intercooler support from hull (one screw on each side).

Remove screws securing VTS support to hull.



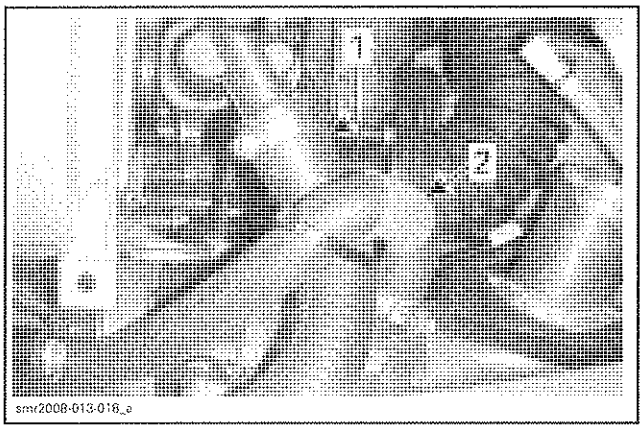
1. *VTS support screws*

Turn intercooler support and VTS toward the RH side to make room.



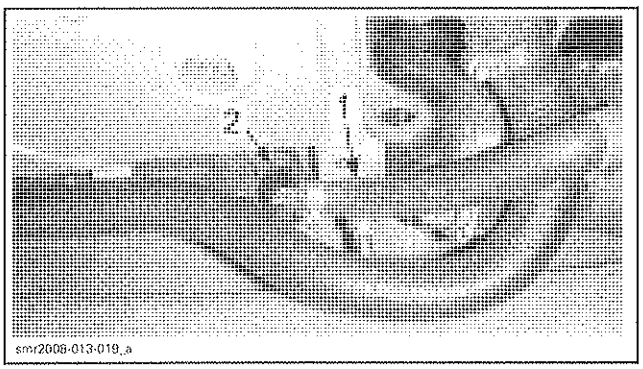
All Models

Cut locking tie securing TOPS valve hose and exhaust manifold water outlet hose.



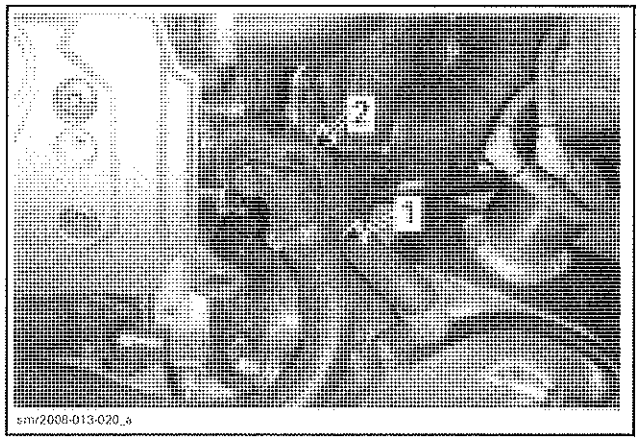
1. *TOPS valve hose*
2. *Exhaust manifold water outlet hose*

Disconnect the upper water outlet hose from the exhaust manifold.



1. *Exhaust manifold water outlet hose*
2. *Exhaust manifold fitting*

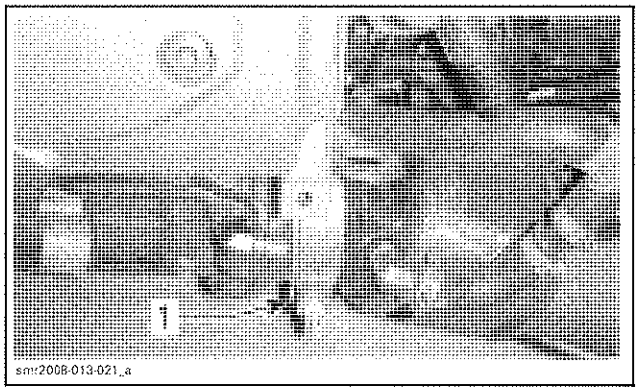
Gently disconnect the TOPS valve hose from TOPS valve.



1. *TOPS valve hose*
2. *TOPS valve*

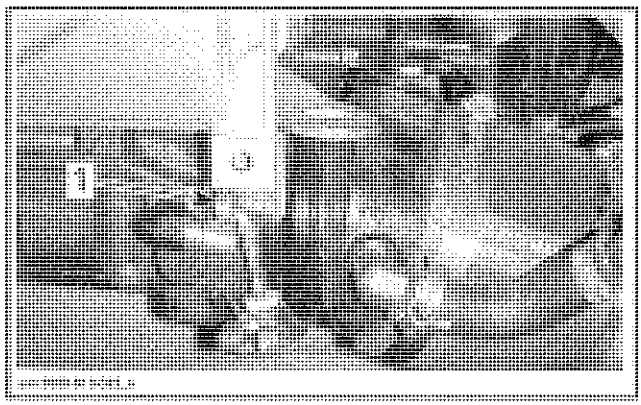
Unscrew exhaust clamp.

CAUTION: Do not use pneumatic or electric tools as seizure may occurs.



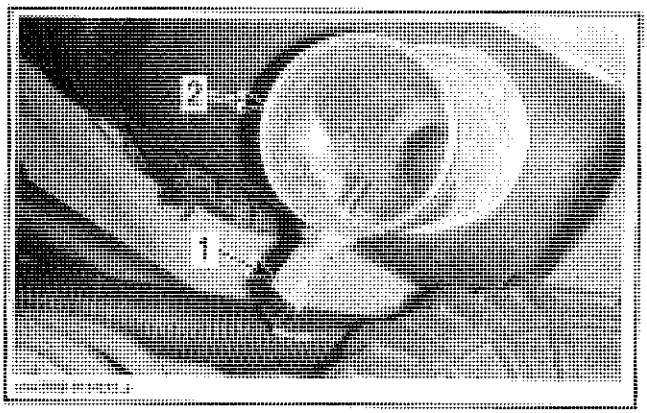
1. *Exhaust clamp*

Move exhaust clamp on exhaust manifold.



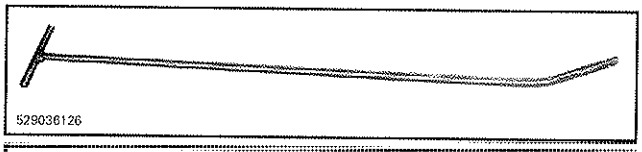
1. *Opened exhaust clamp on exhaust manifold*

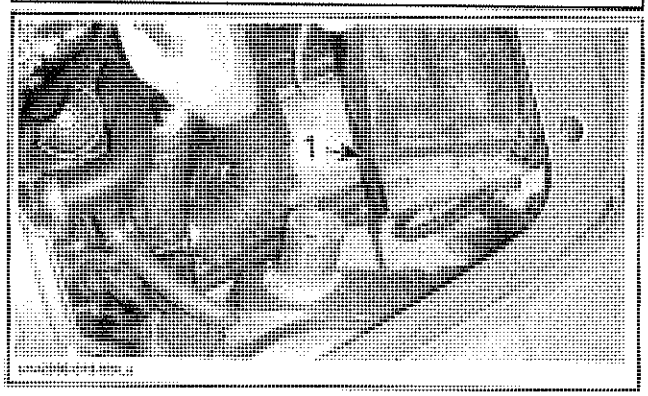
Unplug the exhaust gas temperature sensor (EGTS) from muffler.



1. *Exhaust temperature sensor*
2. *Muffler*

Detach muffler strap using the muffler strap tool (P/N 529 036 126).





1. *Muffler strap tool*

Move muffler backward to extract exhaust manifold from exhaust pipe.

Remove the muffler from vehicle.

Muffler Inspection

Check muffler for:
- Cracks
- Corrosion
- Other damages.

Check if exhaust hose is:
- Brittle
- Hard
- Cracked
- Otherwise damaged.

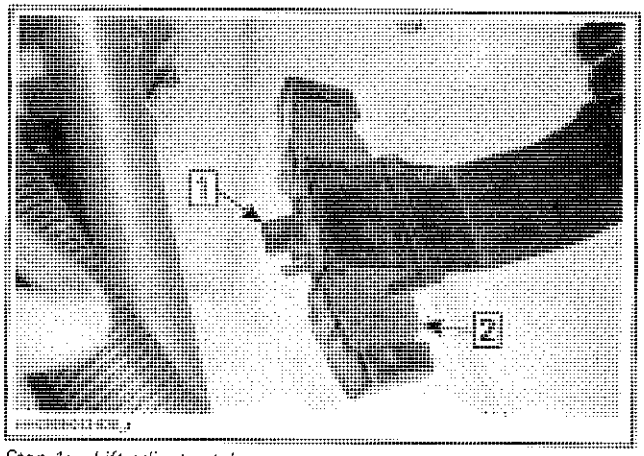
Replace any defective part.

Muffler Installation

Install *EXHAUST PIPE*, see procedure further in this section.

With a new muffler, install the *EXHAUST GAS TEMPERATURE SENSOR*. See procedure further in this section.

Open muffler adjusters by sliding adjuster blocks.



Step 1: Lift adjuster tab
Step 2: Move adjuster outward

Place the muffler in hull.

Align the exhaust pipe flange to the exhaust manifold. Rotate and move muffler so that the exhaust pipe flange makes perfect contact with exhaust manifold.

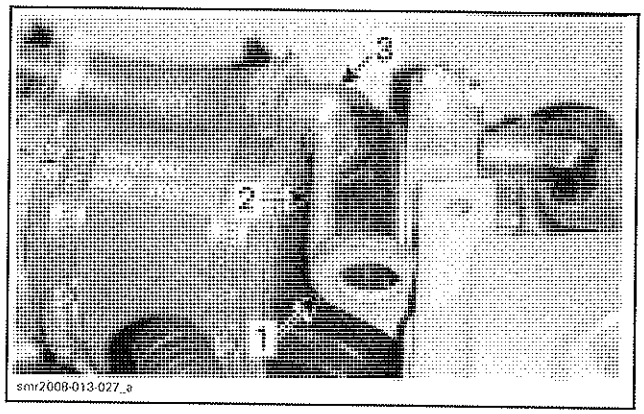
Slide both adjuster blocks against muffler to support it in position.

NOTE: Ensure muffler is in contact with both adjuster blocks. Readjust as required.

Install exhaust clamp with the nut upward.

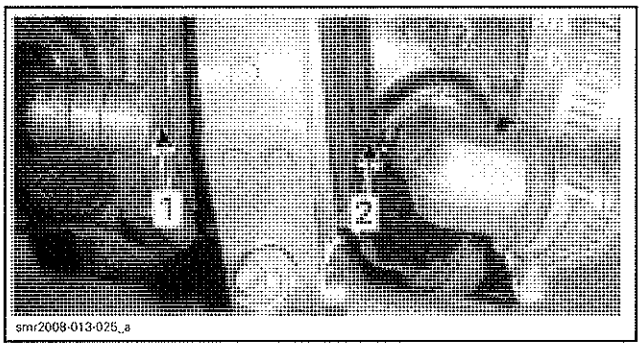
Tighten clamp loosely.

Using a 50 mm (2 in) spacer (in this case a bolt), position the exhaust pipe.



1. *Engine lifting ring*
2. *Spacer*
3. *Exhaust pipe fitting*

Confirm that the exhaust pipe mark is aligned with the mark on the exhaust manifold.



1. Exhaust manifold mark
2. Exhaust pipe mark

Tighten exhaust clamp to 11 N•m (97 lbf•**in**).

CAUTION: Do not use pneumatic or electric tools as seizure may occurs.

Using the muffler strap tool (P/N 529 036 126), install the muffler strap.

CAUTION: Ensure do not rotate muffler during strap installation. The use of a soapy water solution on inner side of muffler strap is recommended.

Install all other removed parts.

After installation, ensure there is no water or exhaust gas leak when engine is running.

Test run the engine while supplying water to the exhaust system.

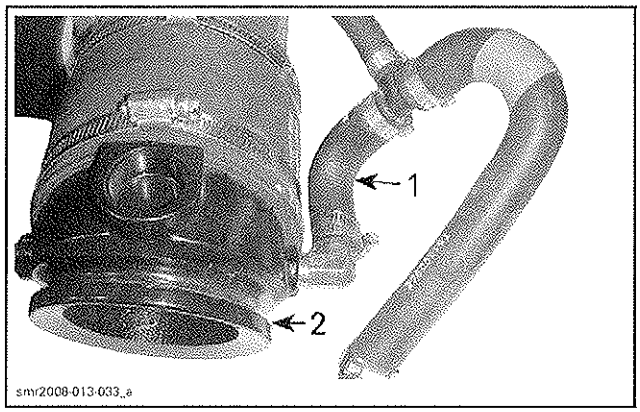
CAUTION: Never run engine without supplying water to the exhaust system when watercraft is out of water.

EXHAUST PIPE

Exhaust Pipe Removal

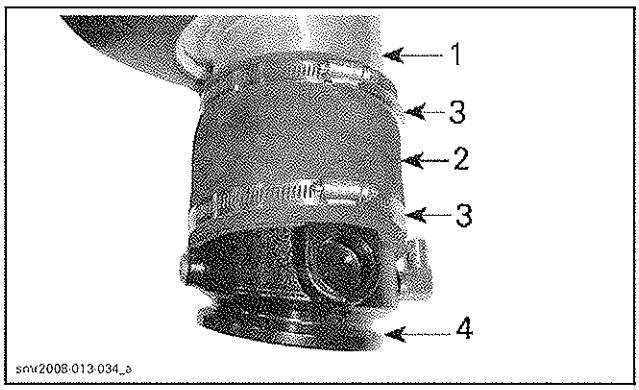
Remove *MUFFLER*, see procedure above in this section.

Disconnect water inlet hose from exhaust pipe fitting.



1. Water inlet hose
2. Exhaust pipe

Loosen rubber adapter clamps.



1. Muffler
2. Rubber adapter
3. Clamps
4. Exhaust pipe

Remove exhaust pipe and the rubber adapter.

Exhaust Pipe Inspection

Inspect exhaust pipe for:
- Cracks
- Flange damages
- Other damages.

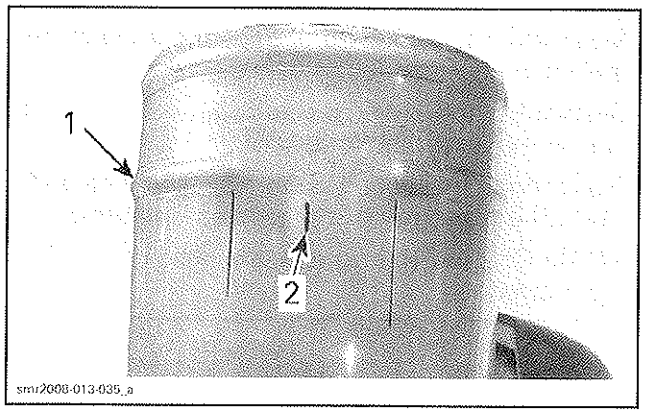
Replace exhaust pipe as required.

Check if the rubber adapter is:
- Brittle
- Hard
- Otherwise damaged.

Replace rubber adapter if necessary.

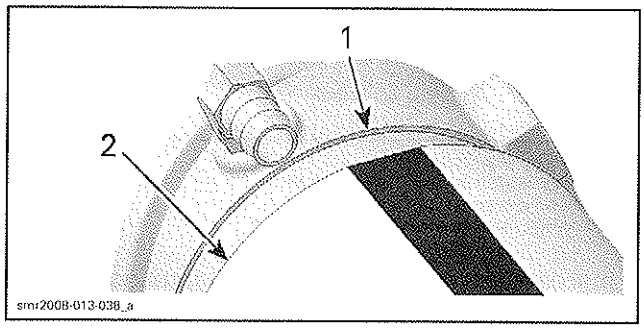
Exhaust Pipe Installation

Trace a mark to locate the middle of the muffler bulge opening.



1. *Bulge*
2. *Middle of the opening*

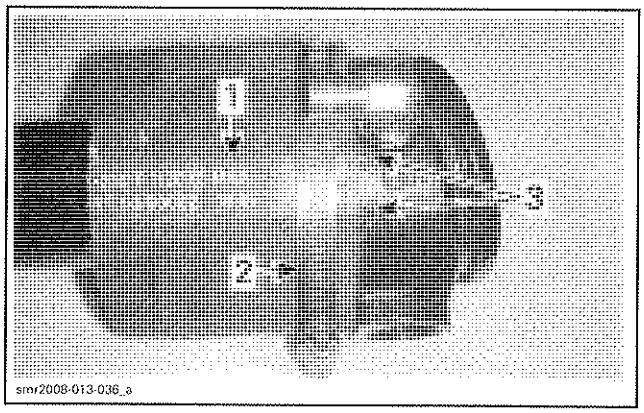
Install the rubber adapter on exhaust pipe. Ensure rubber adapter is properly seats against exhaust pipe shoulder.



1. *Exhaust pipe shoulder*
2. *Rubber adapter*

Center the rubber adapter strip of the rubber adapter between both exhaust pipe marks.

Tighten retaining clamp to 6 N•m (53 lbf•**in**).

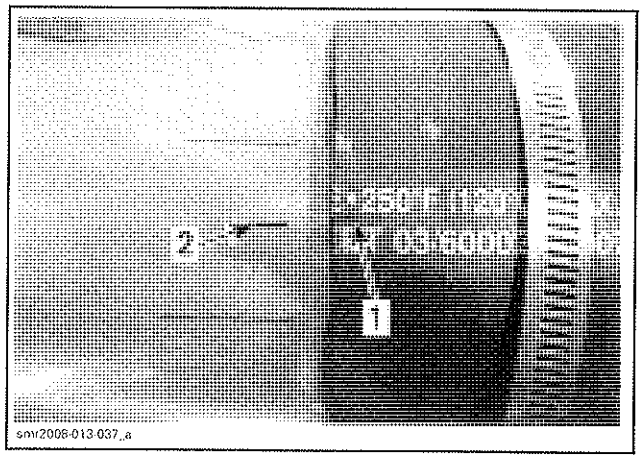


1. *Rubber adapter strip*
2. *Retaining clamp*
3. *Exhaust pipe marks*

Slide the other clamp on the rubber adapter.

Insert the exhaust pipe into the muffler.

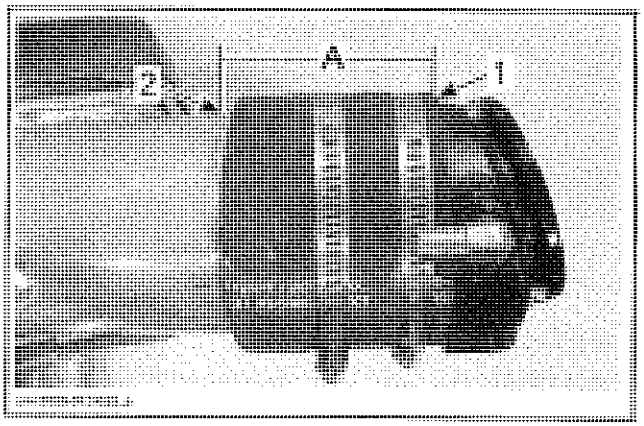
Align the center of the rubber adapter strip with the mark previously traced on muffler.



1. *Middle of rubber adapter strip*
2. *Center of the muffler bulge opening*

Using a caliper, measure the distance between the exhaust pipe shoulder and the outside of the muffler bulge.

Position the muffler to 95 ± 2 mm (3.74 ± .0787 in). Check the distance in several places.



1. *Rubber adapter end*
2. *Outside of the muffler bulge*

A. 95 ± 2 mm (3.74 ± .0787 in)

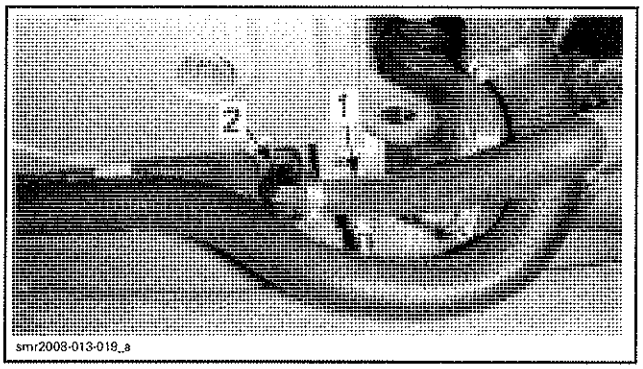
Tighten retaining clamp to 6 N•m (53 lbf•**in**).

Install muffler in vehicle. Refer to *MUFFLER INSTALLATION* in this section for complete procedure.

EXHAUST MANIFOLD

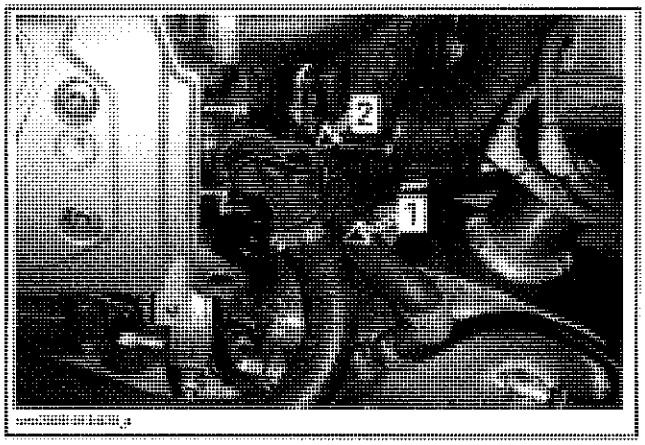
Exhaust Manifold Removal

Disconnect the upper water outlet hose from the exhaust manifold.



1. *Exhaust manifold water outlet hose*
2. *Exhaust manifold fitting*

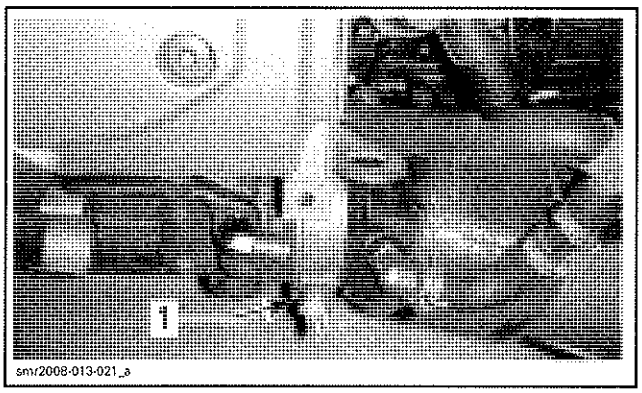
Gently disconnect the TOPS valve hose from TOPS valve.



1. *TOPS valve hose*
2. *TOPS valve*

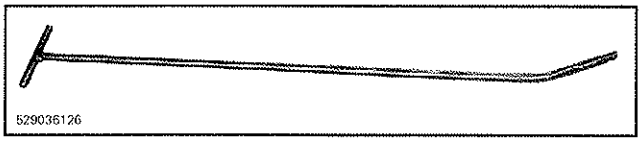
Unscrew exhaust clamp.

CAUTION: Do not use pneumatic or electric tools as seizure may occurs.



1. *Exhaust clamp*

Detach muffler strap using the muffler strap tool (P/N 529 036 126).

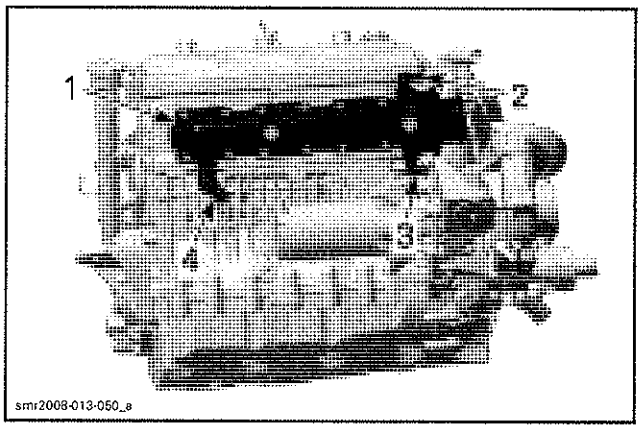


Move muffler backward to separate exhaust pipe from exhaust manifold.

Disconnect the lower water outlet hose from the rear of exhaust manifold.

Disconnect the cooling system supply hose underneath the front part of the exhaust manifold.

NOTE: On the **215 engines**, the hose comes from the intercooler.

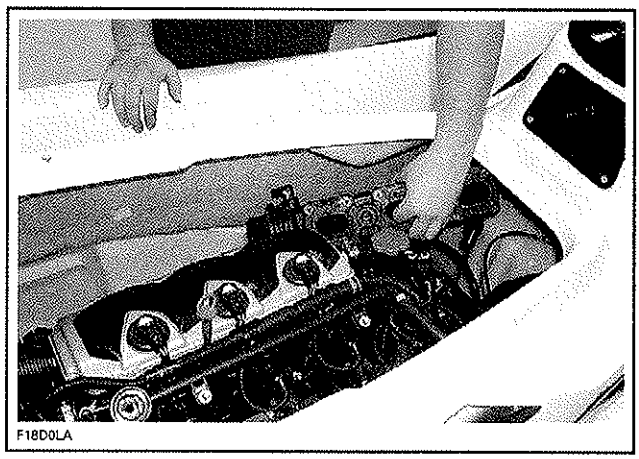


1. *Exhaust manifold*
2. *Upper water outlet hose location*
3. *Lower water outlet hose location*
4. *Cooling system supply hose location*

Unscrew the exhaust manifold beginning with the bottom screws. This will help holding the manifold while you remove the screws.

Remove the manifold and move it out toward the front of the watercraft to withdraw.

NOTE: On **RXP series**, move the manifold rearwards to remove it from vehicle.



TYPICAL

Exhaust Manifold Inspection

Inspect exhaust manifold condition paying attention for cracks or other damage. Check contact surfaces and hose. Replace any defective part.

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

Clean all metal components in a solvent.

Exhaust Manifold Installation

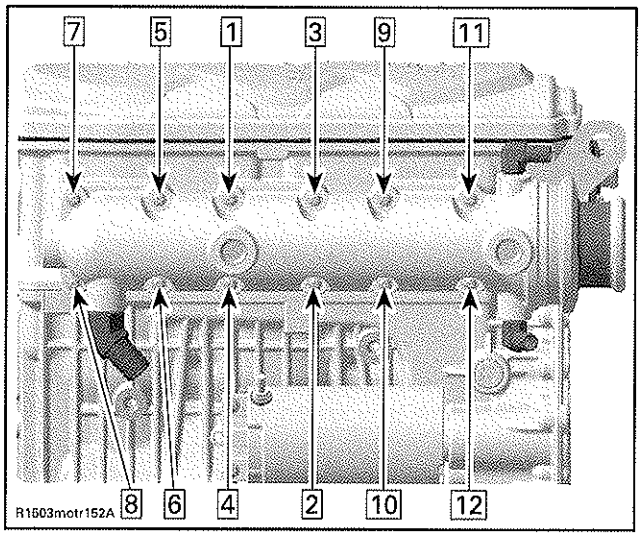
Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

NOTE: There is no gasket between cylinder block and exhaust manifold.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of screws.

To help holding the manifold while installing screws, first insert the exhaust manifold into the exhaust pipe then, install the upper front screw. Continue with the remaining screws.

Torque screws to 10 N•m (89 lbf•**in**) as per following illustrated sequence. Repeat the procedure, torquing screws again to 10 N•m (89 lbf•**in**).



After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the flushing connector.

CAUTION: Never run engine without supplying water to the exhaust cooling system when watercraft is out of water.

RESONATOR

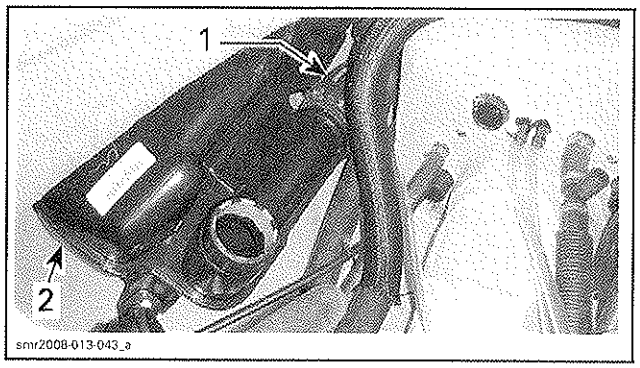
Resonator Removal

130/155 Engines

On WAKE models, remove VTS. Refer to *VARIABLE TRIM SYSTEM (VTS)* section.

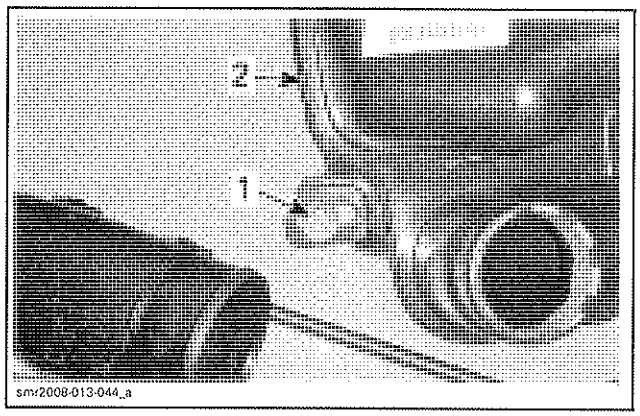
Remove the exhaust hose between muffler and resonator.

Disconnect resonator outlet hose.



1. *Resonator outlet hose*
2. *Resonator*

Remove screw securing resonator.



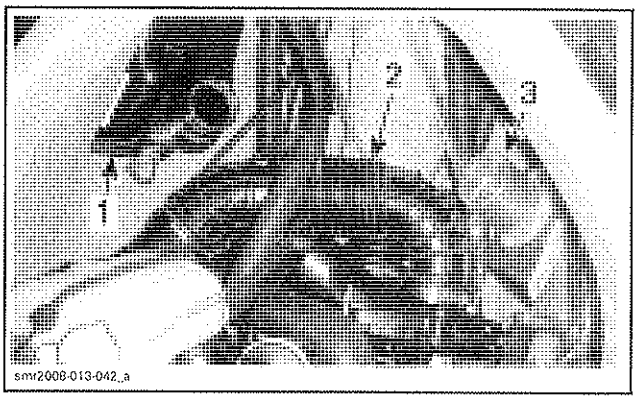
1. *Resonator screw*
2. *Resonator*

Remove resonator from vehicle.

215 Engines

Remove the exhaust hose between muffler and resonator.

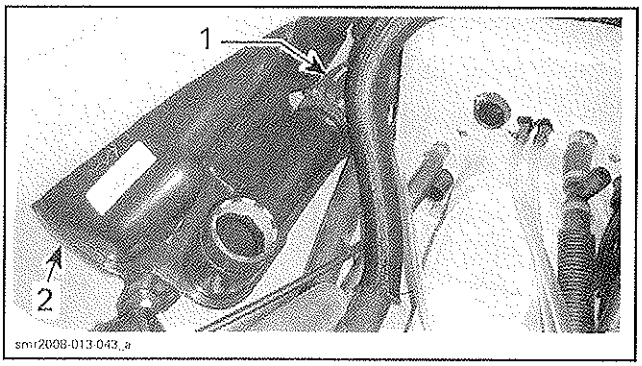
Remove the supercharger outlet hose.



1. *Resonator*
2. *Supercharger outlet hose*
3. *Muffler*

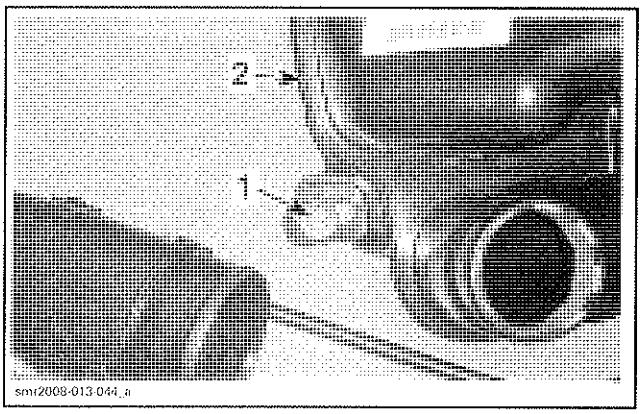
On RXP and WAKE models, remove VTS. Refer to *VARIABLE TRIM SYSTEM (VTS)* section.

Disconnect resonator outlet hose.



1. *Resonator outlet hose*
2. *Resonator*

Remove screw securing resonator.



1. *Resonator screw*
2. *Resonator*

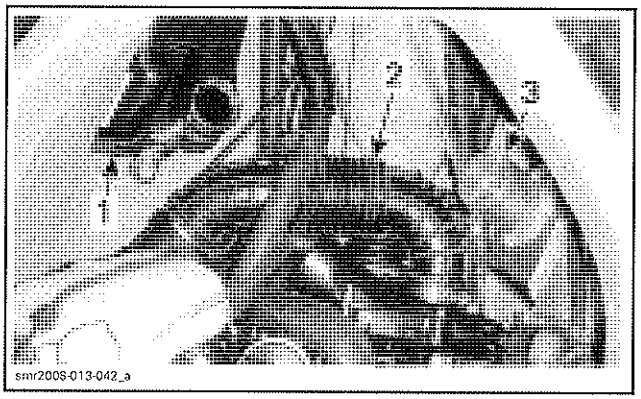
Remove resonator from vehicle.

255 Engines

Remove VTS. Refer to *VARIABLE TRIM SYSTEM (VTS)* section.

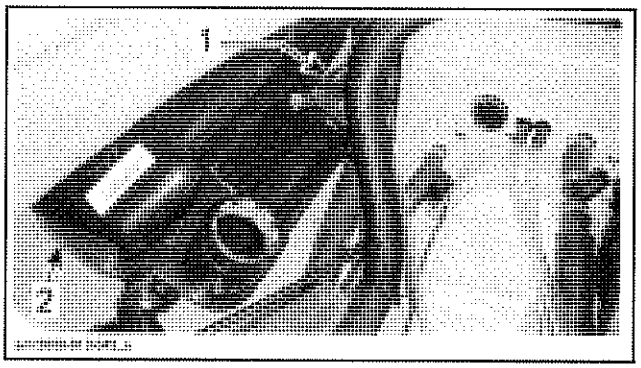
Remove the intercooler and the intercooler support. Refer to *INTERCOOLER (255 ENGINES)* section.

Remove the supercharger outlet hose.



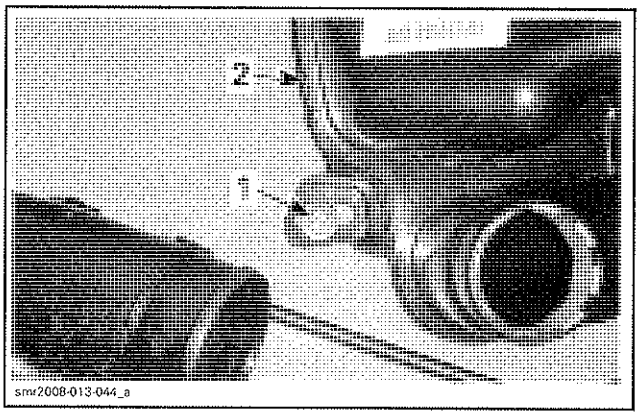
1. *Resonator*
2. *Supercharger outlet hose*
3. *Muffler*

Disconnect resonator outlet hose.



1. *Resonator outlet hose*
2. *Resonator*

Remove screw securing resonator.



1. *Resonator screw*
2. *Resonator*

Remove resonator from vehicle.

Resonator Inspection

Inspect parts condition paying attention for deformation, cracks or other damage. Check hoses. Replace any defective part.

Resonator Installation

Installation is the reverse of the removal procedures. However, pay attention to the following.

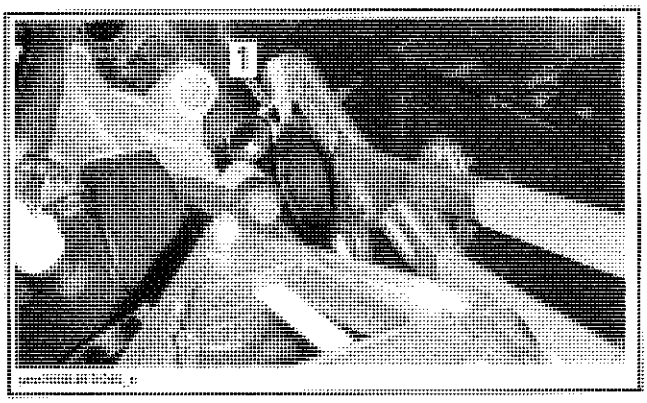
After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the exhaust system.

CAUTION: Never run engine without supplying water to the exhaust system when watercraft is out of water.

EXHAUST OUTLET

Exhaust Outlet Removal

Unscrew the exhaust outlet nut.



FROM OUTSIDE OF HULL
1. Exhaust outlet nut

Push the exhaust outlet inside bilge.

From inside of bilge, remove the exhaust hose from resonator.

Remove resonator screw.

Move resonator forward.

Disconnect outlet hose from resonator.

Remove outlet hose with the exhaust outlet.

Loosen clamp and separate outlet hose from exhaust outlet.

Exhaust Outlet Inspection

Check if the exhaust outlet is:
- Cracks
- Otherwise damage.

Replace as required.

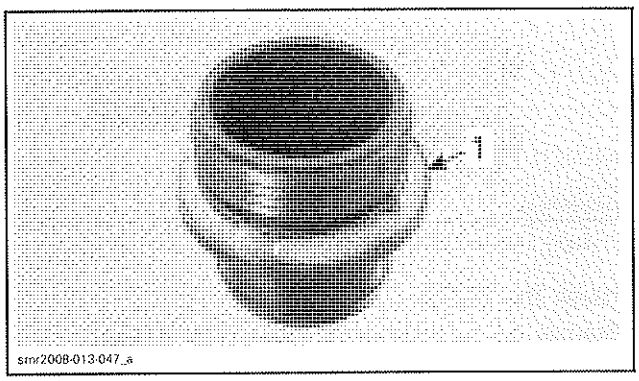
Exhaust Outlet Installation

Installation is essentially the reverse of the removal procedures. However, pay particular attention to the following.

Scrape off sealant residues around exhaust outlet hole on hull and inside bilge.

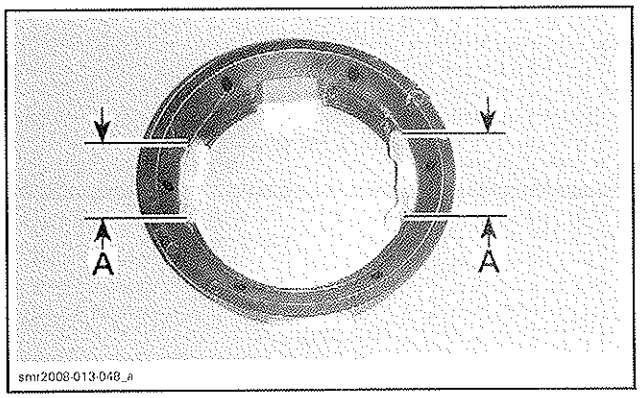
Clean surfaces with acetone based solvent or an equivalent to eliminate grease, dust or any residue of sealant.

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on exhaust outlet gasket as shown.



1. All around

Apply two lines of Loctite 5150 (silicone sealant) (P/N 293 800 086) inside exhaust outlet nut as shown.



A. ± 25 mm (± 1 in)

Install exhaust outlet nut.

Tighten to 23 N•m (17 lbf•ft).

Inside bilge, check for presence of silicone all around the gasket.

Let silicone sealant dry completely and test the bilge for water leaks.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)

The overheat signals will appear when the exhaust temperature reaches 100°C (212°F).

EGTS Test

Refer to *ELECTRONIC FUEL INJECTION (EFI)* section for electrical test.

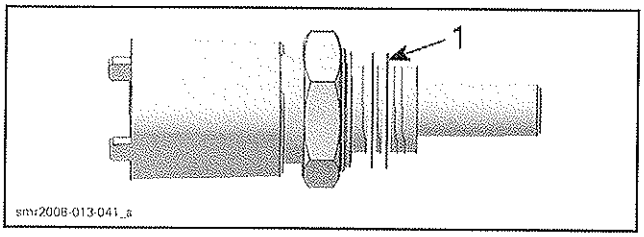
EGTS Replacement

Disconnect the exhaust hose from muffler.

Unplug the EGTS connector.

Unscrew EGTS from muffler.

Apply Loctite 518 (P/N 293 800 038) on the middle threads of EGTS.



1. Apply Loctite 518 in this area

Install the EGTS.

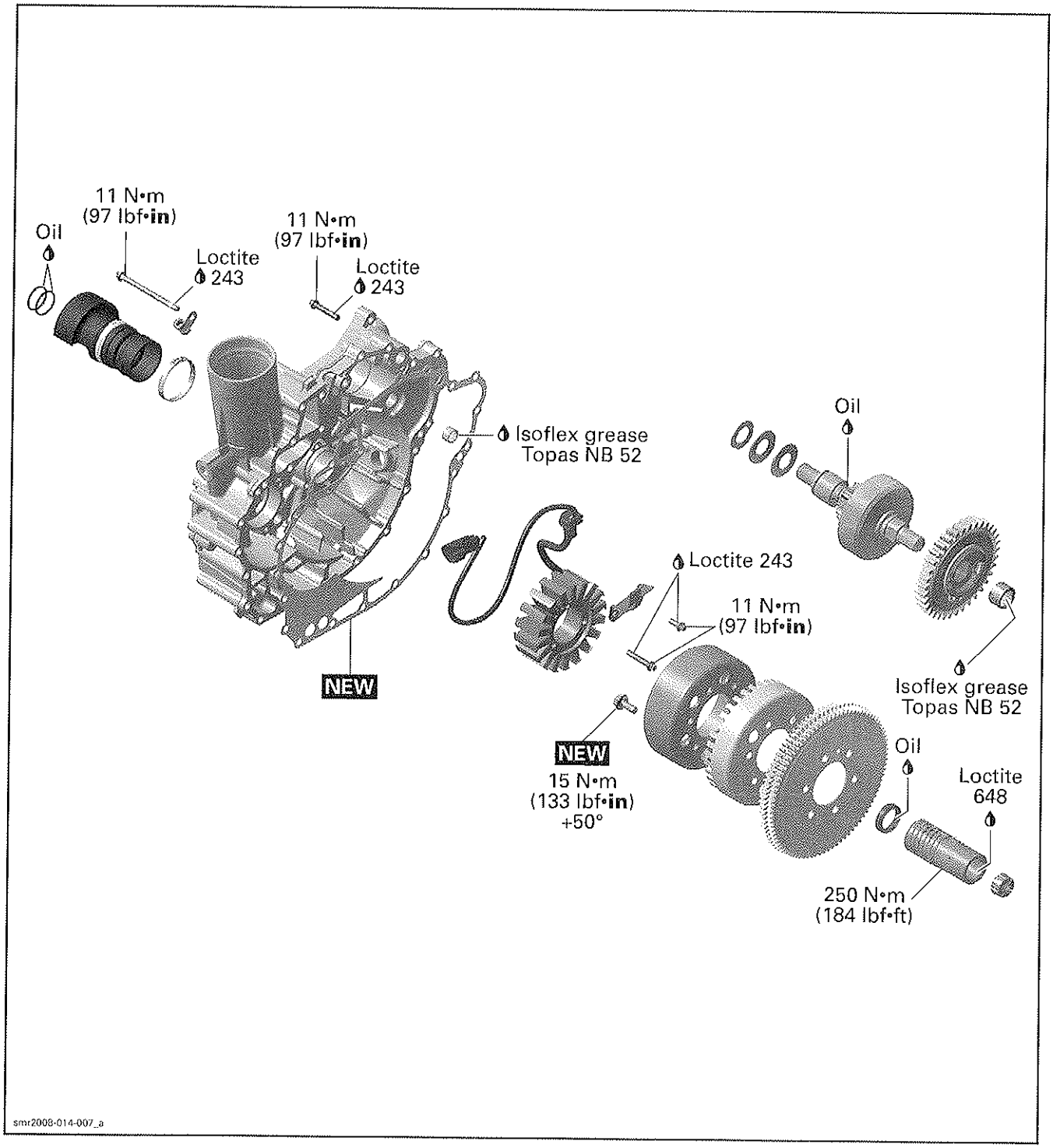
Tighten the sensor to 16 N•m (142 lbf•in).

Plug the EGTS connector.

PTO HOUSING/MAGNETO

SERVICE TOOLS

SERVICE PRODUCTS



GENERAL

NOTE: It is good practice to check for fault codes using the B.U.D.S. software as a first troubleshooting step. Refer to the *MONITORING SYSTEM/FAULT CODES* section.

Always carry out electrical tests on components before removing or installing them.

During assembly, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones.

Always disconnect the negative wire from the battery before working on the engine.

⚠ WARNING

Always disconnect the BLACK (-) cable first and reconnect last.

⚠ WARNING

Before carrying out any inspection or maintenance procedure on the vehicle, wait until the engine and exhaust have cooled down to avoid potential burns.

PROCEDURES

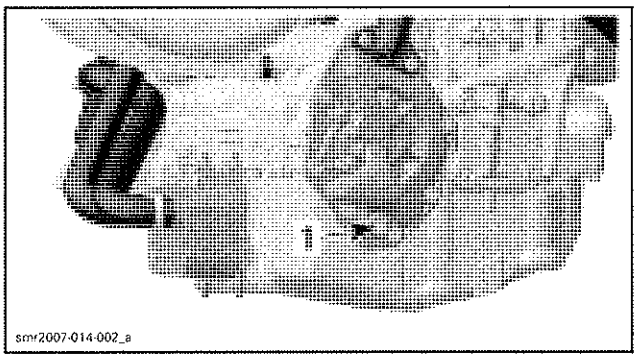
PTO HOUSING

Before removing the PTO housing, drain the engine oil. Refer to *LUBRICATION SYSTEM*.

Also drain the oil in the PTO housing using one of the following two procedures.

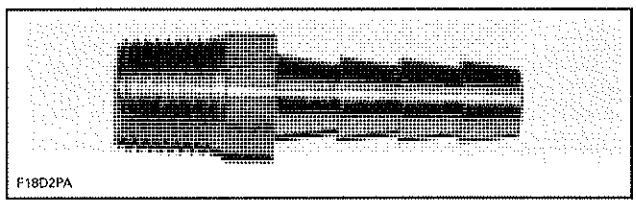
Procedure for Removing Oil in PTO Housing Through the Scavenge Oil Pump Cover

– Remove the scavenge oil pump cover drain plug.



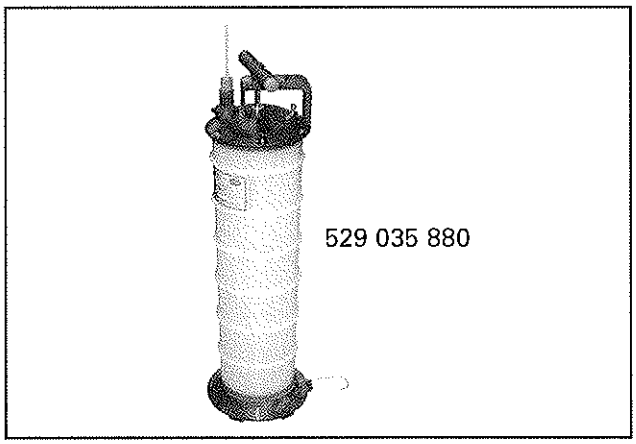
TYPICAL
1. Scavenge oil pump cover drain plug

– Install fitting (P/N 293 710 037) in the scavenge pump cover oil drain hole.



TYPICAL

– Connect syphon pump (P/N 529 035 880) to the fitting.



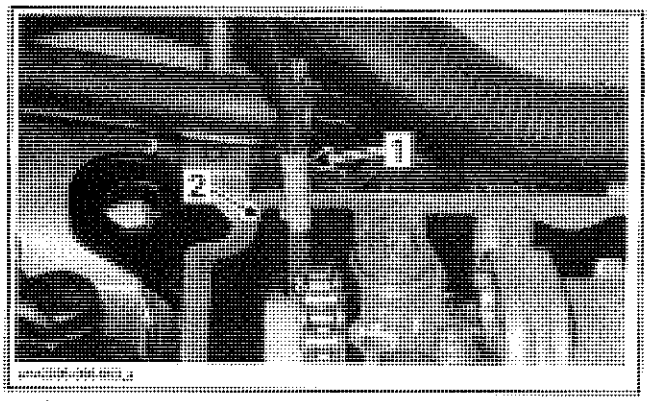
– The front of the engine must be tilted down approximately 15 degrees to facilitate removal of the oil. Raise rear of watercraft accordingly. Siphon the oil from the fitting.
– When oil draining is complete, remove the syphon pump and fitting.
– Clean drain plug and pump cover oil drain hole threads.
– Apply Loctite 243 (blue) (P/N 293 800 060) and reinstall drain plug in scavenge pump cover.

NOTE: If oil spillage occurs during procedure, clean immediately with pulley flange cleaner (P/N 413 711 809) to prevent oil stains.

Procedure for Removing Oil in PTO Housing through the Timing Chain Area

As an alternate method, the oil located in the PTO housing can be siphoned through the timing chain area.

– Remove the valve cover. Refer to *CYLINDER HEAD* section.



1. Oil siphoning tube
2. Edge of cylinder block

– Using syphon pump (P/N 529 035 880), insert the tube in the lower area of the timing chain. Syphon the oil.

PTO Housing Removal

Drain engine coolant, refer to the *COOLING SYSTEM* section.

GTI Models

Remove seat.

GTX, WAKE and RXT Models

Remove:
– Seats
– Seat support
– Air vent tube.

RXP Models

Remove:
– Seat
– Engine cover.

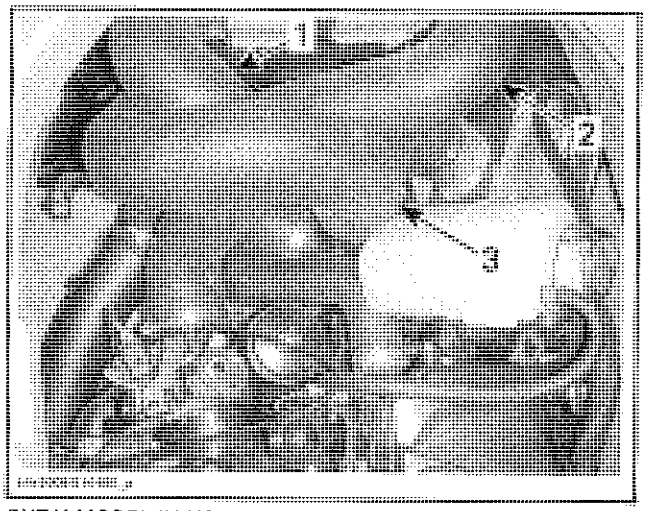
Was the engine oil drained as instructed in the beginning of this section?

Was the oil in the PTO housing drained using one of the two procedures described in the beginning of this section?

RXP-X and RXT-X Models

Remove exhaust system hose, refer to the *EXHAUST SYSTEM* section.

Remove intercooler inlet and outlet hoses, refer to the *AIR INTAKE SYSTEM* section.

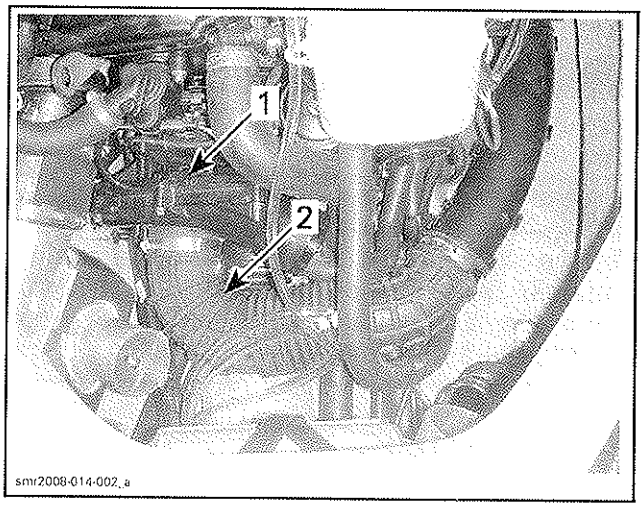


RXT-X MODEL ILLUSTRATED
1. Intercooler outlet hose
2. Intercooler inlet hose
3. Exhaust system hose

All Models

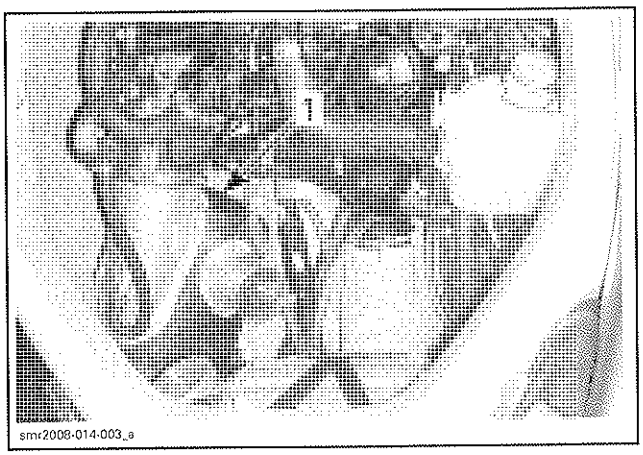
Remove exhaust system hose, refer to the *EXHAUST SYSTEM* section.

Remove supercharger inlet flex hose, refer to the *AIR INTAKE SYSTEM* section.



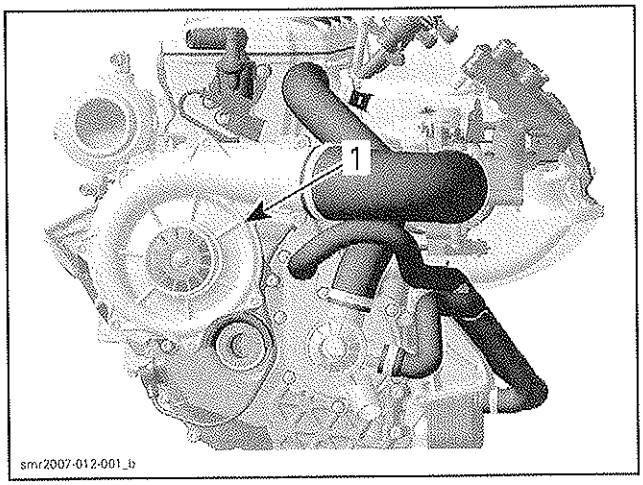
1. Supercharger
2. Supercharger inlet flex hose

Remove exhaust muffler assembly, refer to the *EXHAUST SYSTEM* section.



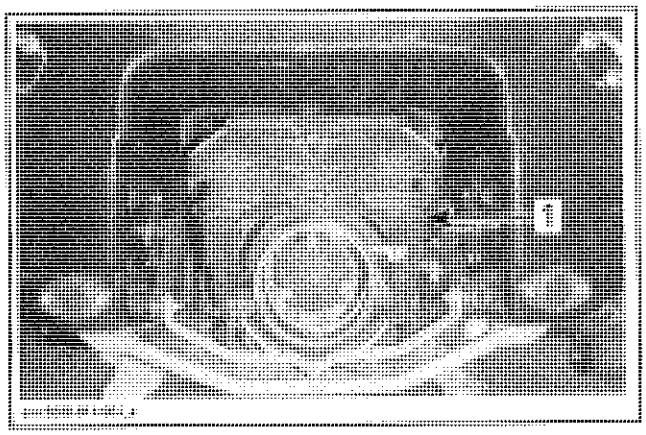
1. *Exhaust muffler*

Remove the supercharger, refer to the *SUPERCHARGER* section.



1. *Supercharger*

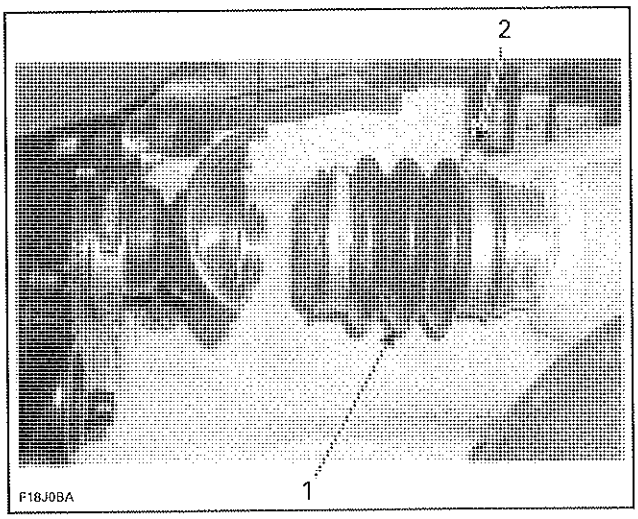
Remove jet pump, refer to *JET PUMP* section.



1. *Jet pump*

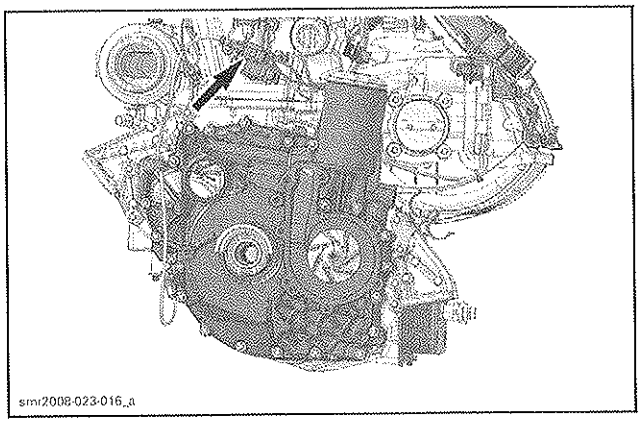
Remove drive shaft, refer to *DRIVE SYSTEM* section.

Loosen the aft retaining clamp on the drive shaft thru-hull fitting boot (bellows) and remove the bellows from the fitting.



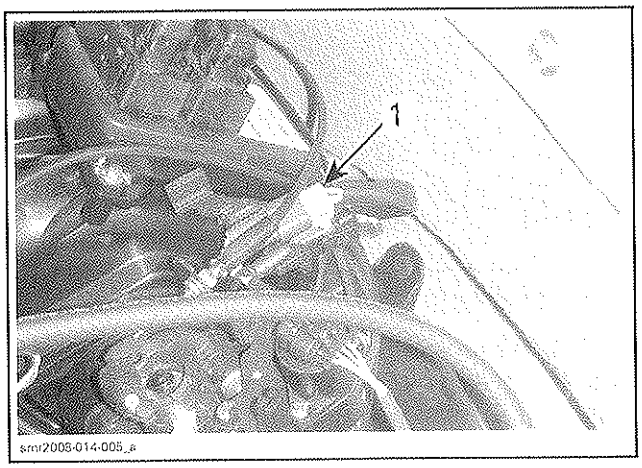
1. *Thru-hull fitting boot*
2. *Remove this clamp*

Disconnect CPS connector from wiring harness.



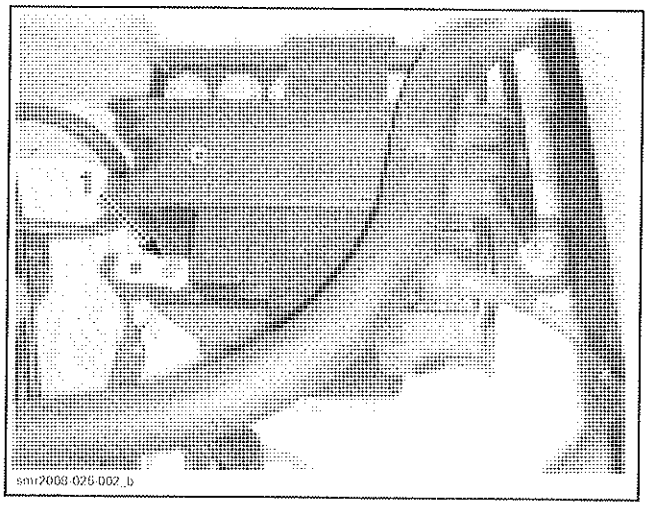
CPS CONNECTOR

Disconnect the magneto connector from wiring harness.



1. *Magneto connector*

Disconnect the battery negative terminal.



TYPICAL – BATTERY
1. Battery negative terminal

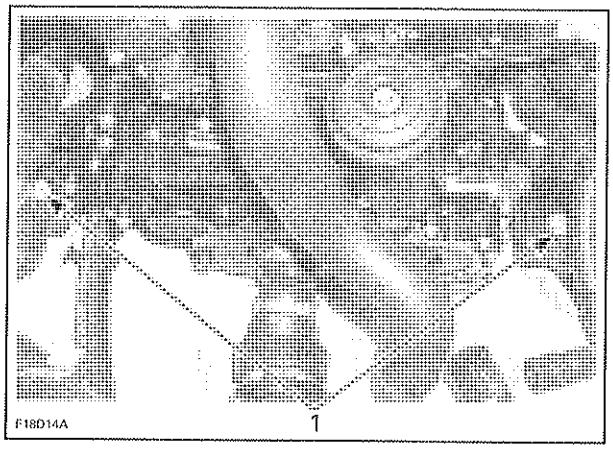
⚠ WARNING

Always disconnect battery cables exactly in the specified order, BLACK negative cable first.

Place rags under PTO housing to prevent oil spillage.

NOTE: Up to 250 ml (8 oz) of oil could flow out when removing PTO housing. If spillage occurs, clean immediately with the pulley flange cleaner (P/N 413 711 809) to prevent oil stains.

Remove the LH and RH rear engine mount thru-bolts.

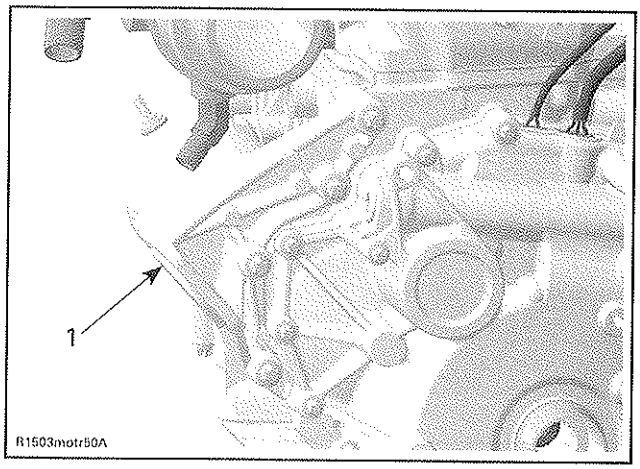


1. Rear engine support thru-bolts

NOTE: When removing engine mount thru-bolts and lifting engine, secure the shims from each mount in a separate bag, identified to the mount position (LH or RH rear mount).

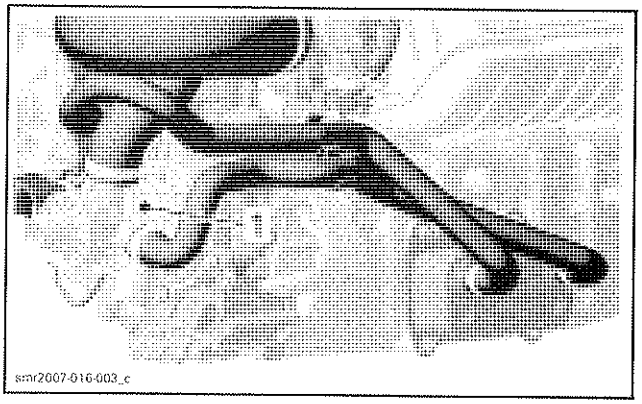
Slightly lift aft end of engine and insert a safely block under the engine to secure it in this position.

Remove LH rear engine support.



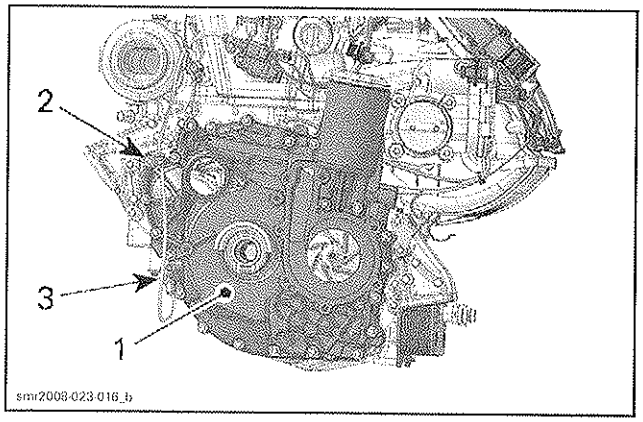
TYPICAL
1. Engine support

Remove water pump housing, refer to *COOLING SYSTEM* section.



1. Water pump housing

Remove PTO housing retaining screws.



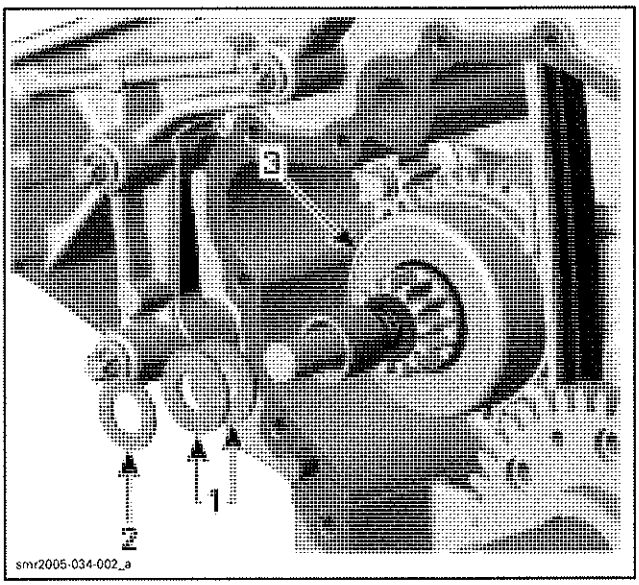
1. PTO housing
2. CPS harness retaining clamp
3. CPS

NOTE: Note position of the CPS harness retaining clamp position as illustrated above for reinstallation.

Remove PTO housing from engine.

CAUTION: To prevent damaging contact surfaces, be sure to use prying lugs to separate PTO housing from engine.

NOTE: Carefully separate PTO housing from engine using two flat screwdrivers prying equally on opposite sides of the housing and at the same time. Proceed slowly to prevent starter gear disc springs and washer from falling down into bilge area.



1. *Disc springs*
2. *Washer*
3. *Starter drive gear*

Remove PTO housing gasket and discard.

PTO Housing Inspection

Inspect PTO housing for cracks or any other damages. Replace if necessary.

Inspect the needle bearing in the PTO housing used to support the starter drive assembly shaft.

NOTE: Clean all disassembled metal components in a non-ferrous metal cleaner.

⚠ WARNING

Wear safety glasses and work in a well ventilated area when working with strong chemical products. Also wear suitable non-absorbent gloves to protect your hands.

Inspect oil sieve for contaminants, debris or other particles. Clean as required.

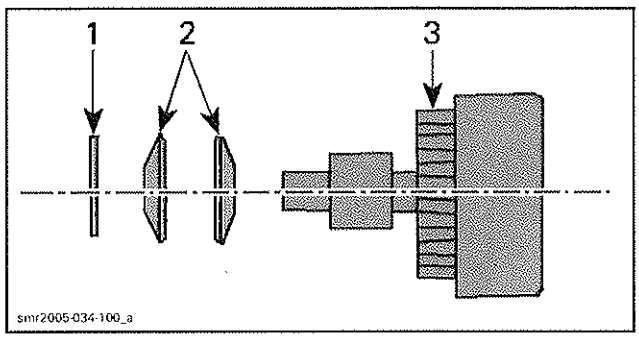
PTO Housing Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Apply lubricants, sealers or thread locker as specified in exploded view.

Apply torques as specified in exploded view.

Position the disc springs and thrust washer onto the starter drive assembly shaft as per following illustration.



TYPICAL
1. *Thrust washer*
2. *Disc springs*
3. *Starter drive assembly*

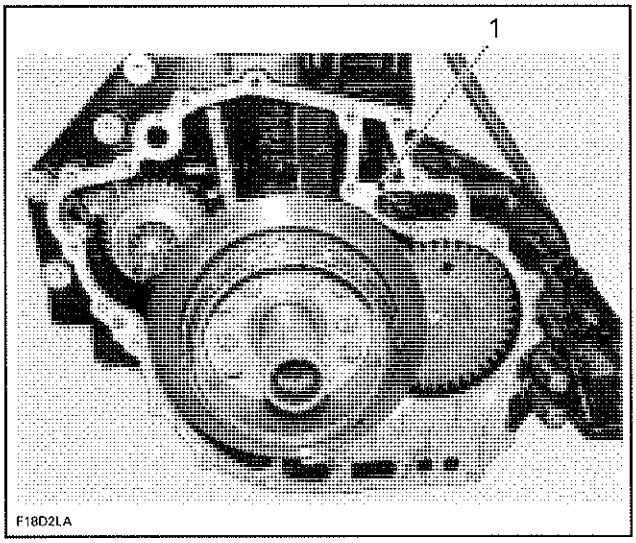
NOTE: When installing a new starter drive assembly, oil the shaft and gear splines with engine oil.

Install a new PTO housing gasket.

NOTE: When installing the PTO housing, you will need to rotate the oil/water pump shaft slightly to align it with the balance shaft for proper insertion.

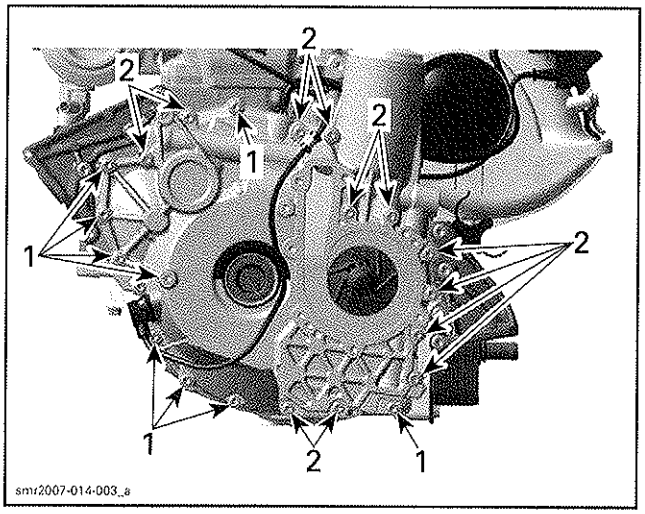
CAUTION: Pay particular attention to the PTO housing gasket alignment to ensure that it does not get pinched, or slide out of its surface contact area. Never force housing when installing it. If there is a strong resistance, remove housing and check oil/water pump shaft alignment and starter gear drive alignment.

CAUTION: Ensure the starter drive gear shaft is well aligned when engaging it in the PTO housing needle bearing.



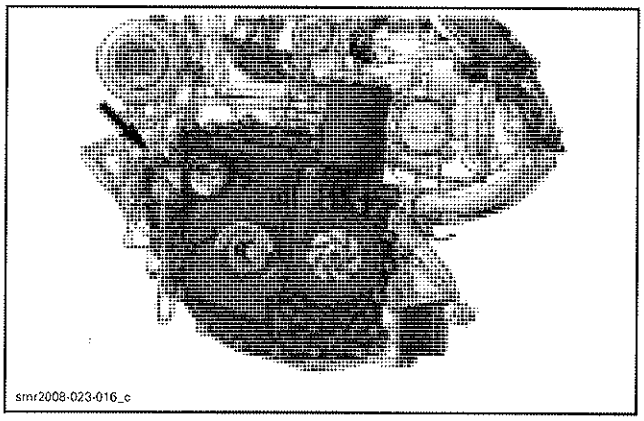
1. *Pay attention that gasket remains properly positioned on this surface*

Refer to the following illustration to identify the locations of the various housing screws.



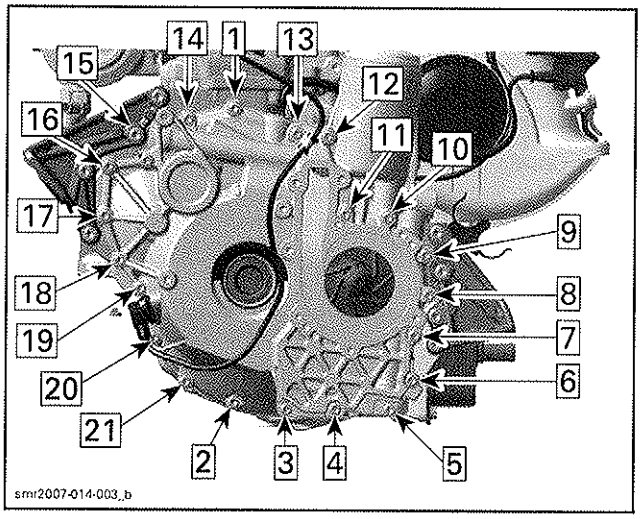
TYPICAL
1. Screws M6 x 35
2. Screws M6 x 85

NOTE: Install the CPS harness retaining clamp at the position noted during the PTO housing removal.



1. CPS harness retaining clamp

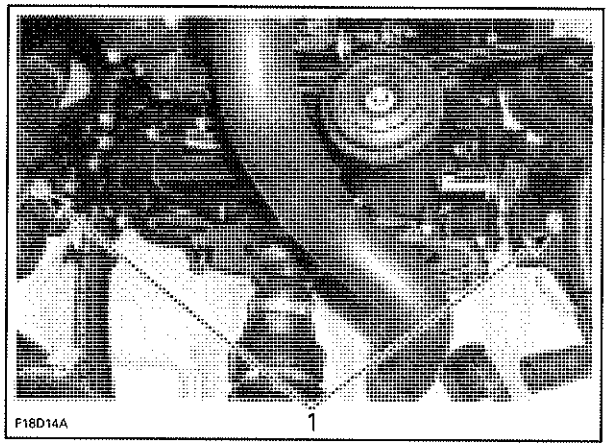
Install the PTO housing screws finger tight, then torque them as per sequence numbered in the following illustration.



Reinstall LH engine support. Apply Loctite 243 (blue) (P/N 293 800 060) on screw threads then torque to 24 N•m (18 lbf•ft).

Remove block under engine.

Install the engine mount thru-bolts loosely.



1. Rear engine support thru-bolts

Install the engine mount shims on each mount as noted prior to removal and carry out an engine alignment, refer to the *ENGINE* section.

CAUTION: An engine alignment procedure must be carried out to ensure proper engine alignment or severe component damage may occur.

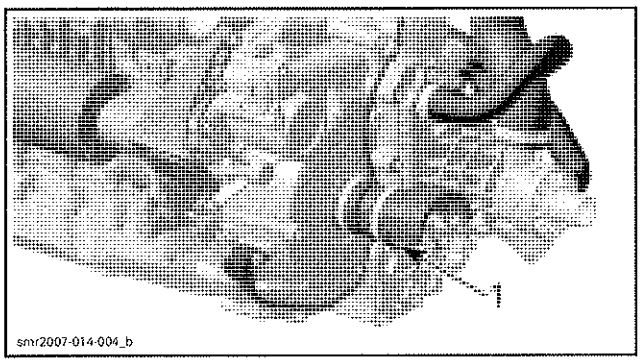
Install all remaining parts, reconnect hoses and electrical connectors. Refer to applicable sections for procedures and specific details (torques, service products or special instructions).

Refill engine with oil and cooling system with coolant. Refer to *LUBRICATION SYSTEM* and *COOLING SYSTEM* sections.

PTO SEAL

PTO Seal Inspection

Inspect the PTO seal and O-rings on the PTO housing. If brittle, hard or damaged, or if you see a sign of oil leakage, replace it.



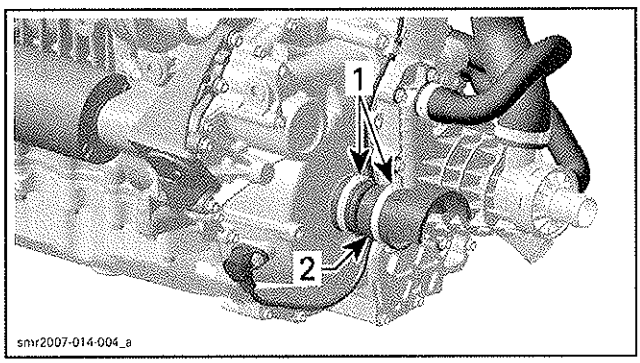
1. PTO seal

PTO Seal Removal

Place rags under PTO housing to prevent spillage. If spillage occurs, clean immediately with pulley flange cleaner (P/N 413 711 809) to prevent oil stains.

NOTE: Note position of seal and orientation of Oetiker clamp for installation.

Remove the Oetiker clamp retaining the seal to the PTO housing.



TYPICAL
1. Oetiker clamps
2. PTO seal

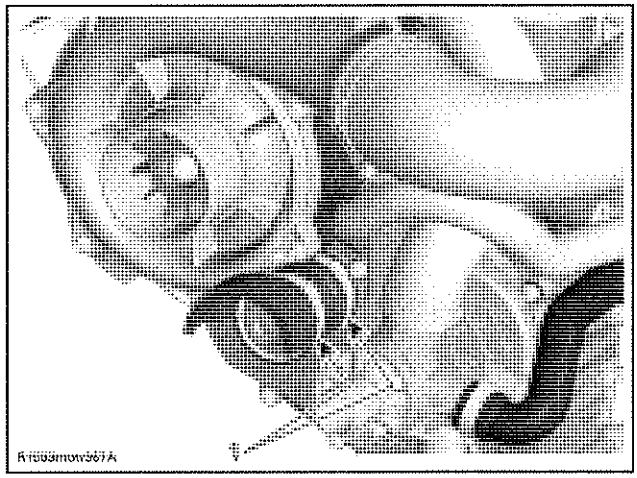
Pull seal from PTO housing.

PTO Seal Installation

Insert a new Oetiker clamp over the seal.

Push seal onto PTO housing. Be sure to align seal and clamp as noted at removal.

CAUTION: When installing PTO seal on supercharged engines, make sure to position the Oetiker clamps as illustrated.



1. Oetiker clamps

Crimp Oetiker clamp using Oetiker pliers (P/N 295 000 070).

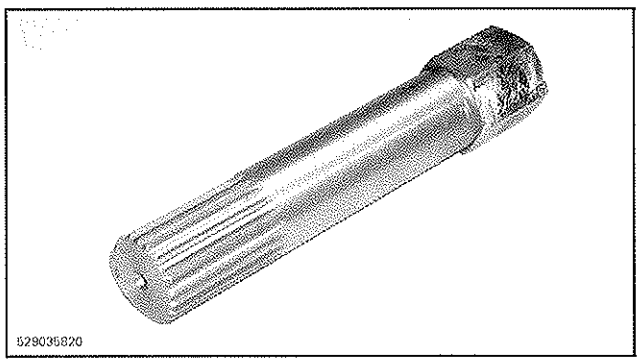
PTO COUPLING

PTO Coupling Removal

Lock crankshaft. Refer to *CYLINDER BLOCK* section for procedure.

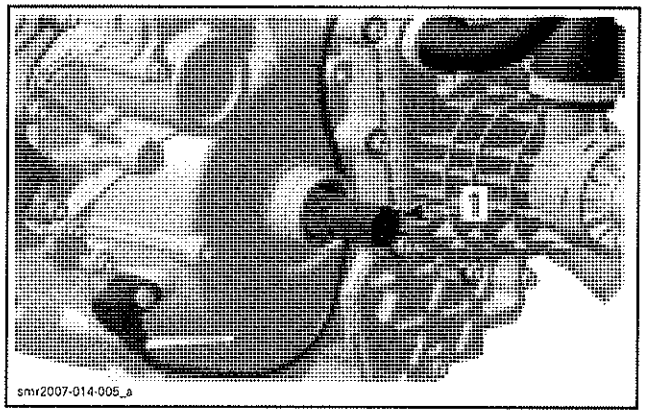
Remove PTO seal as described in previous procedure.

Unscrew coupling from crankshaft using impeller removal tool (P/N 529 035 820).



IMPELLER REMOVAL TOOL

CAUTION: Apply engine oil to the removal tool to protect the seal located within the PTO coupling.



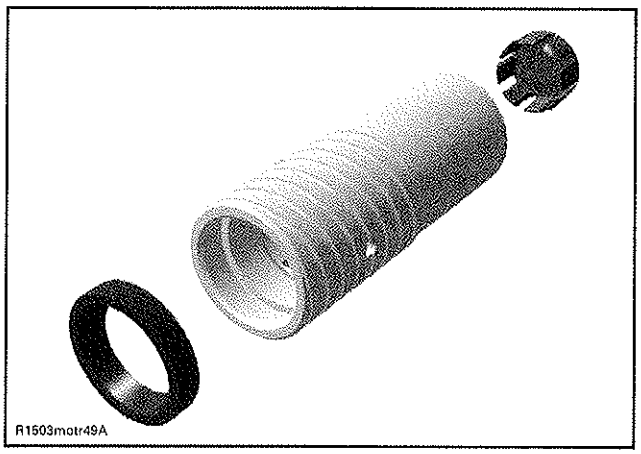
TYPICAL
1. Impeller removal tool

NOTE: PTO coupling has left hand threads.

PTO Coupling Inspection

Inspect seal within coupling, if it is brittle, cracked or hard, replace it.

Check coupling for worn or damaged splines. Replace as required.

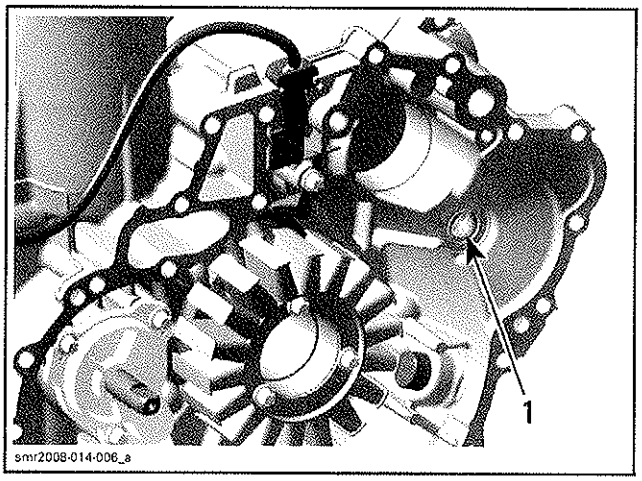


PTO Coupling Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Apply Loctite 648 (P/N 413 711 400) on threads and torque PTO coupling to 250 N•m (184 lbf•ft).

STARTER DRIVE BEARING



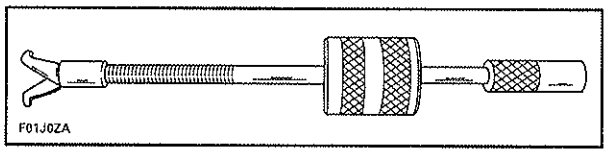
1. Starter drive bearing

Starter Drive Bearing Removal

Remove PTO housing, see procedure in this section.

Remove starter drive bearing from PTO housing using the following suggested tool or equivalent:

– Snap-On hammer puller including:
  - Handle CJ93-1
  - Hammer CJ125-6
  - Claws CJ93-4.



Close puller claws and insert them through the bearing until they bottom out in the PTO housing.

Turn puller shaft clockwise to open claws until they are tight against bearing.

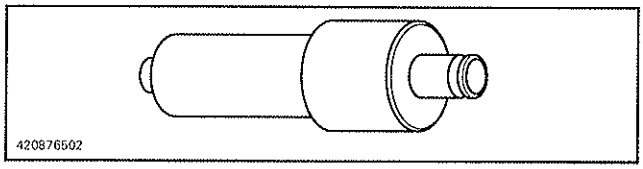
CAUTION: Puller claws must not come into contact with the inner diameter of the bearing bore in the PTO housing.

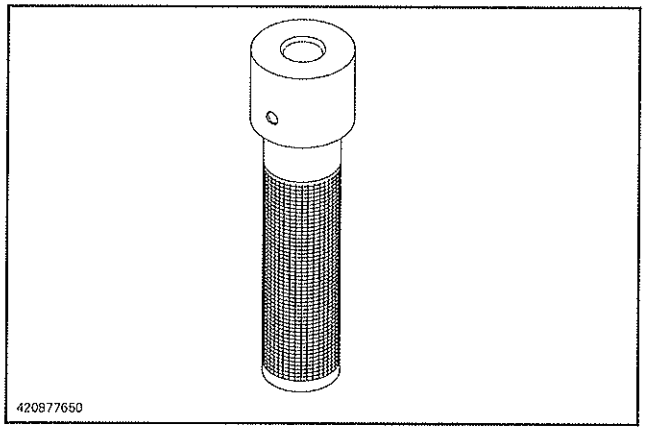
Slide puller hammer outwards to extract bearing from PTO housing. Retighten claws as necessary to maintain them tight against bearing.

Starter Drive Bearing Installation

Prior to assembly grease starter drive bearing with Isoflex grease Topas NB 52 (P/N 293 550 021).

Install starter drive bearing in PTO housing using starter drive seal pusher (P/N 420 876 502) and handle (P/N 420 877 650).

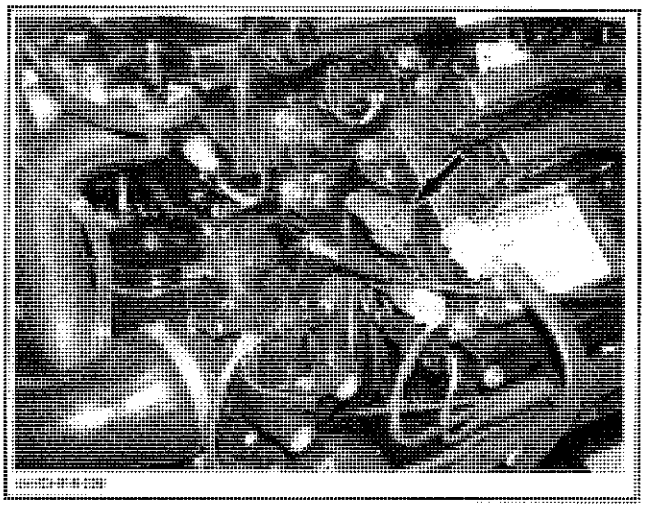




STATOR

Stator Output Voltage Test

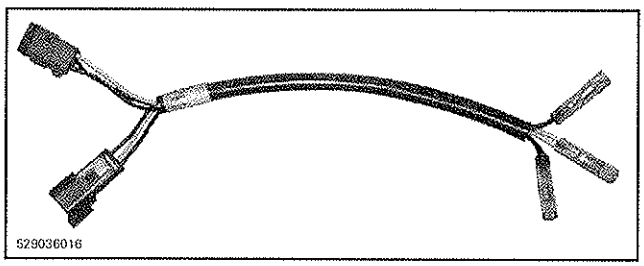
Disconnect the magneto wiring harness connector.



TYPICAL – ENGINE COVER REMOVED FOR CLARITY OF ILLUSTRATION

Install the 3-pin magneto harness adapter (P/N 529 036 016) onto the magneto connector.

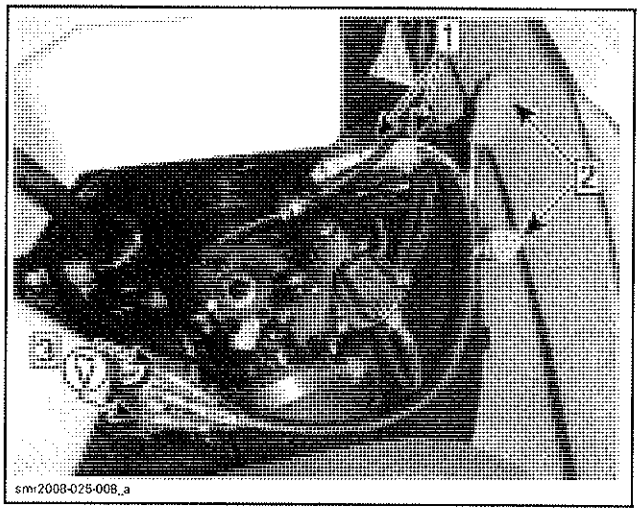
NOTE: Do not connect the magneto harness adapter to the vehicle harness connector.



Set multimeter to Vac scale.

Start engine.

Connect multimeter between each pair of YELLOW wires as per following table.



STATOR OUTPUT VOLTAGE TEST (ENGINE COVER INSTALLED)
Step 1: Connect adapter to magneto stator connector
Step 2: Leave vehicle harness disconnected
Step 3: Measure AC voltage between each pair of wires

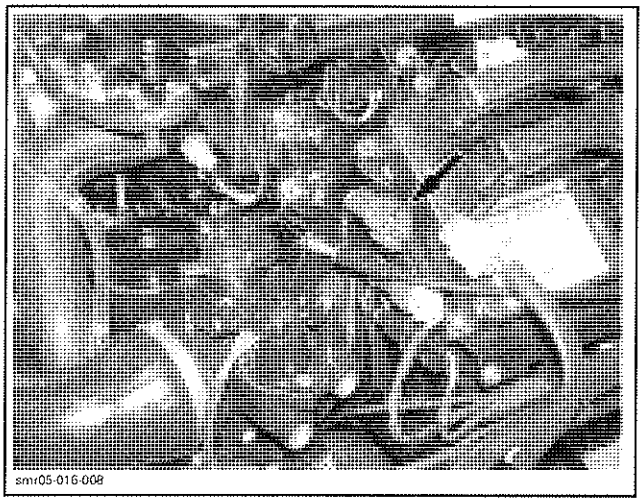
Read voltage as per following table.

STATOR OUTPUT VOLTAGE TEST		
TEST ENGINE SPEED	TERMINAL	VOLTAGE (AC)
4000 RPM	1 and 2	Approx. 50 Vac
	1 and 3	
	2 and 3	

If voltage is lower than specification, carry out a *STATOR CONTINUITY TEST* and a *STATOR INSULATION TEST*. See procedures in this section.

Stator Continuity Test

Disconnect the magneto wiring harness connector.



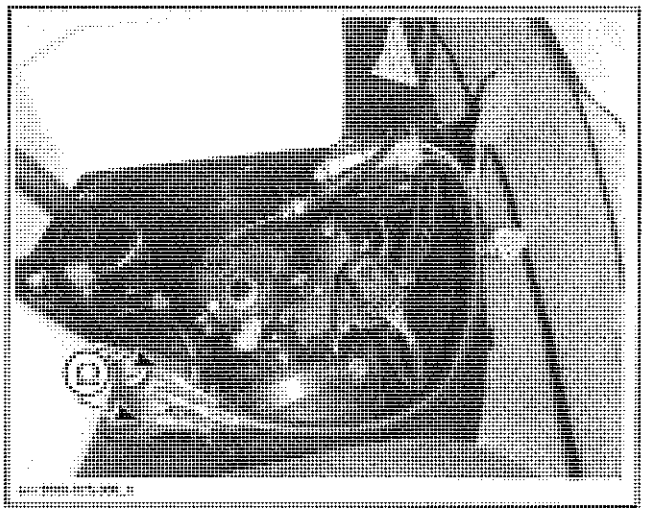
TYPICAL – ENGINE COVER REMOVED FOR CLARITY OF ILLUSTRATION

Install the 3-pin magneto harness adapter (P/N 529 036 016) onto the magneto connector.

NOTE: Do not connect the magneto harness adapter to the vehicle harness connector.

Set multimeter to Ω.

Connect multimeter between each pair of YELLOW wires.



STATOR CONTINUITY TEST (ENGINE COVER INSTALLED)

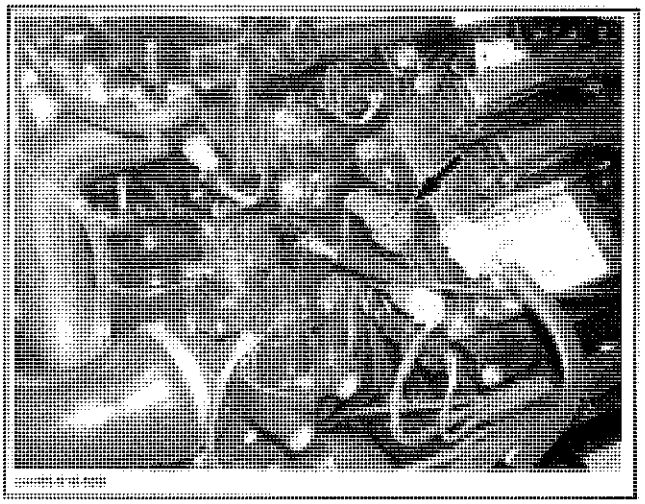
Read resistance.

STATOR CONTINUITY TEST	
TERMINAL	RESISTANCE @ 20°C (69°F)
1 and 2	0.1 - 1 Ω
1 and 3	
2 and 3	

If any result is out of specification, replace stator.

Stator Insulation Test

Disconnect the magneto wiring harness connector.



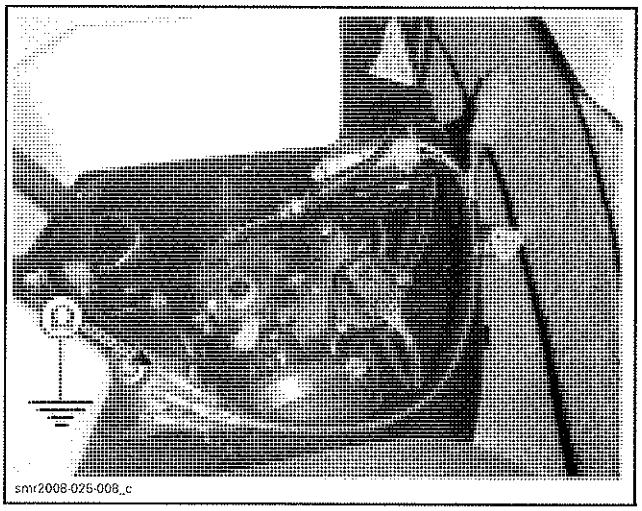
TYPICAL – ENGINE COVER REMOVED FOR CLARITY OF ILLUSTRATION

Install the 3-pin magneto harness adapter (P/N 529 036 016) onto the magneto connector.

NOTE: Do not connect the magneto harness adapter to the vehicle harness connector.

Set multimeter to Ω.

Connect multimeter between any YELLOW wire and engine ground.



STATOR INSULATION TEST (ENGINE COVER INSTALLED)

Read resistance.

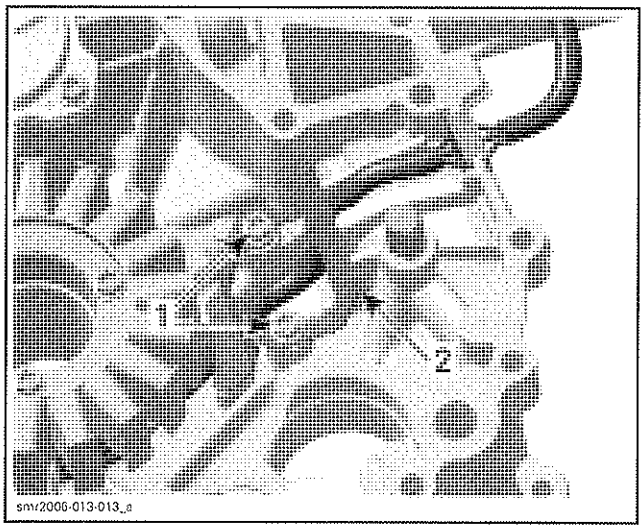
STATOR INSULATION TEST	
TERMINAL	RESISTANCE @ 20°C (69°F)
Any YELLOW wire and engine ground	Infinity (open circuit)

If there is a resistance or continuity to engine ground, the stator coils and/or the wiring is grounded and need to be repaired or replaced.

Stator Removal

Remove PTO housing, see procedure in this section.

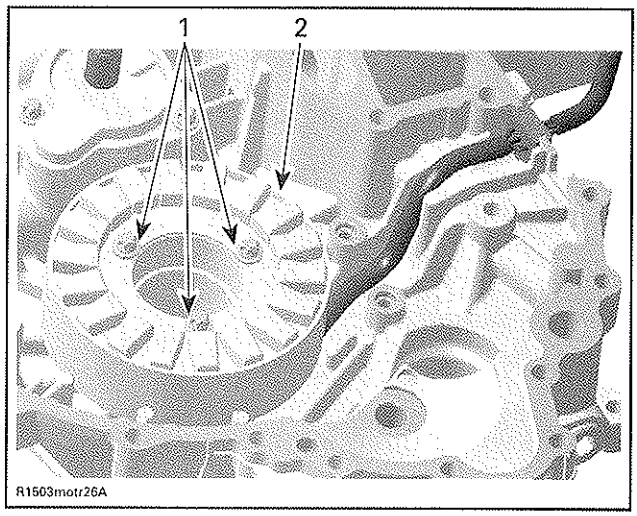
Remove stator cable holding plate from PTO housing.



TYPICAL
1. Screws
2. Holding plate

Remove stator retaining screws.

Remove stator from PTO housing.

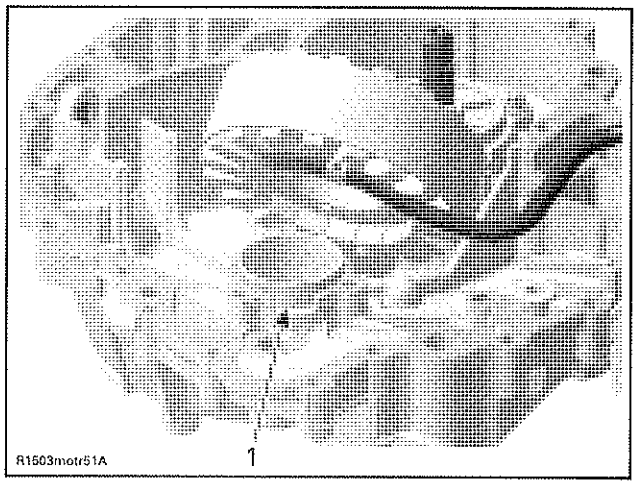


TYPICAL
1. Stator screws
2. Stator

Stator Installation

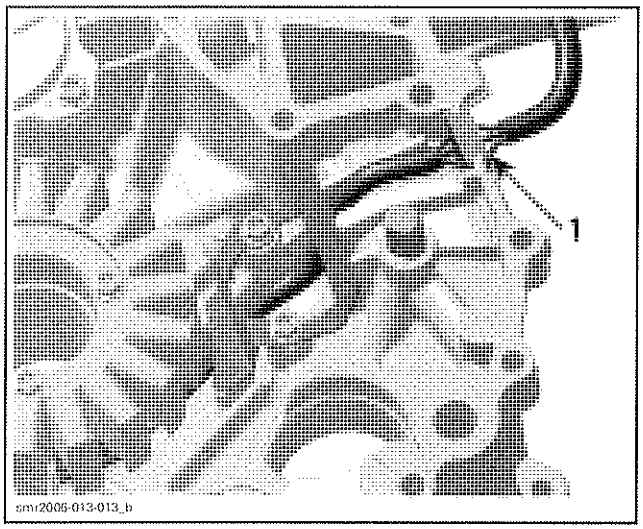
For installation, reverse the removal procedure. However, pay attention to the following.

NOTE: The position of the stator in the PTO housing is determined by a key on the stator and a notch in the magneto housing.



TYPICAL
1. Notch for stator

Place the stator cable rubber grommet in the notch provided in the PTO housing.



TYPICAL
1. Stator cable grommet

Apply Loctite 243 (blue) (P/N 293 800 060) on the stator screw threads and stator cable holding plate screw threads.

Torque stator and cable holding plate screws to 10 N•m (89 lbf•**in**).

Install PTO housing as per procedures in this section.

ROTOR AND TRIGGER WHEEL

Rotor and Trigger Wheel Inspection

Inspect rotor and trigger wheel condition. Pay particular attention to the inside of the rotor for cracks, rub marks or discoloration. If damaged, replace faulty part.

Check the trigger wheel for bent teeth using the following procedure.

Install a dial indicator on crankcase casting.

Position the gauge on a tooth and set it to zero (0). Be sure to lock the indicator dial to prevent movement of the dial during the remainder of the procedure.

Draw a line on the tooth to indicate it as the first tooth measured (reference tooth).

Gently lift the gauge contact point off the tooth and rotate the flywheel to the next tooth.

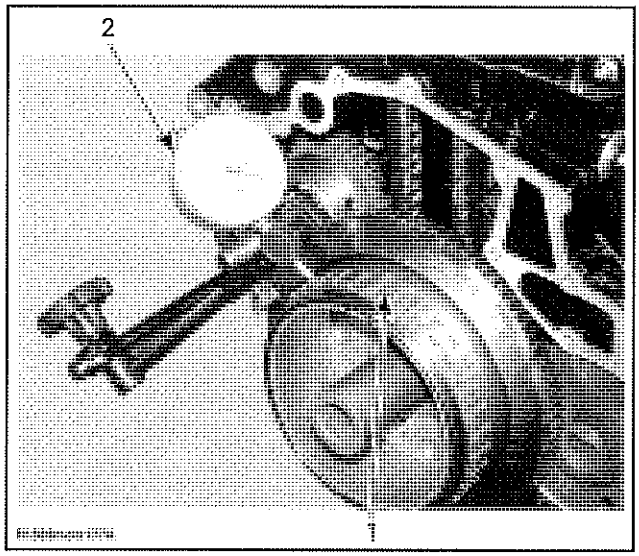
NOTE: When lifting contact point off the tooth for flywheel rotation, be careful not to move gauge position or test readings taken on next tooth will not be accurate with reference to the reference tooth.

Gently set the gauge contact point on the next tooth and read the dial indicator.

Repeat this procedure taking a reading at each tooth.

Recheck reading on reference tooth to ensure gauge has not changed position (gauge should still read zero).

NOTE: The maximum allowable difference between teeth is 0.15 mm (.006 in). If the reading exceeds the maximum allowable difference, straighten the tooth or replace the trigger wheel.



1. Trigger wheel
2. Dial indicator

Properly reinstall cover.

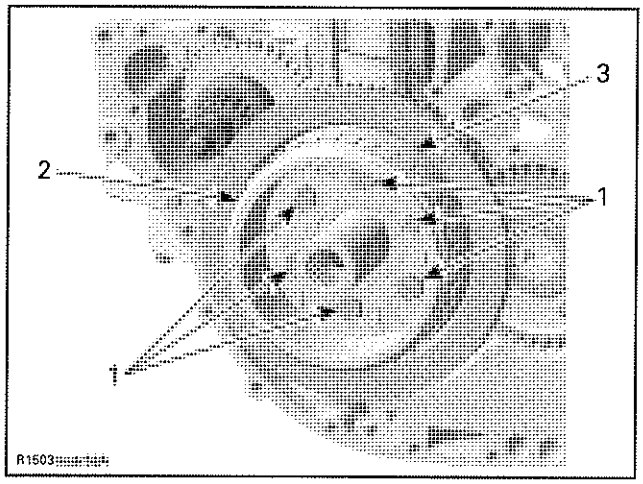
Rotor and Trigger Wheel Removal

Lock crankshaft, refer to *CYLINDER BLOCK* section for procedure.

Remove PTO housing, see procedure in this section.

Remove and discard the magneto rotor retaining screws.

Pull rotor and trigger wheel off crankshaft end.



TYPICAL
1. *Rotor retaining screws*
2. *Rotor*
3. *Trigger wheel*

Rotor and Trigger Wheel Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Align the trigger wheel to the crankshaft using the location pin on the crankshaft end.

NOTE: Do not reuse or apply a threadlocker to the old rotor screws. These are stretch screws that are one time use only.

CAUTION: Always use new OEM screws when installing the rotor. Not replacing rotor screws may lead to screw failure and engine damage.

Torque rotor screws to 15 N•m (133 lbf•**in**) using a crisscross pattern.

With the specified torque applied to the rotor screws, tighten the screws an additional 50° of rotation using a torque angle gauge.

RING GEAR

Ring Gear Removal

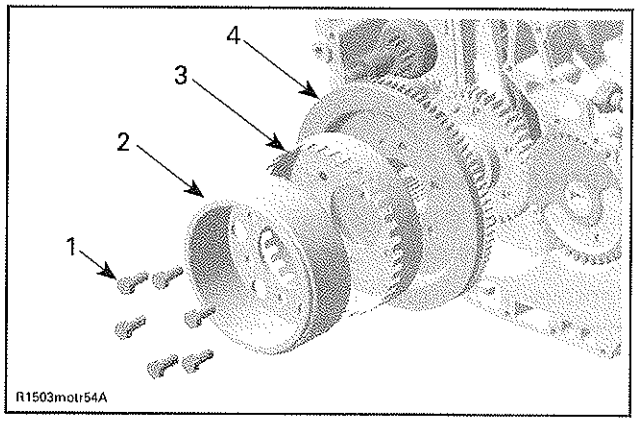
Lock crankshaft. Refer to *CYLINDER BLOCK* section for procedure.

Remove the PTO housing cover, see procedure in this section.

Remove and discard the magneto rotor retaining screws.

Pull rotor and trigger wheel off crankshaft end.

Pull rotor, trigger wheel, and ring gear off crankshaft end.



TYPICAL
1. *Magneto rotor retaining screws*
2. *Rotor*
3. *Trigger wheel*
4. *Ring gear*

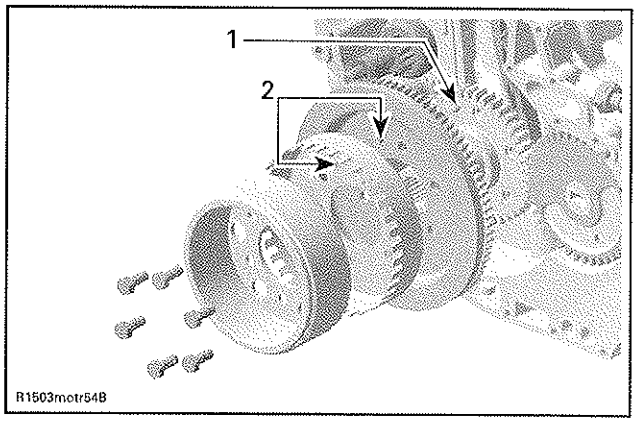
Ring Gear Inspection

Inspect ring gear for damages. Pay particular attention to teeth condition. If badly worn, cracked, or broken teeth are found, replace ring gear.

Ring Gear Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Align the ring gear and trigger wheel to the crankshaft using the location pin on the crankshaft end.



TYPICAL
1. *Location pin*
2. *Location pin holes*

NOTE: Do not reuse or apply a threadlocker to the old rotor screws, always install new screws that have a threadlocker already applied. These are stretch screws that are one time use only.

Install new rotor screws and torque them to 15 N•m (133 lbf•ft) in a crisscross pattern.

CAUTION: Always install new OEM screws. Not replacing rotor screws may lead to engine damage and failure.

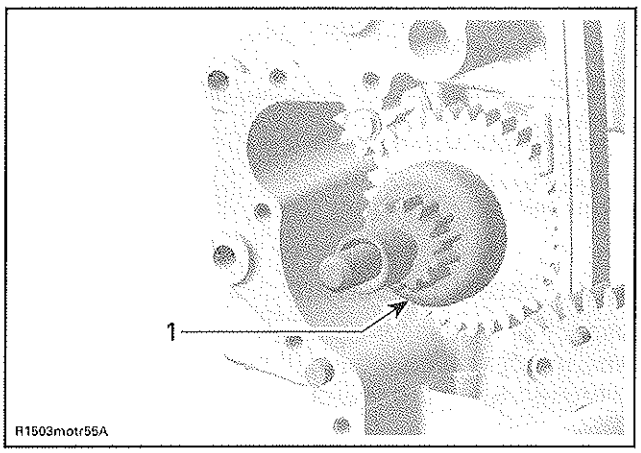
Finish tightening screws with an additional 50° rotation with a torque angle gauge.

STARTER DRIVE

Starter Drive Removal

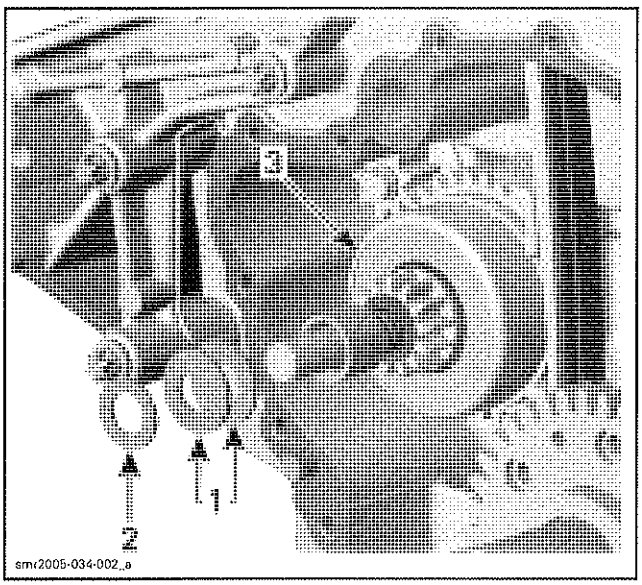
Remove the PTO housing and ring gear as described in this section.

Remove starter drive assembly.



TYPICAL
1. Starter drive assembly

CAUTION: Be careful not to lose the disc springs and thrust washer located on the starter drive shaft.



TYPICAL
1. Disc springs
2. Thrust washer
3. Starter drive gear

Starter Drive Inspection

Inspect all starter drive parts for excessive wear, cracks and other defects. Pay attention to the condition of the drive gear teeth.

Ensure proper operation of the starter drive sprag clutch.

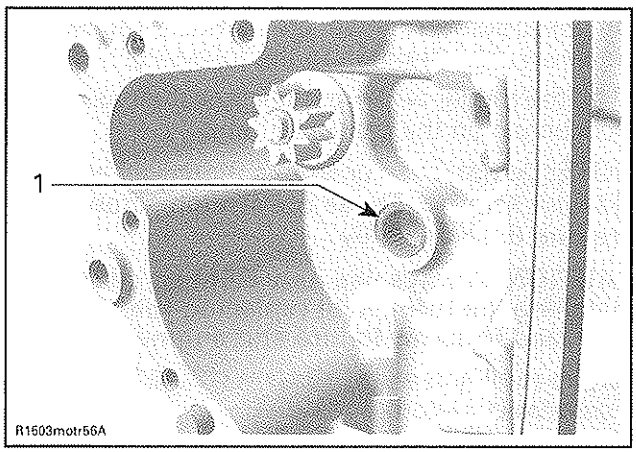
If any part of the assembly shows signs of abnormal wear, cracks, broken teeth or malfunction (sprag clutch), replace the faulty part.

Starter Drive Installation

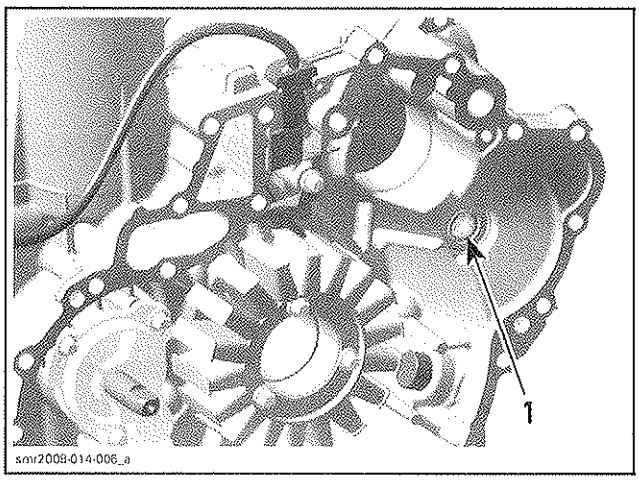
For installation, reverse the removal procedure. However, pay attention to the following.

NOTE: When installing a new starter drive assembly, oil the shaft, gear teeth and splines with engine oil.

Apply Isoflex grease Topas NB 52 (P/N 293 550 021) on the starter drive bearing located in the cylinder block and in the PTO housing.



TYPICAL
1. Starter drive bearing (cylinder block)



TYPICAL
1. Starter drive bearing (PTO housing)

CAUTION: Be sure not to forget the disc springs and washer on the starter drive shaft when re-assembling.

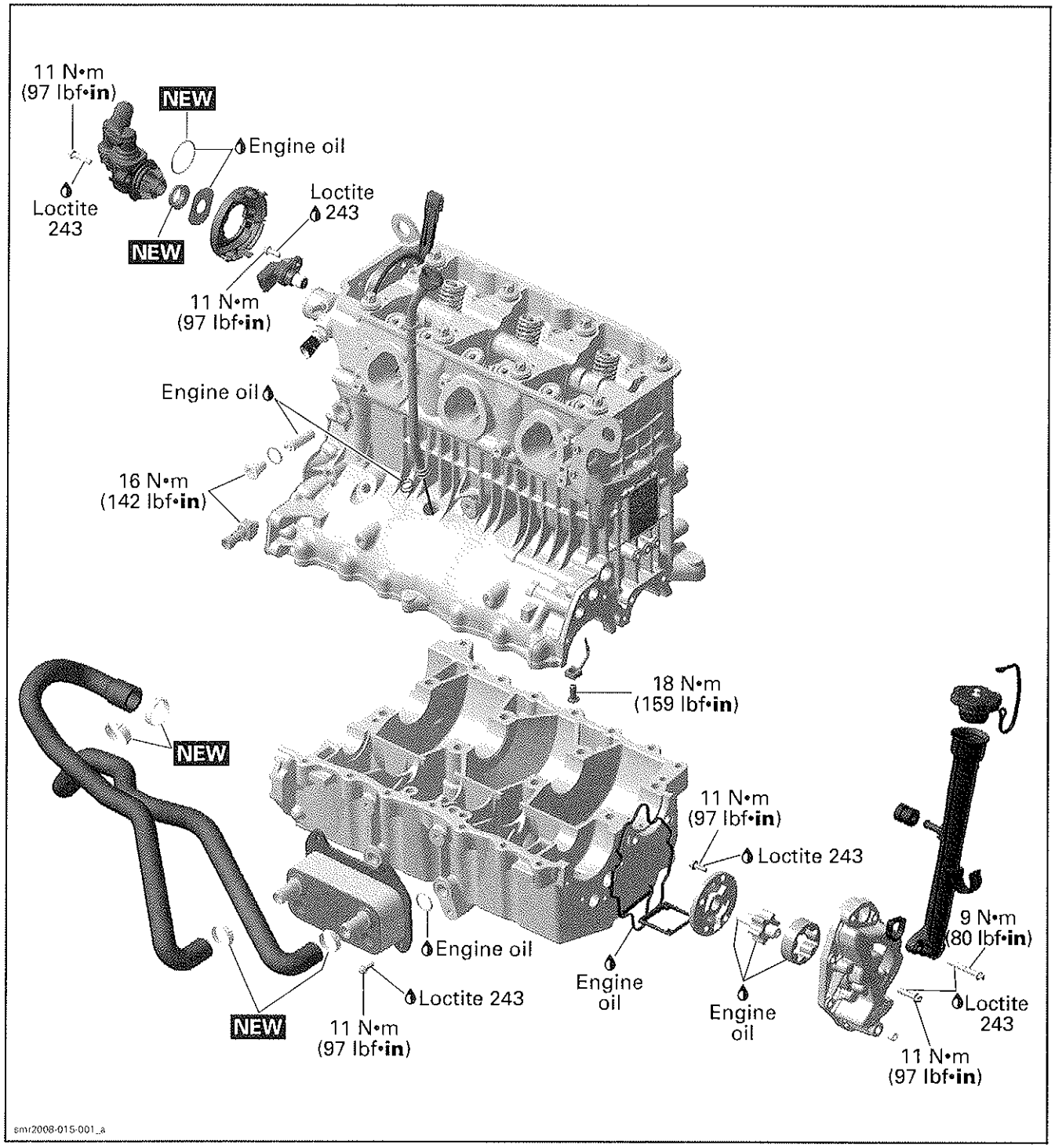
LUBRICATION SYSTEM

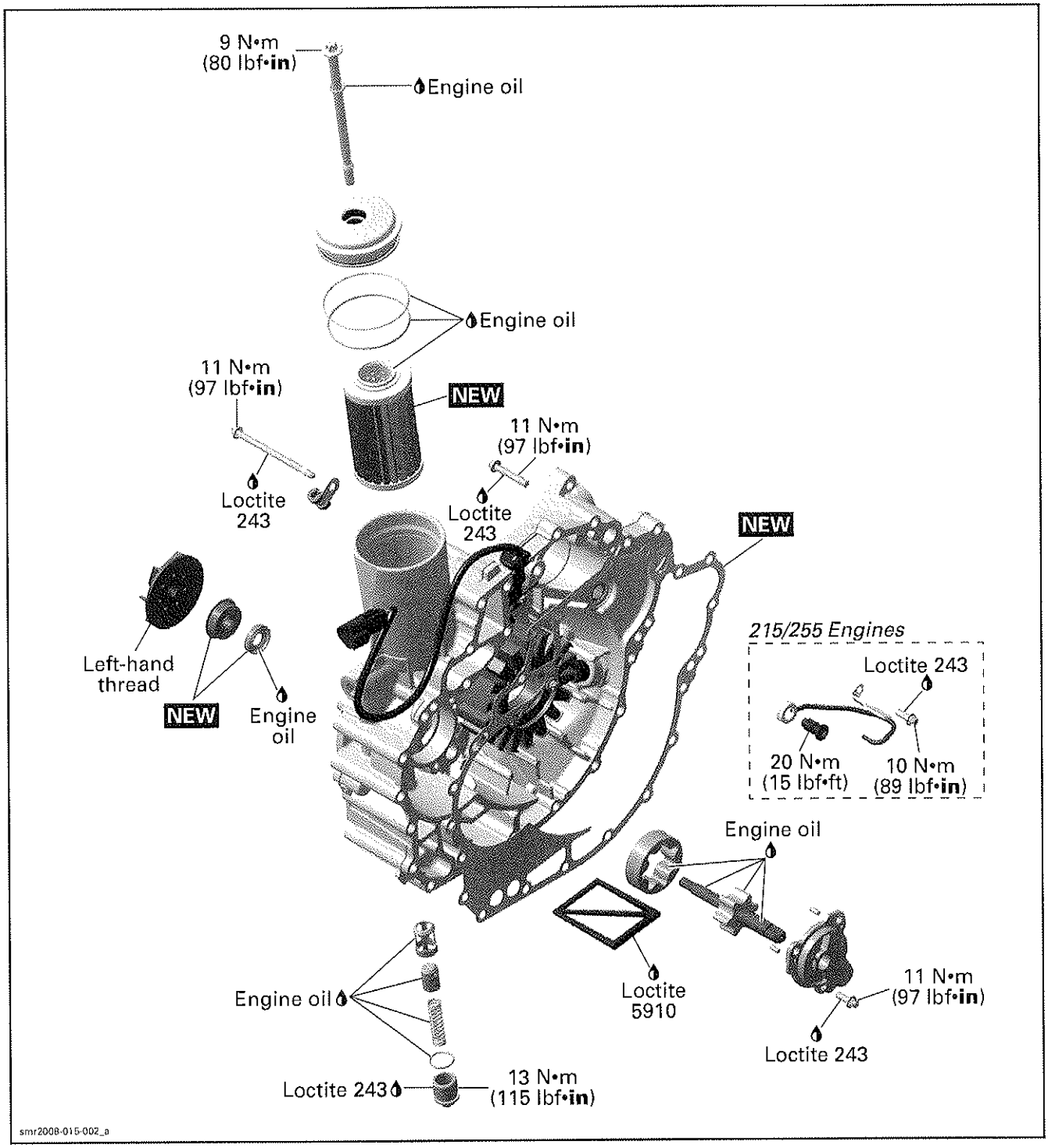
SERVICE TOOLS

Description	Part Number	Page
hose adaptor	529 035 652	112
oil pressure gauge	529 035 709	112
oil seal protector	529 035 822	120
rotary seal pusher	529 035 823	119–120
suction pump	529 035 880	111
oil filter cover separator	529 036 038	111
oil filter cover puller	529 036 057	111
supercharger oil spray jet tool	529 036 134	123

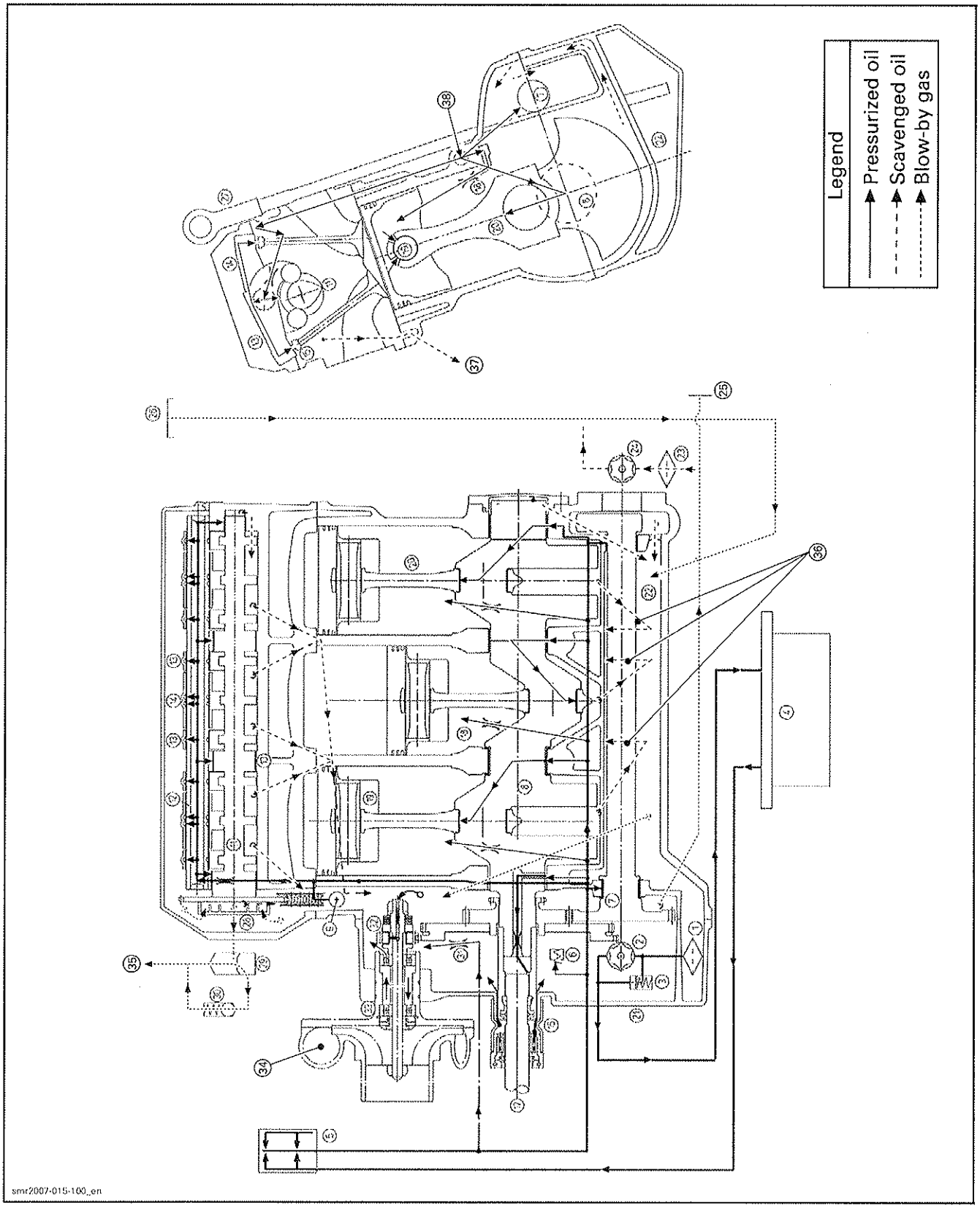
SERVICE PRODUCTS

Description	Part Number	Page
XP-S 10W 40 mineral oil	219 700 346	109
Super Lube grease	293 550 030	112
XP-S 5W 40 synthetic oil	293 600 039	109
Loctite 243 (blue)	293 800 060	115, 117, 120, 122–123, 126–127
Loctite 5910	293 800 081	114
pulley flange cleaner	413 711 809	112, 115, 121





ENGINE OIL FLOW



1. Oil strainer (pressure pump)
2. Pressure pump
3. Pressure relief valve
4. Oil cooler
5. Oil filter
6. Oil pressure switch
7. Balance shaft
8. Crankshaft
9. Hydraulic chain tensioner
10. Cylinder head
11. Camshaft
12. Rocker arm axle
13. Rocker arm (exhaust)
14. Rocker arm (intake)
15. Hydraulic valve lifter
16. PTO seal
17. Drive shaft
18. Piston cooling
19. Piston pin
20. Connecting rod
21. PTO cover
22. Oil tank
23. Oil strainer (scavenge pump)
24. Scavenge pump
25. Oil drainage (PTO cover)
26. Oil filler cap
27. Oil dipstick
28. Oil separator
29. TOPS valve
30. Pressure relief valve
31. Oil spray nozzle
32. Friction clutch
33. Supercharger bearing (if so equipped)
34. Supercharger (if so equipped)
35. To air intake silencer
36. Scavenge of oil and blow-by gas
37. Into PTO cover
38. From oil filter

GENERAL

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

MAINTENANCE

ENGINE OIL

Recommended Oil

130 and 155 Engines

Use the 10W 40 grade mineral or synthetic motor oil meeting the requirements for API service classification SM, SL or SJ. Always check the API service label certification on the oil container, it must contain at least one of the above standards.

The XP-S 10W 40 mineral oil (P/N 219 700 346) and the XP-S 5W 40 synthetic oil (P/N 293 600 039) meets the above requirements.

215 and 255 Engines

Use the XP-S 10W 40 mineral oil (P/N 219 700 346) or a BRP approved equivalent.

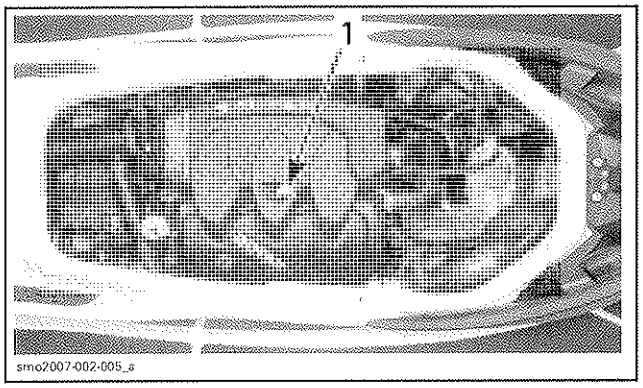
The same oil lubricates both the engine and the supercharger clutch. The XP-S 10W 40 mineral oil (P/N 219 700 346) has been thoroughly tested to be free of any additives that could impair the functionality of the supercharger clutch.

Use of any oil that is not recommended in the 215 and 255 HP engines may void BRP's limited warranty.

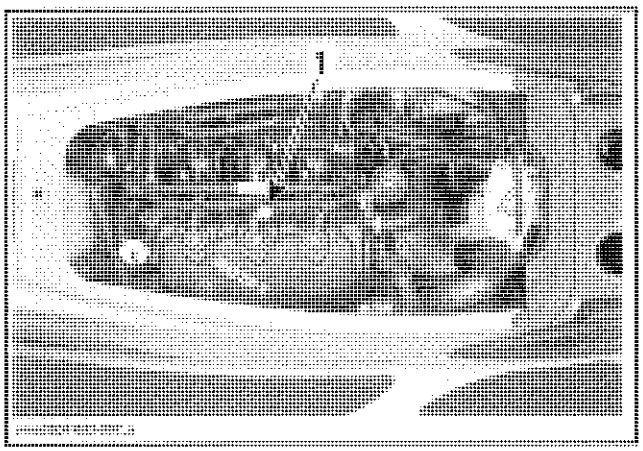
CAUTION: NEVER use synthetic oil in 215 and 255 HP engines. This would impair the proper operation of the supercharger clutch. Do not add any additives to the recommended oil. Beware that mineral oil not recommended by BRP may also contain additives (friction modifiers) that may cause inappropriate slippage of the supercharger and eventually lead to premature wear. For this reason, the XP-S 10W 40 mineral oil (P/N 219 700 346) or a BRP approved equivalent are the only recommended oils.

Oil Level Verification

CAUTION: Check level frequently and refill if necessary. Do not overfill — it would make the engine smoke and reduce its power. Operating the engine with an improper level may severely damage engine. Wipe off any spillage.



ALL MODELS EXCEPT GTI MODELS
1. *Oil dipstick*



GTI MODELS
1. *Oil dipstick*

Check the oil level as follows:

NOTE: It is of the utmost importance to follow this procedure in order to obtain an accurate reading of the engine oil level.

- Watercraft must be level. Check oil level either with watercraft in water or out of water.
- If the watercraft is out of water, link a garden hose to the hose adapter. Refer to *STORAGE PROCEDURE* in *MAINTENANCE* section and follow the procedures.

CAUTION: Never run engine without supplying water to the exhaust cooling system when watercraft is out of water. Failure to cool exhaust cooling system may severely damage engine and/or exhaust system.

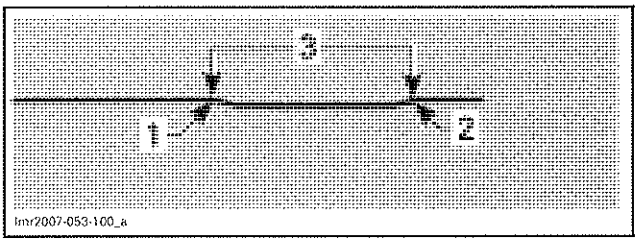
- Warm-up engine then let idle for 30 seconds before stopping.
- Stop engine.
- Wait at least 30 seconds then pull dipstick out and wipe clean.

⚠ WARNING

Engine oil may be hot. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

CAUTION: Never run engine longer than 5 minutes. Drive line seal has no cooling when watercraft is out of water.

- Reinstall dipstick, push in completely.
- Remove dipstick and read oil level. It should be between marks.



1. *Full*
2. *Add*
3. *Operating range*

Otherwise, add oil until its level is between marks as required.

To add oil, unscrew oil cap. Place a funnel into the opening and add the recommended oil to the proper level. Do not overfill.

Oil Replacement

NOTE: Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

Bring engine to its normal operating temperature.

CAUTION: Never run engine without supplying water to the exhaust system when watercraft is out of water. Failure to cool exhaust system may severely damage exhaust system.

CAUTION: Never run engine longer than 5 minutes. Drive line seal has no cooling when watercraft is out of water.

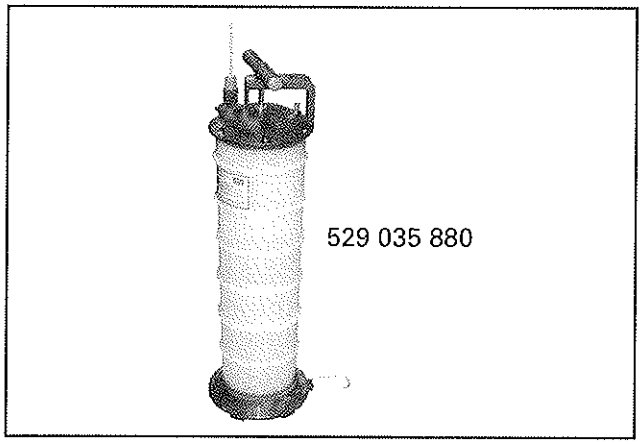
Run engine for 10 seconds at 4000 RPM and shut it off at this RPM. This will move oil from PTO housing to oil tank to allow maximum oil draining.

Remove oil filler cap and dipstick.

⚠ WARNING

Engine oil may be hot. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

Using the suction pump (P/N 529 035 880), siphon oil through dipstick hole.



CAUTION: Never crank or start engine when suction pump tube is in dipstick hole. Never start engine when there is no oil in engine.

NOTE: So that suction pump tube is located at the proper height to siphon oil, it is suggested to put some electrical tape on tube at 475 mm (18.7 in) from its end. Then, insert the tube until you reach the tape.

1. Suction pump
2. Suction pump tube in dipstick hole

Pull suction pump tube out of dipstick hole then crank engine (do not start) while in engine drown mode (fully depress throttle lever and HOLD, then crank engine).

Crank engine for 10 seconds. Siphon oil again. Repeat the crank-siphon cycle 2 - 3 times.

Refill engine with the recommended oil, see *RECOMMENDED OIL* above in this section.

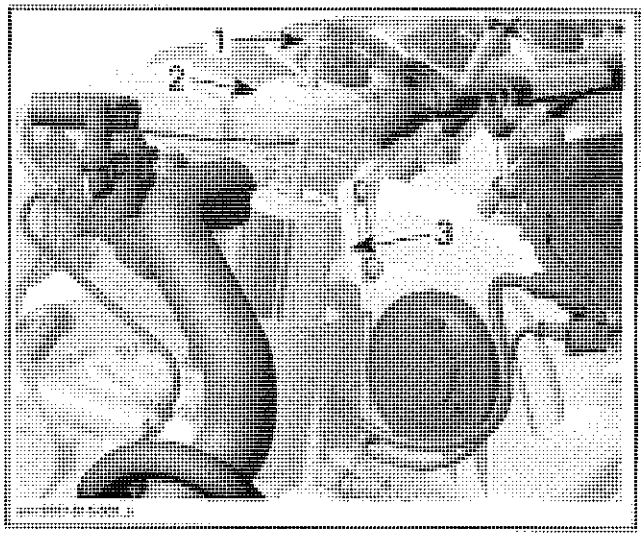
Reinstall oil filler cap and dipstick.

Replace *OIL FILTER*, see procedure further in this section.

OIL FILTER

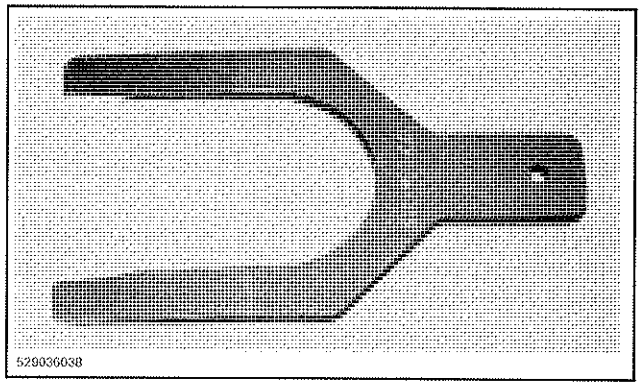
Oil Filter Removal

Remove:
- Oil filter screw
- Oil filter cover
- Oil filter.

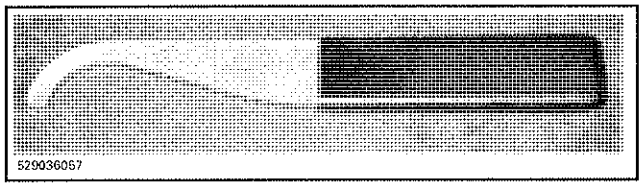


TYPICAL
1. Oil filter screw
2. Oil filter cover
3. Oil filter

NOTE: If the oil filter cover is hard to remove, use the oil filter cover separator (P/N 529 036 038) and the oil filter cover puller (P/N 529 036 057).



OIL FILTER COVER SEPARATOR



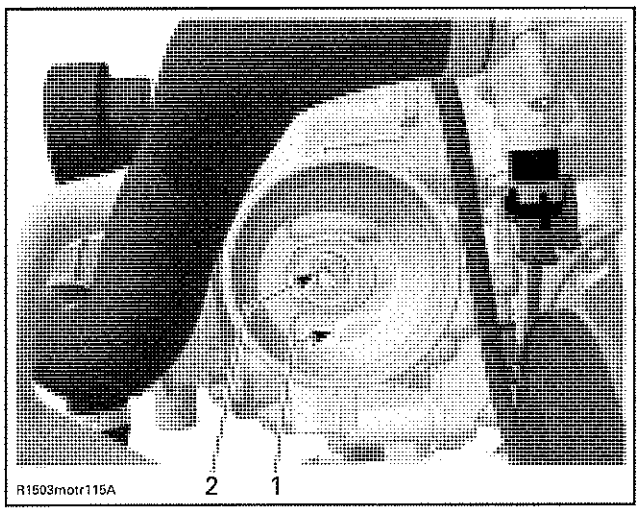
OIL FILTER COVER PULLER

Place rags in filler area to prevent spillage. If spillage occurs, clean immediately with the pulley flange cleaner (P/N 413 711 809) to prevent stains.

Oil Filter Inspection

Check oil filter cover O-ring and oil filter screw O-ring, change if necessary.

Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



TYPICAL
1. *Inlet bore from the oil pump to the oil filter*
2. *Outlet bore to the engine oil providing system*

Oil Filter Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Install a NEW oil filter.

Install O-ring on oil filter cover.

Apply engine oil on filter ring, filter cover O-rings and on oil filter screw O-ring.

NOTE: In salt water area, it is recommended to coat mating surface of cover with Super Lube grease (P/N 293 550 030).

Torque oil filter screw to 9 N•m (80 lbf•**in**).

INSPECTION

ENGINE OIL PRESSURE

NOTE: Depending on the oil pressure switch, the threshold value to send a signal of low oil pressure may vary from a minimum of 180 kPa (26 PSI) to a maximum of 220 kPa (32 PSI).

Bring engine to its normal operating temperature.

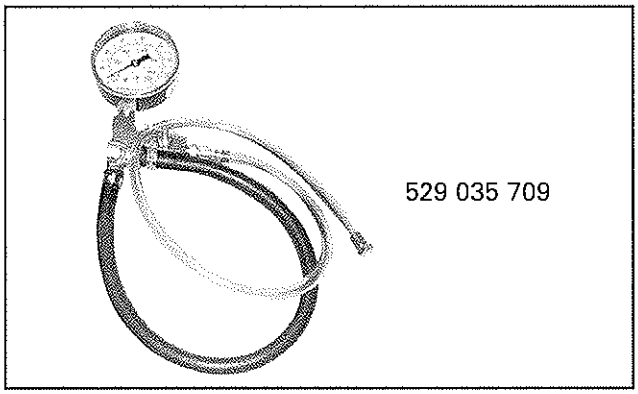
⚠ WARNING

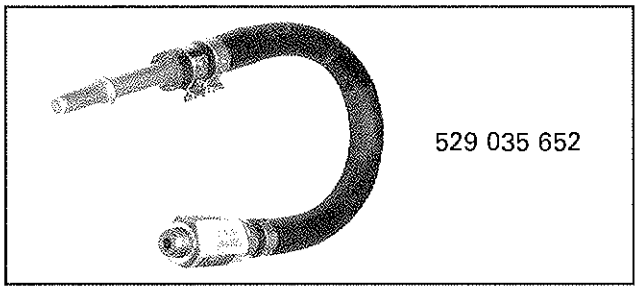
Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

CAUTION: Never run engine without supplying water to the exhaust system when watercraft is out of water. Failure to cool exhaust system may severely damage exhaust system.

CAUTION: Never run engine longer than 5 minutes. Drive line seal has no cooling when watercraft is out of water.

The oil pressure is measured using the oil pressure gauge (P/N 529 035 709) and the hose adaptor (P/N 529 035 652). A 1/8 NPT pipe extension may ease the installation.



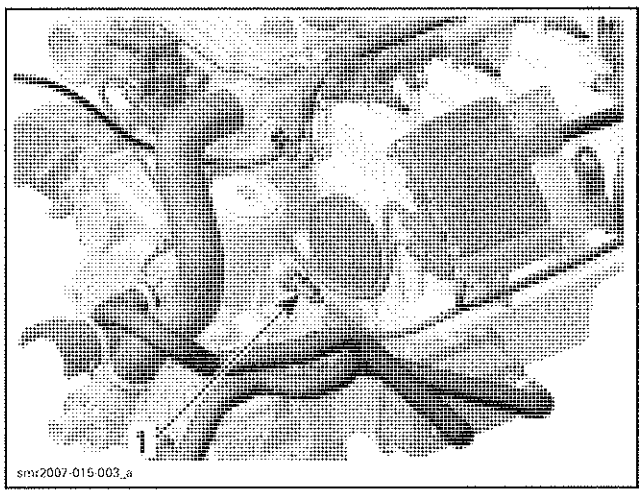


Use the following table to compare the oil pressure at different RPM.

OIL PRESSURE	
ALL ENGINES kPa (PSI)	
Idle (cold)	448 - 648 (65 - 94) for a very short time
Idle (at 80°C (176°F))	Min. 228 (33)
4000 - 7500	400 - 496 (58 - 72)

Test at the Oil Pressure Switch Location

Remove oil pressure switch and install gauge.



INSTALLATION AT PRESSURE SWITCH LOCATION
1. Remove oil pressure switch and install gauge here

To prevent the EMS to go in limp home mode (at 2500 RPM) or to generate a fault code, do the following:

- Ground OPS to engine.
- Plug OPS to harness.
- Start engine.
- While engine is running, unplug OPS from harness.

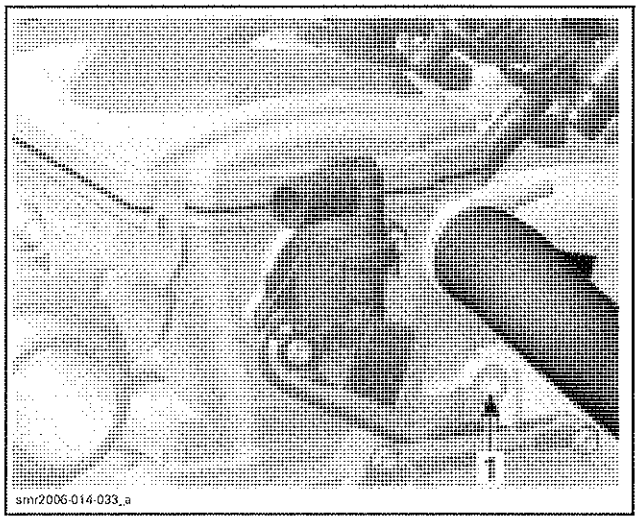
Read oil pressure at different RPM as per table above.

Reinstall oil pressure switch.

Test at the Cylinder Head Location

The oil pressure may be measured from cylinder head if desired.

Remove plug located on cylinder head and install gauge.



INSTALLATION AT CYLINDER HEAD
1. Remove plug and install gauge here

Start engine and read pressure at different RPM as per table above.

Reinstall plug.

PROCEDURES

PTO OIL STRAINER

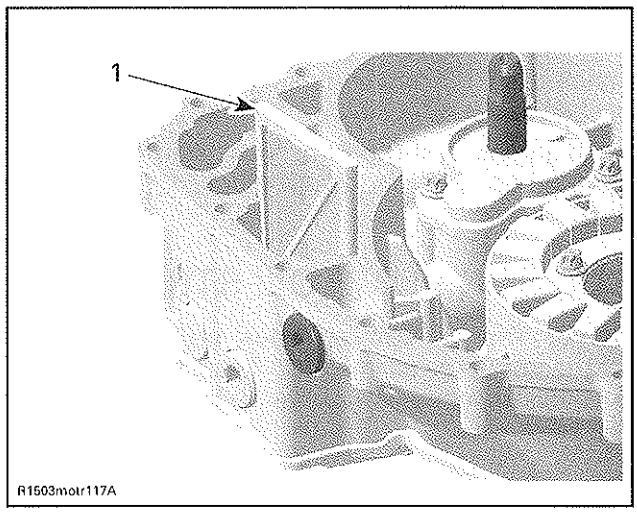
NOTE: The oil strainer does not need to be cleaned at every oil change. Clean it during other inspections, especially when the engine is disassembled.

PTO Oil Strainer Removal

Remove engine oil. See procedure in *OIL REPLACEMENT* above in this section.

Remove the PTO housing. Refer to *PTO HOUSING/MAGNETO* section.

Remove the oil strainer.



1. PTO oil strainer

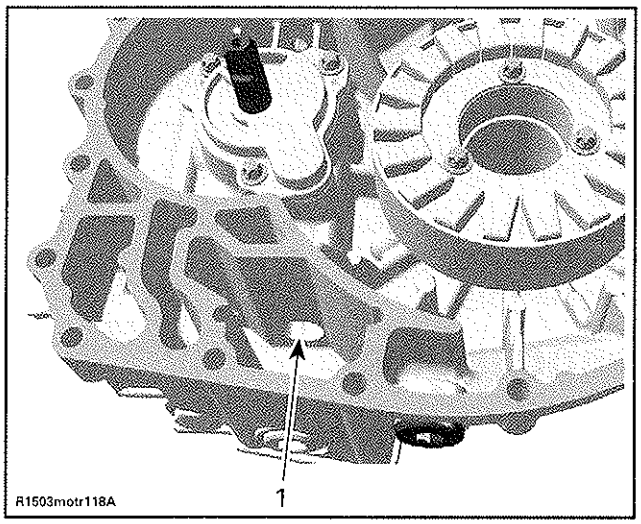
PTO Oil Strainer Cleaning/Inspection

Clean oil strainer with a part cleaner then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out in and an injury to your eyes.

Check and clean the oil outlet area for dirt and other contaminations.



1. Oil inlet to the oil pump

PTO Oil Strainer Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Clean cylinder block to remove all remaining silicone residues in oil strainer area.

Apply a thin layer of Loctite 5910 (P/N 293 800 081) on oil strainer side.

Install it in the cylinder block.

Install the PTO housing using the procedure described in the *PTO HOUSING/MAGNETO* section.

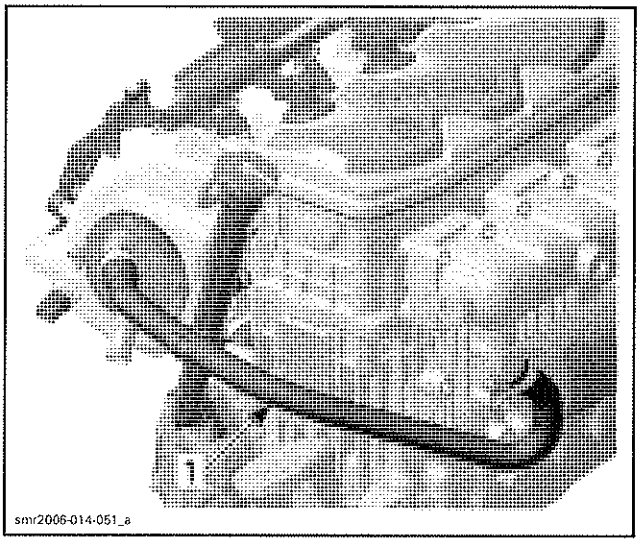
Refill engine at the proper level with the recommended oil. Refer to *ENGINE OIL* for the procedure.

SUCTION PUMP OIL STRAINER

NOTE: The oil strainer does not need to be cleaned at every oil change. Clean it during other inspections, especially when the engine is disassembled.

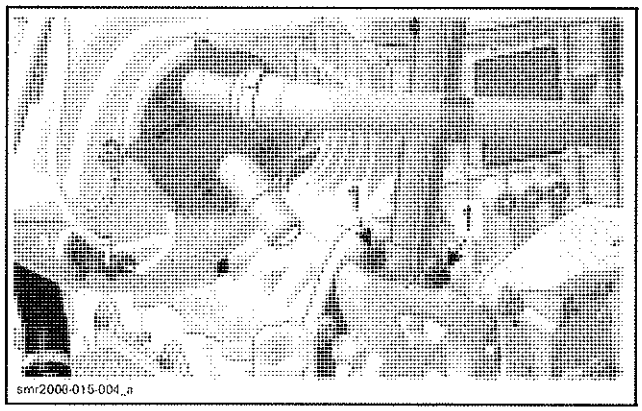
Suction Pump Oil Strainer Removal

- On **215 engine models**, detach the intercooler outlet hose from the oil filler tube.



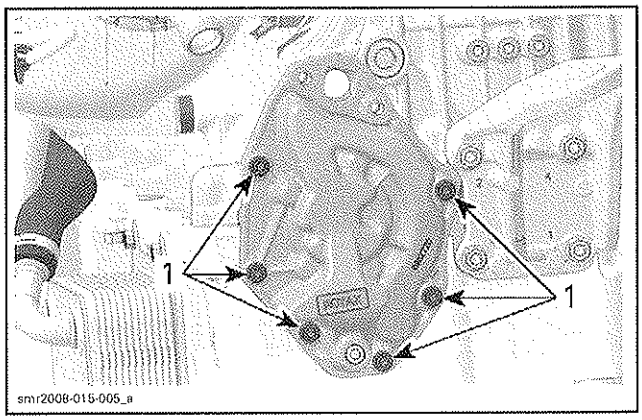
TYPICAL — 215 ENGINES
1. Outlet hose

- Detach intake hose from throttle body (**130 and 155 engines** only).
- Remove other required parts from vehicle to access the oil suction pump cover.
- Remove retaining screws from oil filler tube.



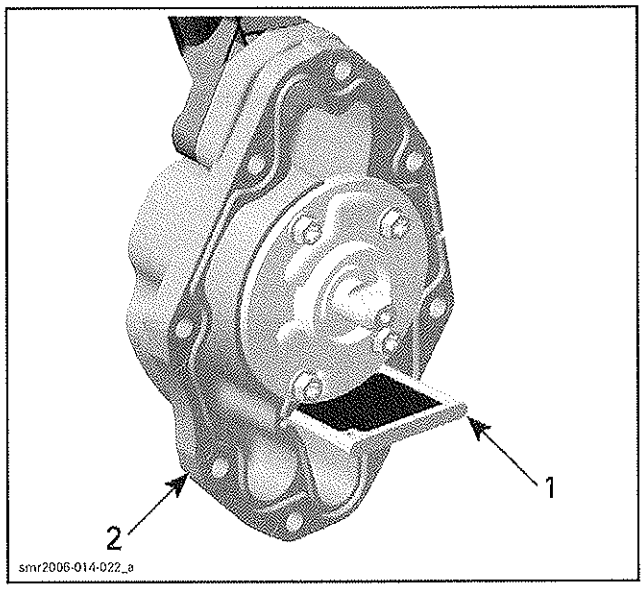
1. Oil filler tube screws

- Remove oil filler tube.
- Remove retaining screws from suction pump cover.



1. Suction pump cover screws

- Place rags under cover to prevent spillage. If spillage occurs, clean with the pulley flange cleaner (P/N 413 711 809).
- Remove oil suction pump cover.
- Remove oil strainer from the suction pump cover.

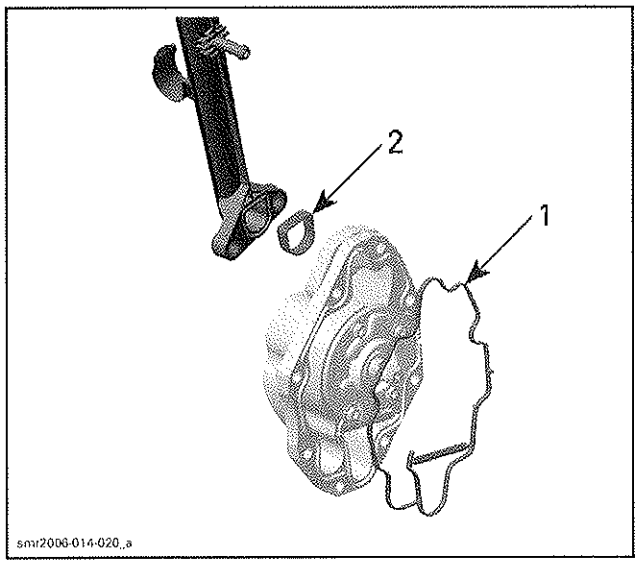


1. Oil strainer
2. Suction pump cover

Suction Pump Oil Strainer Cleaning/Inspection

Clean oil strainer with a part cleaner then use an air gun to dry it.

Inspect rubber ring gaskets.

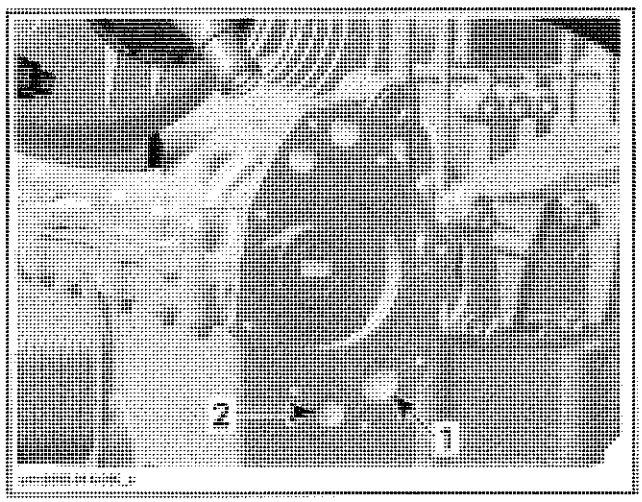


1. Suction pump cover gasket
2. Oil filler tube gasket

If rubber rings are brittle, cracked or hard, replace them.

Clean both contact surfaces of oil suction pump cover.

Check and clean the oil inlet and outlet area for dirt and other contaminations.



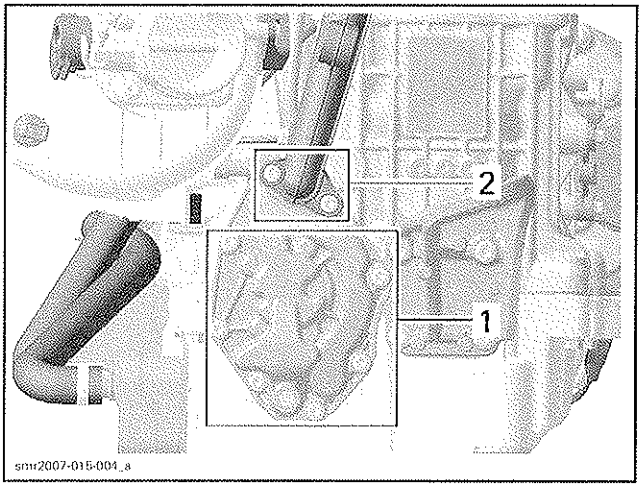
TYPICAL
1. Oil inlet
2. Oil outlet

Suction Pump Oil Strainer Installation

For installation, reverse the removal procedure. However, pay attention to the following.

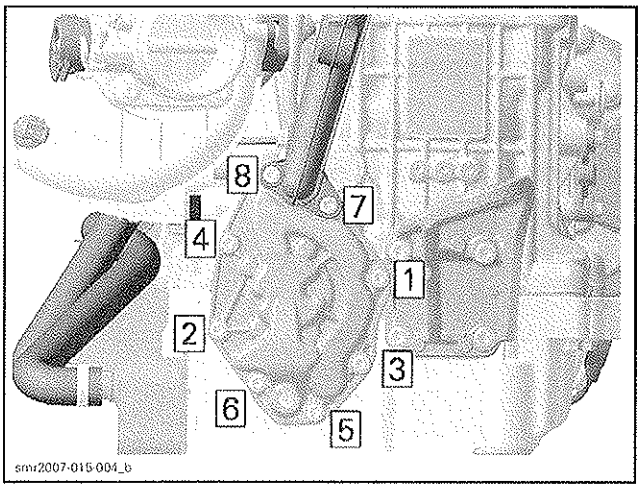
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of the suction pump cover screws.

Position screws according to their length as shown.



TYPICAL
1. *Screws M6 x 25*
2. *Screws stainless steel M6 x 45*

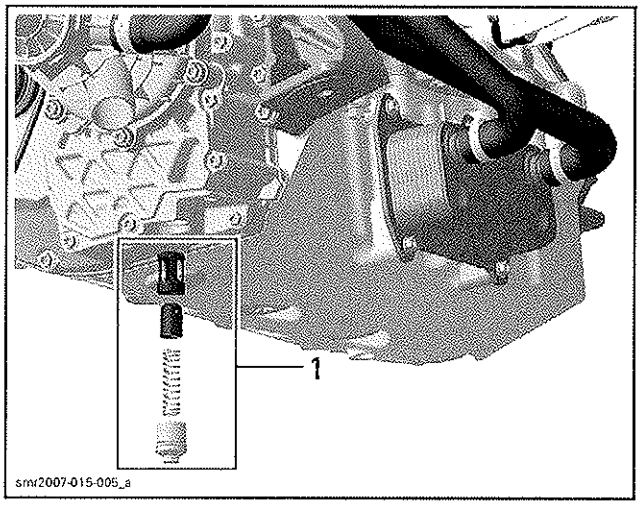
Torque suction pump cover screws as per sequence illustrated below.



Step 1: 1 to 6 at 11 N•m (97 lbf•in)
Step 2: 7 and 8 to 9 N•m (80 lbf•in)

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the bottom of the PTO housing.



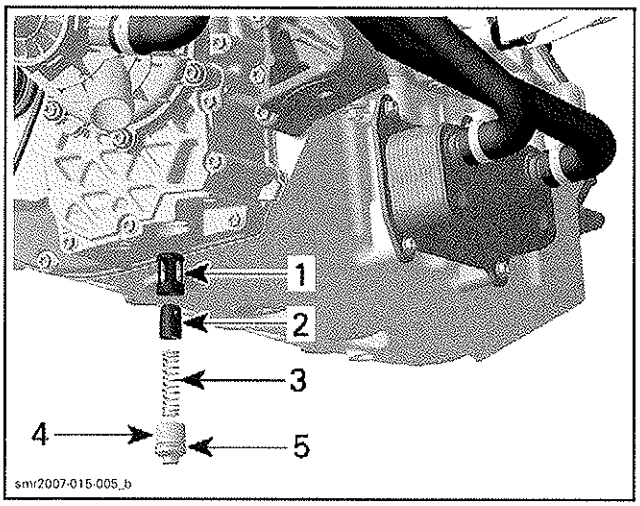
TYPICAL
1. *Oil pressure regulator*

NOTE: The oil pressure regulator system opens when the oil pressure exceeds 400 kPa (58 PSI).

Oil Pressure Regulator Removal

Remove engine oil. See procedure in *OIL REPLACEMENT* above in this section.

Remove:
- Oil pressure regulator plug
- Compression spring
- Valve piston
- Valve piston guide.



TYPICAL
1. *Valve piston guide*
2. *Valve piston*
3. *Compression spring*
4. *Oil pressure regulator plug*
5. *O-Ring*

⚠ WARNING

Oil pressure regulator plug on oil pump housing is spring loaded.

Oil Pressure Regulator Inspection

Inspect valve piston and valve piston guide for scoring or other damages.

Check compression spring for free length.

COMPRESSION SPRING FREE LENGTH	
NEW NOMINAL	58.2 mm (2.291 in)
SERVICE LIMIT	50.3 mm (1.980 in)

Replace parts if important wear or damage are present.

Clean bore and threads in the PTO housing from metal shavings and other contaminations.

Oil Pressure Regulator Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Be careful that the O-ring on plug screw is in place.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of the oil pressure regulator plug.

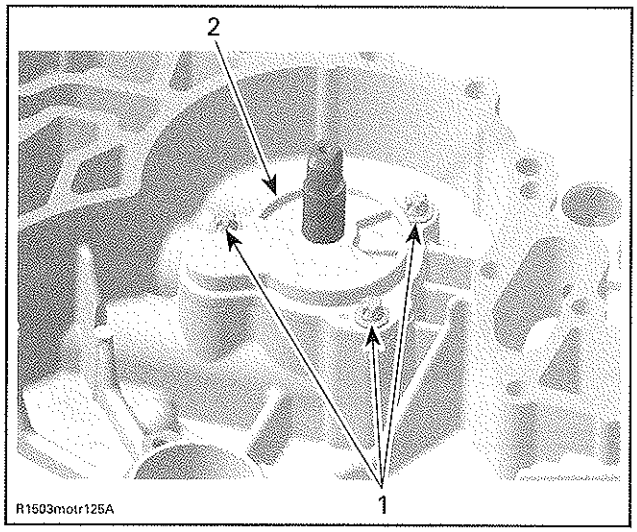
Torque plug screw to 13 N•m (115 lbf•**in**) maximum.

OIL PRESSURE PUMP

The oil pressure pump is located in the PTO housing and is driven by the balance shaft.

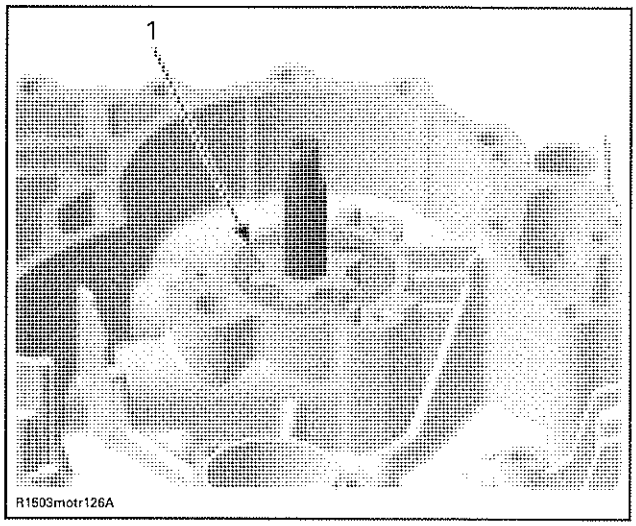
Oil Pressure Pump Removal

- Remove engine oil. See procedure in *OIL REPLACEMENT* above in this section.
- Remove the PTO housing. Refer to *PTO HOUSING/MAGNETO* section.
- Remove water pump housing and the impeller. Refer to *COOLING SYSTEM*.
- Remove screws securing the oil pump cover.



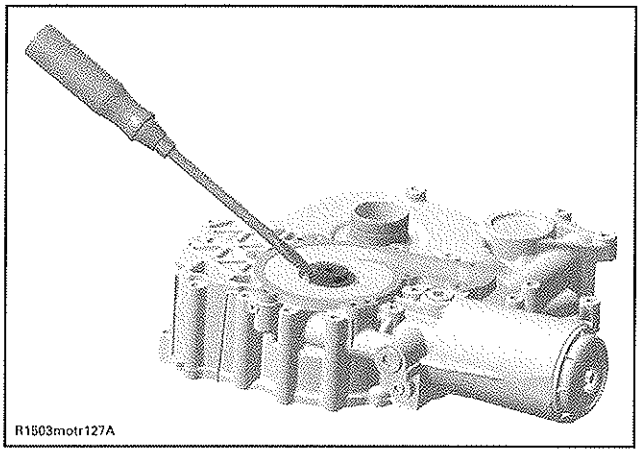
1. *Screws*
2. *Oil pump cover*

- Pull and remove the outer oil pump rotor.



1. *Outer oil pump rotor*

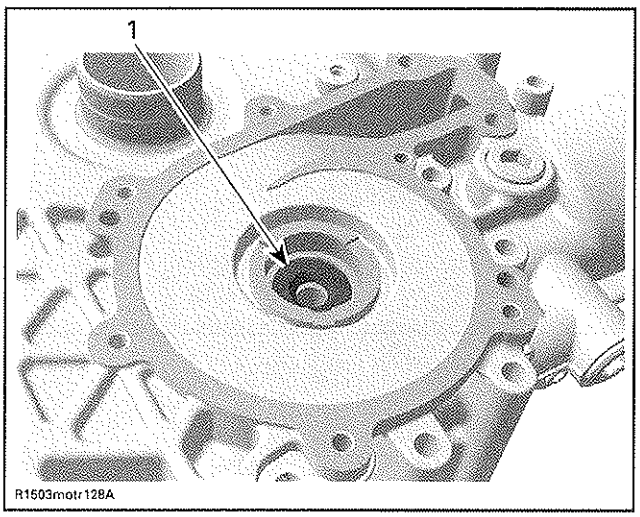
- Refer to *COOLING SYSTEM* section and extract the water/oil pump shaft from outside PTO housing.
- Using a screwdriver, remove the rotary seal.



TYPICAL

CAUTION: Be careful not to damage the surface of the rotary seal bore in PTO housing cover.

- Remove and discard the oil seal behind rotary seal.

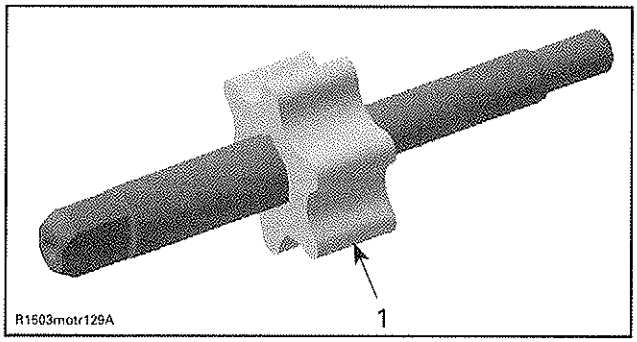


1. Oil seal

Oil Pressure Pump Inspection

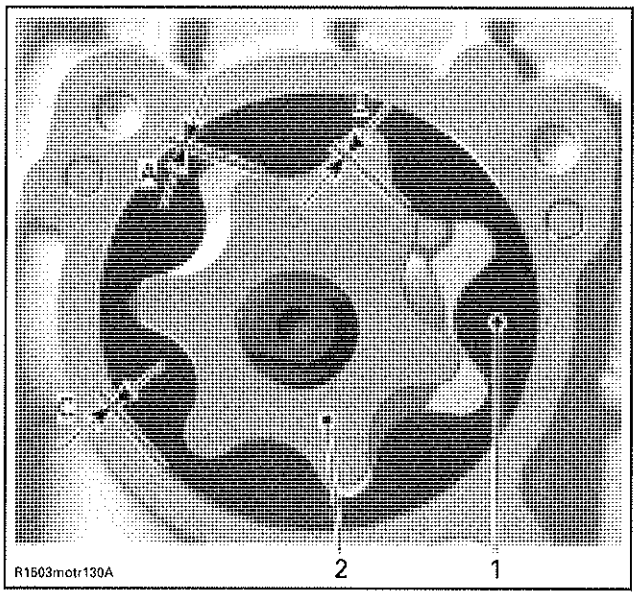
Inspect oil pump shaft, housing and cover for marks or other damages.

Check inner rotor for corrosion pin-holes or other damages. If so, replace oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.



1. Pittings on the teeth

Using a feeler gauge, measure the clearance between inner and outer rotors.



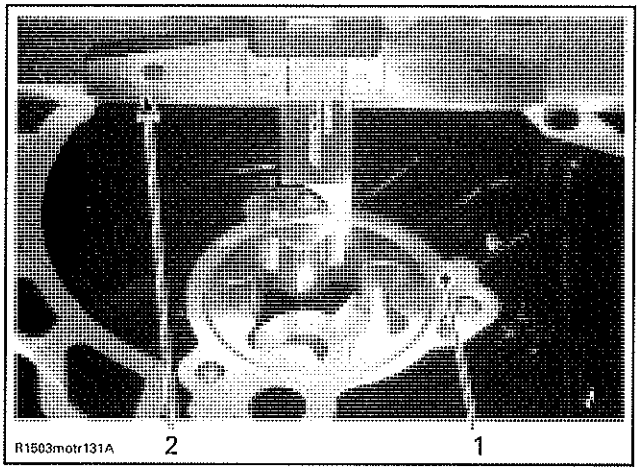
1. Outer rotor
2. Inner rotor

OUTER AND INNER ROTOR CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.009 in)
B	
C	

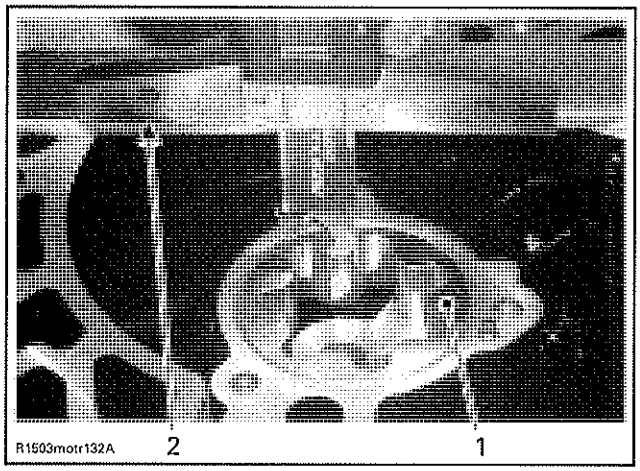
If clearance between inner and outer rotors exceeds the tolerance, replace water/oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump and the PTO housing.

Using a vernier depth gauge, measure side wear as shown.



1. *PTO housing surface*
2. *Vernier depth gauge*



1. *Oil pump outer rotor surface*
2. *Vernier depth gage*

Difference between pump housing and outer rotor should not exceed 0.1 mm (.004 in). If so, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump shaft increases, the oil pressure decreases.

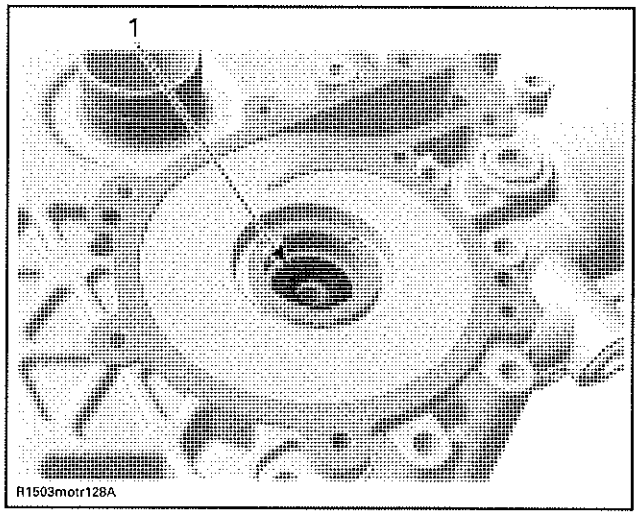
Check the inside of oil pump housing and its cover for scoring or other damages and replace if damaged.

Oil Pressure Pump Installation

For installation, reverse the removal procedure. Pay attention to the following details.

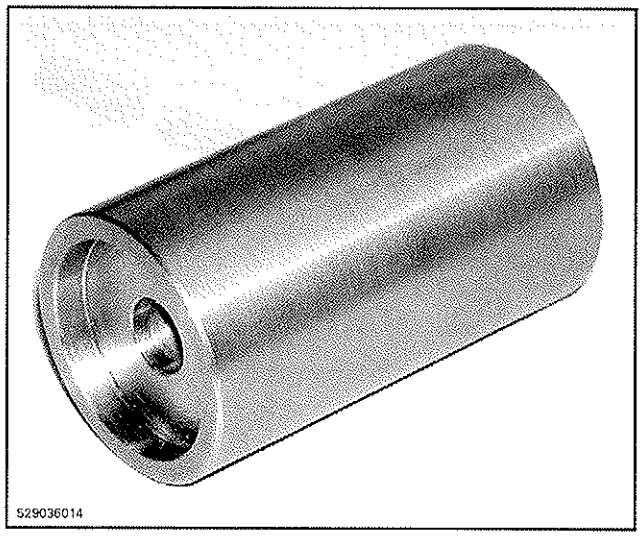
NOTE: Never use oil in the press fit area of the rotary seal.

Push water/oil pump shaft seal in place by using thumb.

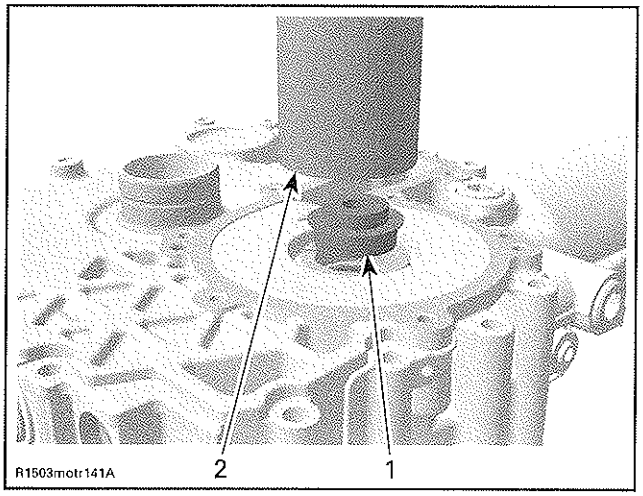


1. *Oil seal*

Install the new rotary seal by using the rotary seal pusher (P/N 529 035 823).

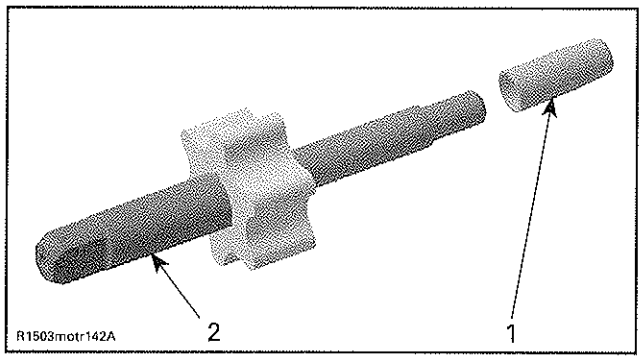


CAUTION: Never use a hammer for the rotary seal or water/oil pump shaft installation. Only use a press to avoid damaging the ceramic component.



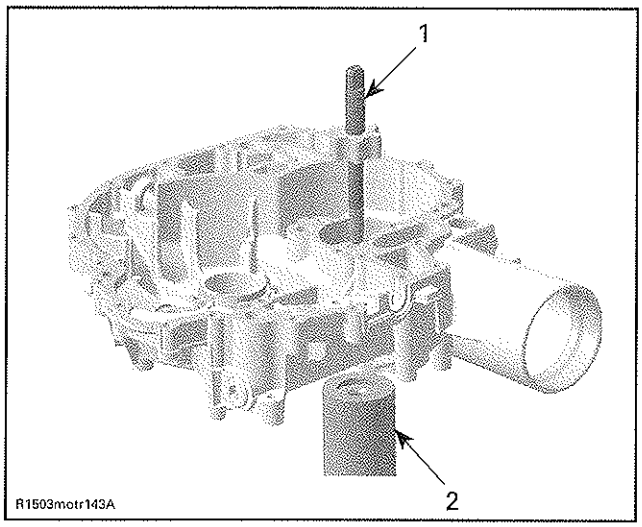
TYPICAL
1. *Rotary seal*
2. *Rotary seal pusher*

Install the oil seal protector (P/N 529 035 822) on the end of coolant/oil pump shaft.



1. *Oil seal guide*
2. *Water/oil pump shaft*

Using the rotary seal installer (P/N 529 035 823) to support the PTO cover, install the coolant/oil pump shaft.



1. *Water/oil pump shaft with oil seal guide*
2. *Rotary seal pusher*

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of oil pump cover screws.

Tighten oil pump cover screws and torque to 11 N•m (97 lbf•in).

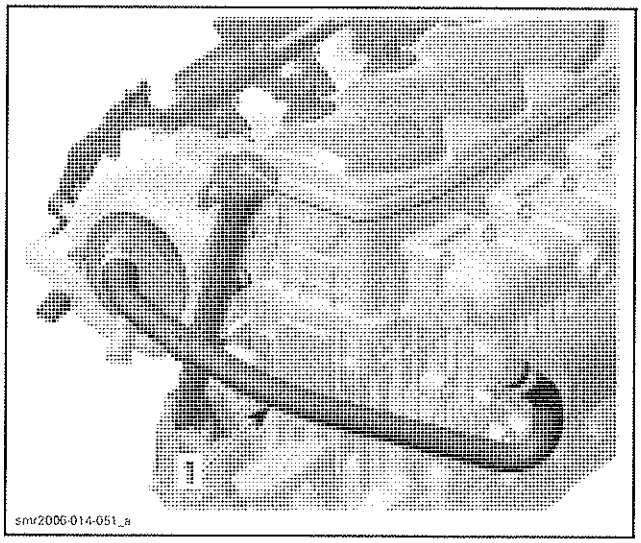
After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

OIL SUCTION PUMP

The oil suction pump is located on the front side of the engine inside of the oil suction pump housing at the bottom of the oil filler tube.

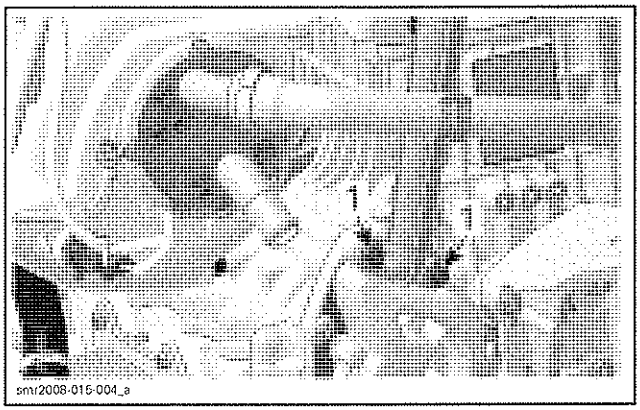
Oil Suction Pump Removal

- On 215 engine models, detach the intercooler outlet hose from the oil filler tube.



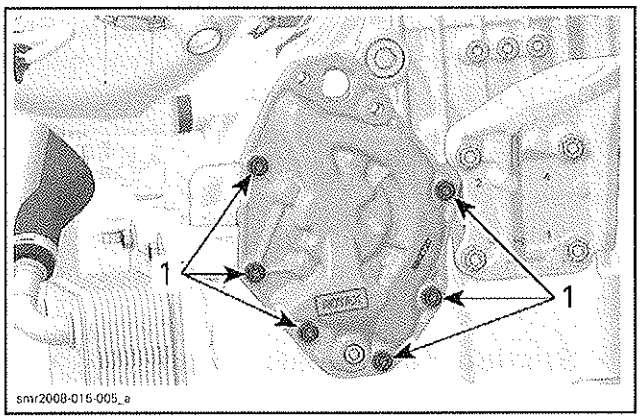
TYPICAL — 215 ENGINES
1. *Outlet hose*

- Detach intake hose from throttle body (130 and 155 engines only).
- Remove other required parts from vehicle to access the oil suction pump housing.
- Remove retaining screws from oil filler tube.



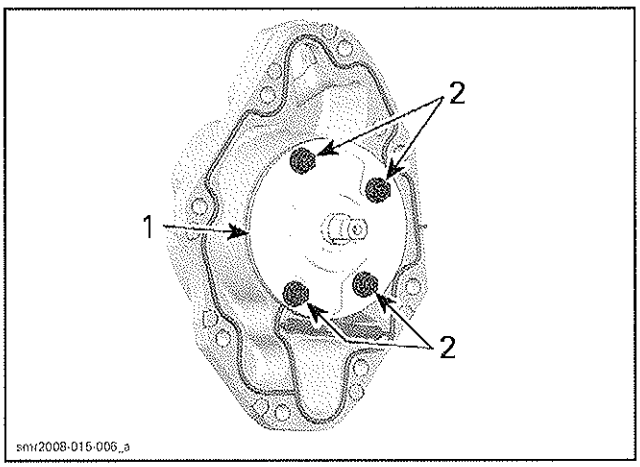
1. Oil filler tube screws

- Remove oil filler tube.
- Remove retaining screws.



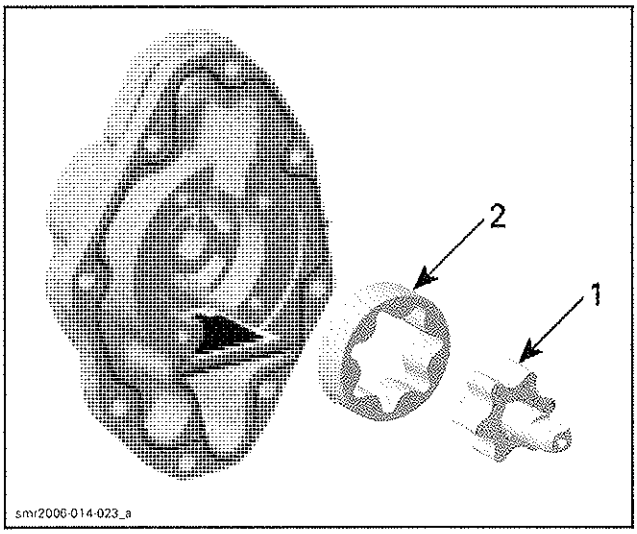
1. Suction pump cover screws

- Place rags under cover to prevent spillage. If spillage occurs, clean with the pulley flange cleaner (P/N 413 711 809).
- Remove the oil suction pump housing.
- Remove oil pump screws and cover.



TYPICAL
1. Oil pump cover
2. Oil pump screws

- Remove oil pump shaft.
- Remove outer rotor.

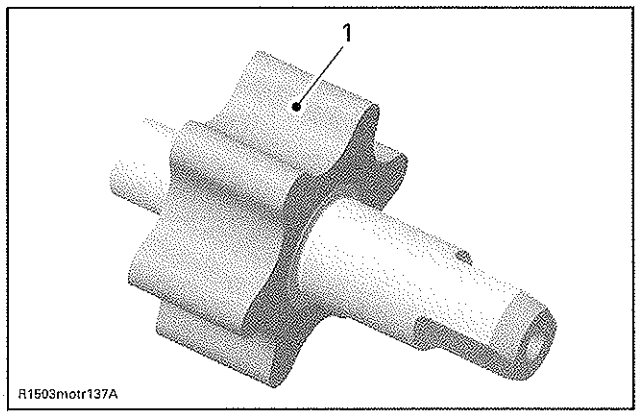


TYPICAL
1. Oil pump shaft
2. Outer rotor

Oil Suction Pump Inspection

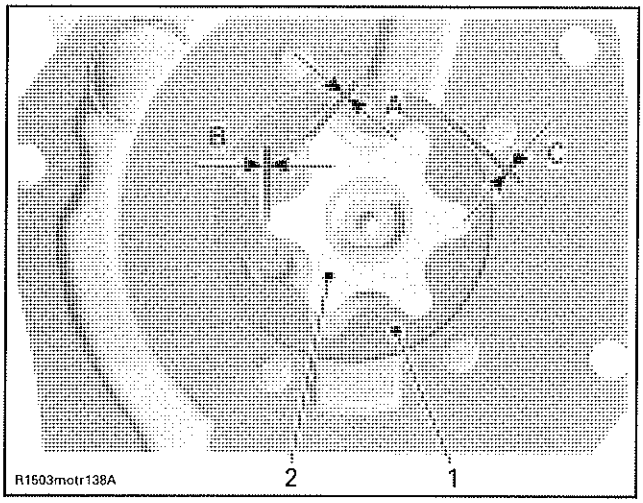
Inspect oil pump shaft, housing and cover for marks or other damages.

Check inner rotor for corrosion, pin-holes or other damages. If so, replace oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.



1. Pittings on the teeth

Using a feeler gauge, measure the clearance between inner and outer rotors.



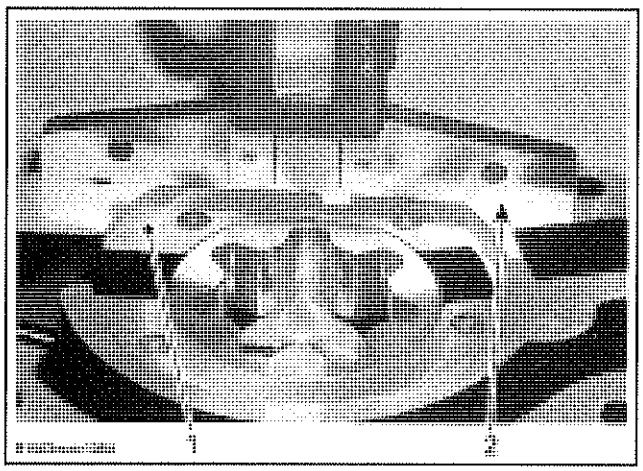
1. *Outer rotor*
2. *Inner rotor*

OUTER AND INNER ROTOR CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.009 in)
B	
C	

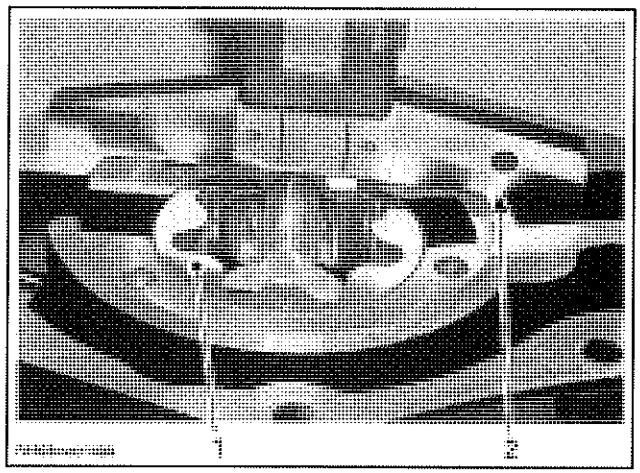
If clearance between inner and outer rotors exceeds the tolerance, replace oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump and the PTO housing.

Using a vernier depth gage, measure side wear as shown.



1. *Oil pump housing surface*
2. *Vernier depth gage*



1. *Oil pump outer rotor surface*
2. *Vernier depth gage*

Difference between pump housing and outer rotor should not exceed 0.1 mm (.004 in). If so, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

Check the inside of oil pump housing and its cover for scoring or other damages and replace if damaged.

Oil Suction Pump Installation

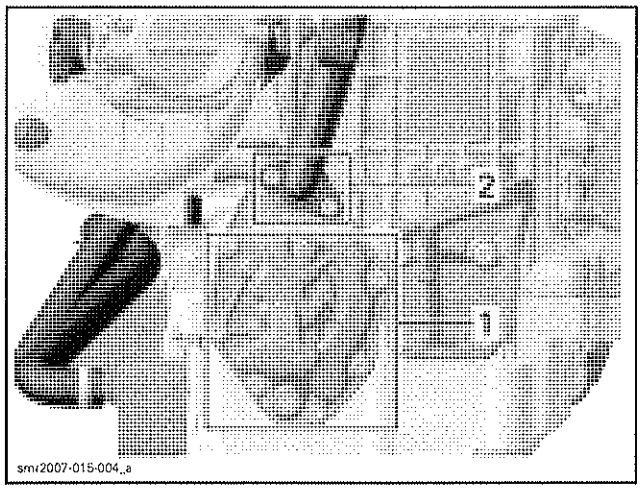
For installation, reverse the removal procedure. Pay attention to the following details.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of the oil pump cover screws.

Torque oil pump cover screws to 11 N•m (97 lbf•in).

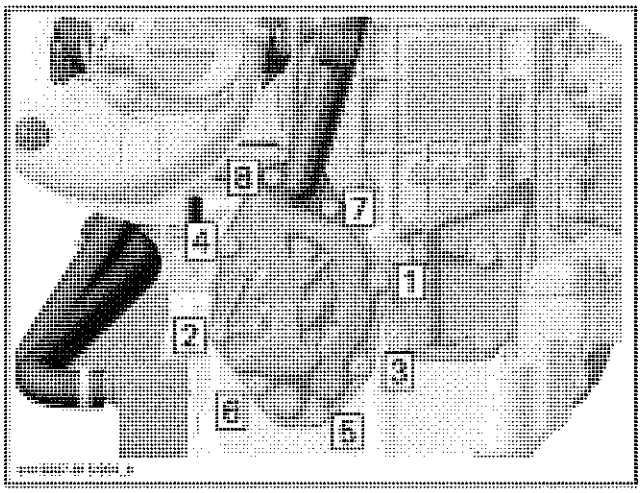
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of the suction pump cover screws.

Position screws according to their length as shown.



1. *Screws M6 x 25*
2. *Screws M6 x 45*

Tighten suction pump cover screws as per following sequence.



Step 1: 1 to 6 at 11 N•m (97 lbf•in)
Step 2: 7 and 8 to 9 N•m (80 lbf•in)

OIL SPRAY JET

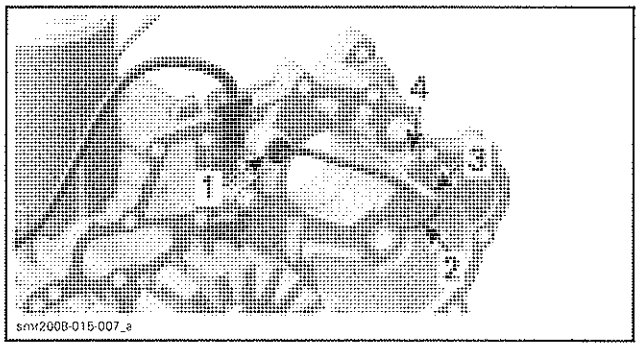
215/255 Engines

Oil Spray Jet Removal

Remove the PTO housing. Refer to *PTO HOUSING/MAGNETO* section.

Remove the Torx screw securing the oil spray jet support.

Unscrew the Banjo bolt.



1. *Banjo bolt*
2. *Oil spray jet*
3. *Oil spray jet support*
4. *Torx screw*

Oil Spray Jet Inspection

Check if oil spray jet for:

- Dirt
- Bend
- Other damages.

Replace if necessary.

Oil Spray Jet Installation

For installation reverse the removal procedure. However, pay attention to the following.

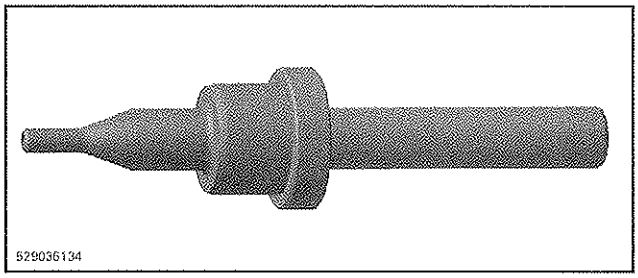
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of Torx screw.

Install the oil spray jet support.

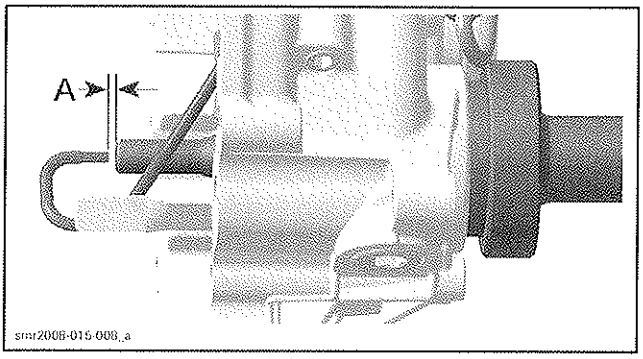
Tighten Torx screw to 10 N•m (89 lbf•in).

Install oil spray jet with Banjo bolt loosely.

To install and adjust the position of the oil spray jet, use supercharger oil spray jet tool (P/N 529 036 134).

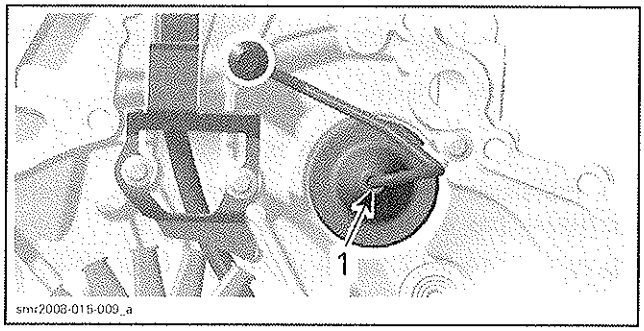


The distance between the adjustment tool and oil spray jet must be within 1 mm (0.039 in).



A. 1 mm (0.039 in)

NOTE: Make sure that the oil spray jet is facing to the center of the tool. Not following this procedure will lead to an insufficient oiling of the supercharger and a supercharger failure can occurs. Adjust the oil spray jet if necessary by slightly bending it, take care not to over bend the oil spray jet.



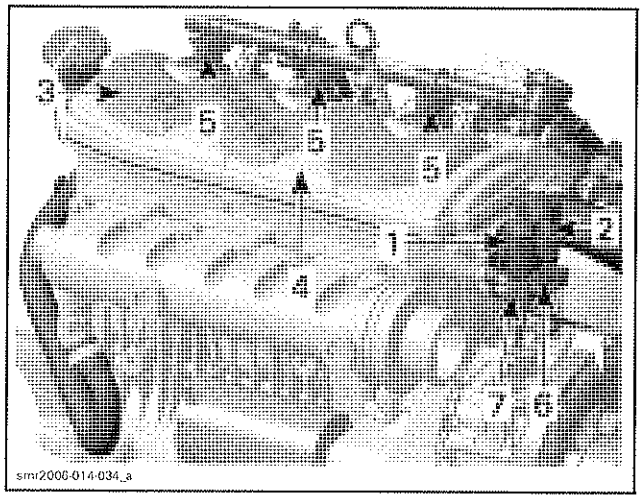
1. Center of supercharger oil spray jet tool

Tighten Banjo bolt to 20 N•m (15 lbf•ft).

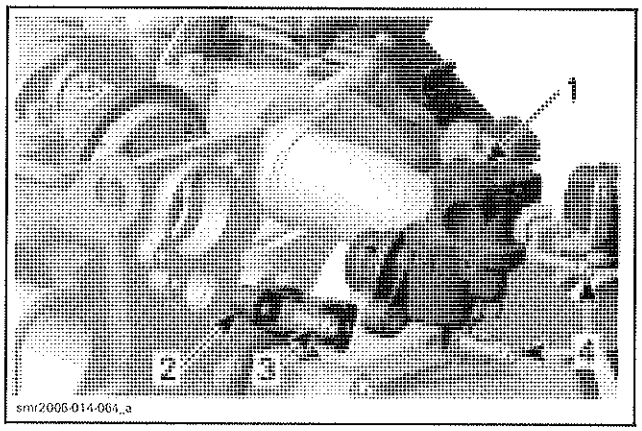
OIL SEPARATOR COVER

Oil Separator Cover Removal

- Remove the ventilation hose from TOPS valve.



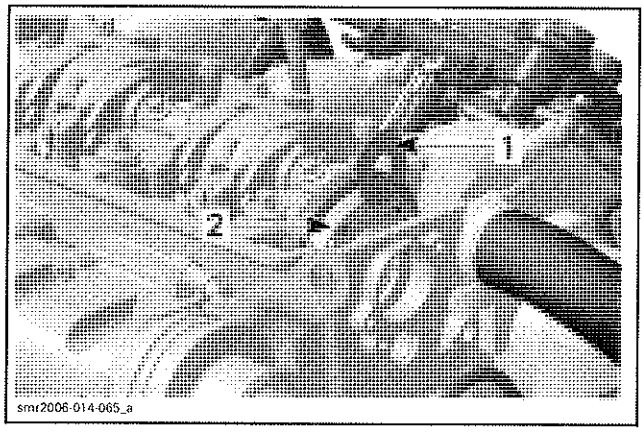
TYPICAL
1. *TOPS valve*
2. *Ventilation hose (not visible)*
3. *Valve cover cowl*
4. *Valve cover*
5. *Ignition coil*
6. *Crankshaft position sensor cable*
7. *Camshaft position sensor*



1. *TOPS valve*
2. *Camshaft position sensor*
3. *Retaining screw*
4. *Retaining screws*

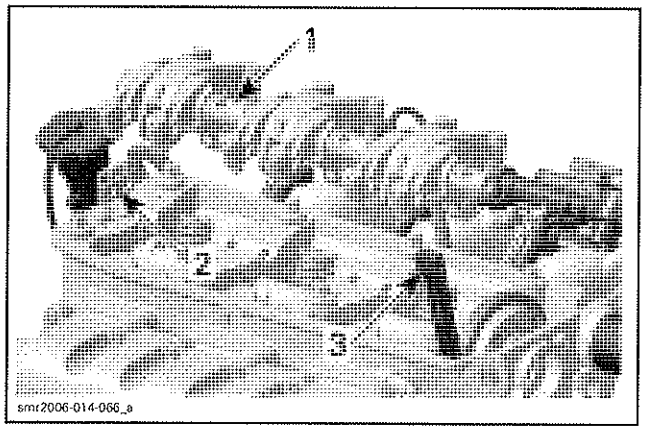
- Remove CPS cable from TOPS valve.
- Remove TOPS valve from cylinder head.
- Remove camshaft sensor.
- Take off engine cover and valve cover cowl.
- Unplug and remove ignition coils.
- Remove valve cover.
- Remove thrust washer from oil separator cover.

NOTE: Make sure not to loose thrust washer when removing it from oil separator cover, otherwise thrust washer would fall into the PTO housing.



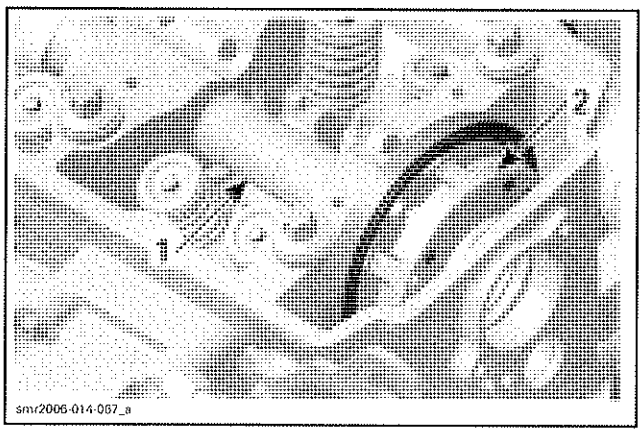
1. *Thrust washer*
2. *Oil separator*

- Remove spark plug tube.
- Remove rocker arm shaft together with rocker arms.
- Remove chain guide and camshaft guide.



1. *Rocker arm*
2. *Camshaft guide*
3. *Chain guide*

- Move camshaft backwards as far as possible.
- Unclip oil separator cover from timing gear.



1. *Camshaft*
2. *Oil separator cover*

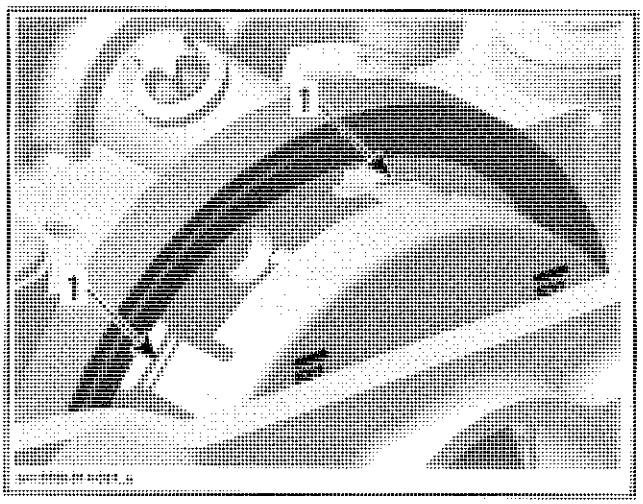
NOTE: Be careful not to break the holding clips from oil separator cover when its removed from the timing gear.

Oil Separator Cover Inspection

If O-rings and V-rings are brittle, cracked or hard, replace them.

Clean all contact surfaces of oil separator cover and TOPS valve.

Inspect oil separator cover for marks or other damages. Ensure to check also the holding clips of oil separator cover and for thrust washer. If any damage is visible replace oil separator cover.



1. *Holding clips*

Oil Separator Cover Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Install oil separator cover and thrust washer. They need to be in a perfect even position with timing gear.

NOTE: Make sure not to lose thrust washer when installed on oil separator cover.

Install all other removed parts.

TOPS VALVE

The TOPS valve is a mechanical device that does not require electrical supply for its operation.

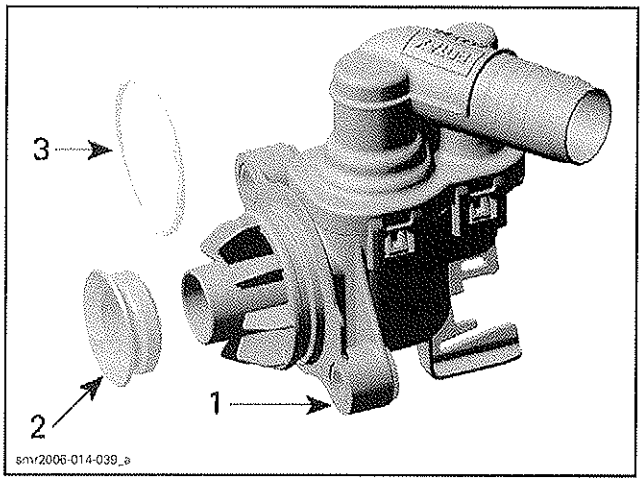
TOPS Valve Removal

Remove ventilation hose from TOPS valve.

Unscrew and remove the TOPS valve.

Remove O-ring and V-ring.

NOTE: TOPS valve can not be disassembled.



1. TOPS valve
2. V-ring
3. O-ring

TOPS Valve Inspection

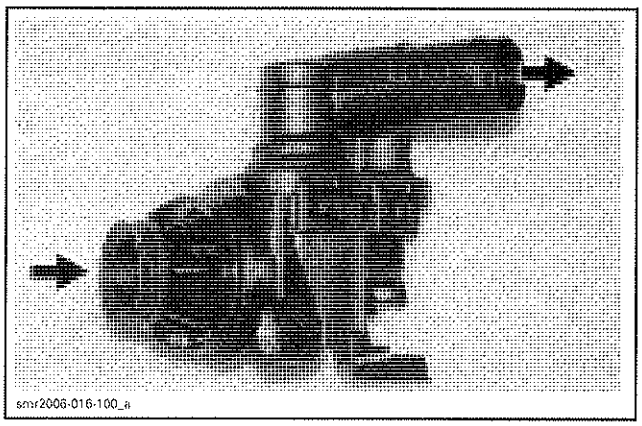
If O-rings or V-rings are brittle, cracked or hard, replace them.

If TOPS valve is damaged, replace it.

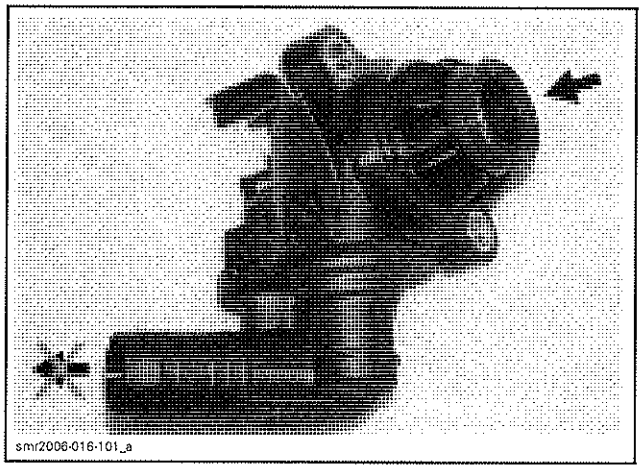
Clean all contact surfaces of TOPS valve.

Place a clean rag on valve inlet.

Blow air through inlet port. Air must flow freely to the outlet port.



Turn valve upside down and blow air again. Air must not flow out.



If test fails, replace valve.

TOPS Valve Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Install the TOPS valve with NEW O-ring and V-ring.

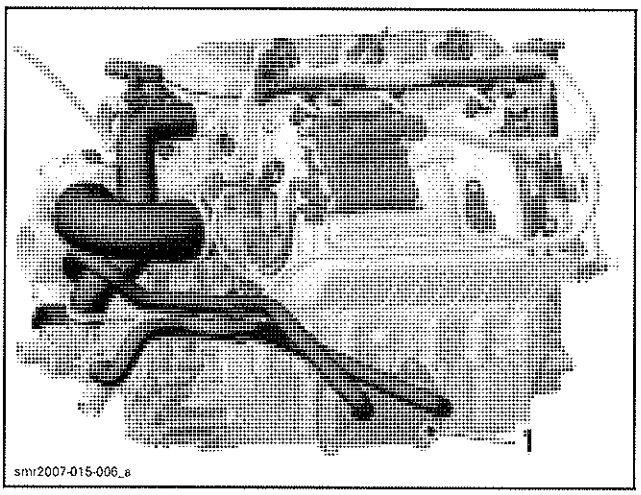
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of TOPS valve screws.

Tighten TOPS valve screws to 11 N•m (97 lbf•**in**).

Reinstall remaining removed parts.

OIL COOLER

The oil cooler is located below the air intake manifold.

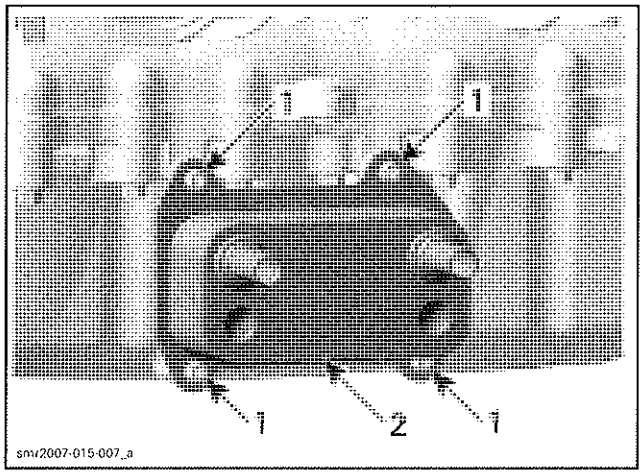


TYPICAL
1. Oil cooler

Oil Cooler Removal

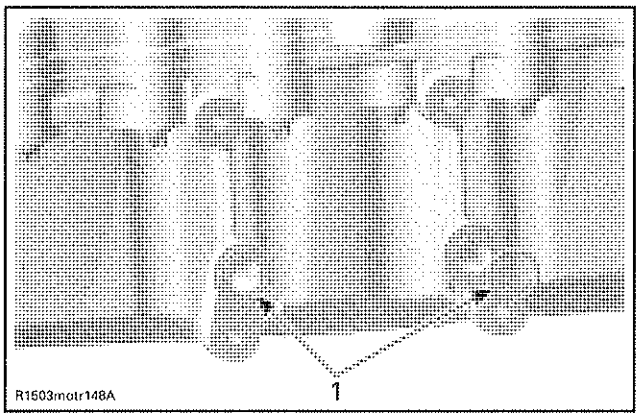
Disconnect cooling hoses from oil cooler.

Remove screws securing oil cooler.



1. *Oil cooler crews*
2. *Oil cooler*

Remove oil cooler from engine. Ensure do not lose O-rings located between oil cooler and engine.



1. *O-rings*

Oil Cooler Inspection

If O-rings are brittle, cracked or hard, replace them.

Clean both contact surfaces of oil cooler.

Check and clean the oil inlet and outlet area for dirt and other contaminations.

Oil Cooler Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply engine oil on O-rings.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of oil cooler screws.

Tighten screws to 11 N•m (97 lbf•**in**).

COOLING SYSTEM

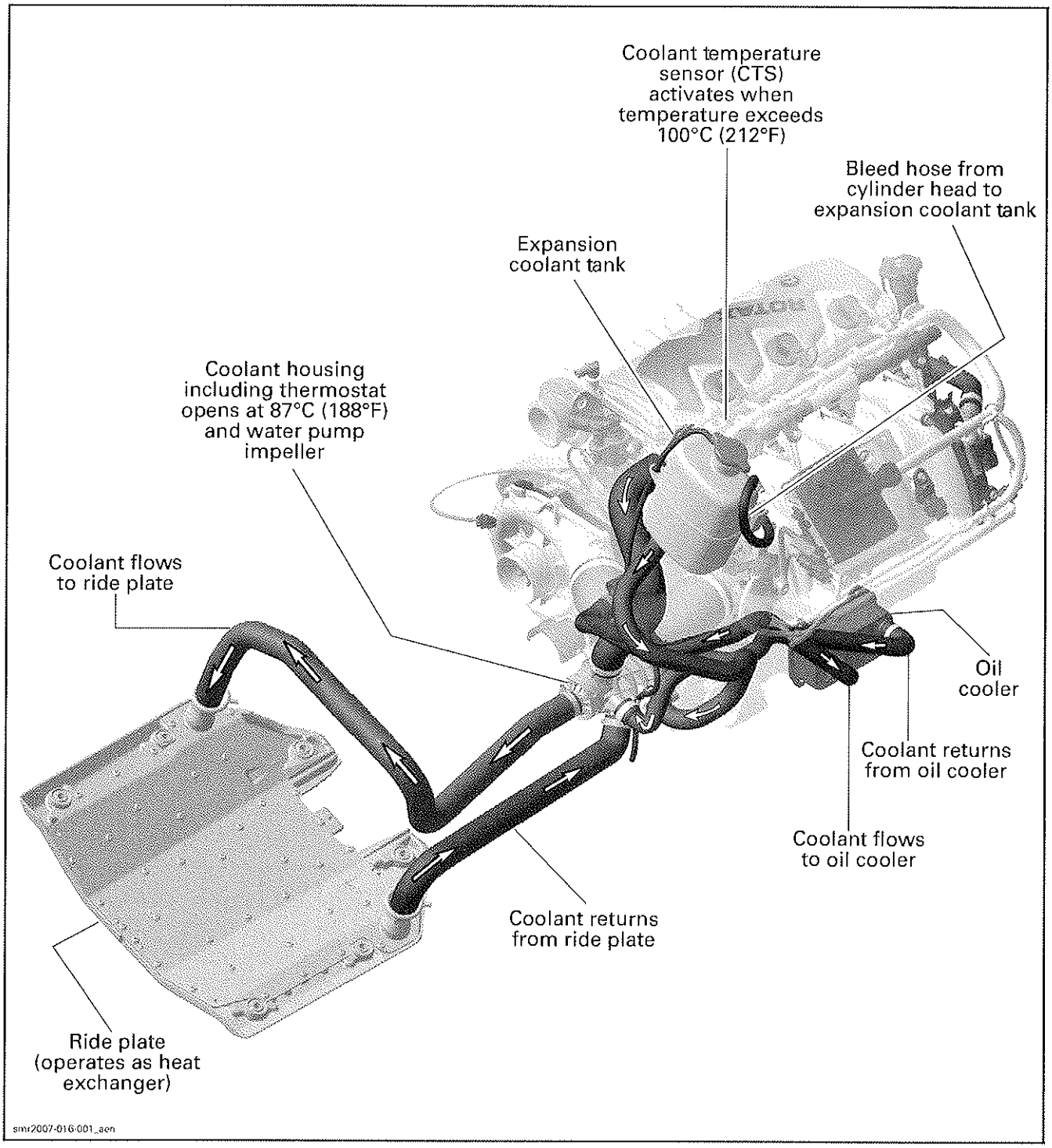
SERVICE TOOLS

Description	Part Number	Page
pliers Oetiker 1099	295 000 070	137
vacuum/pressure pump	529 021 800	135
oil seal protector	529 035 822	142
rotary seal installer	529 035 823	141–142
test cap	529 035 991	135

SERVICE PRODUCTS

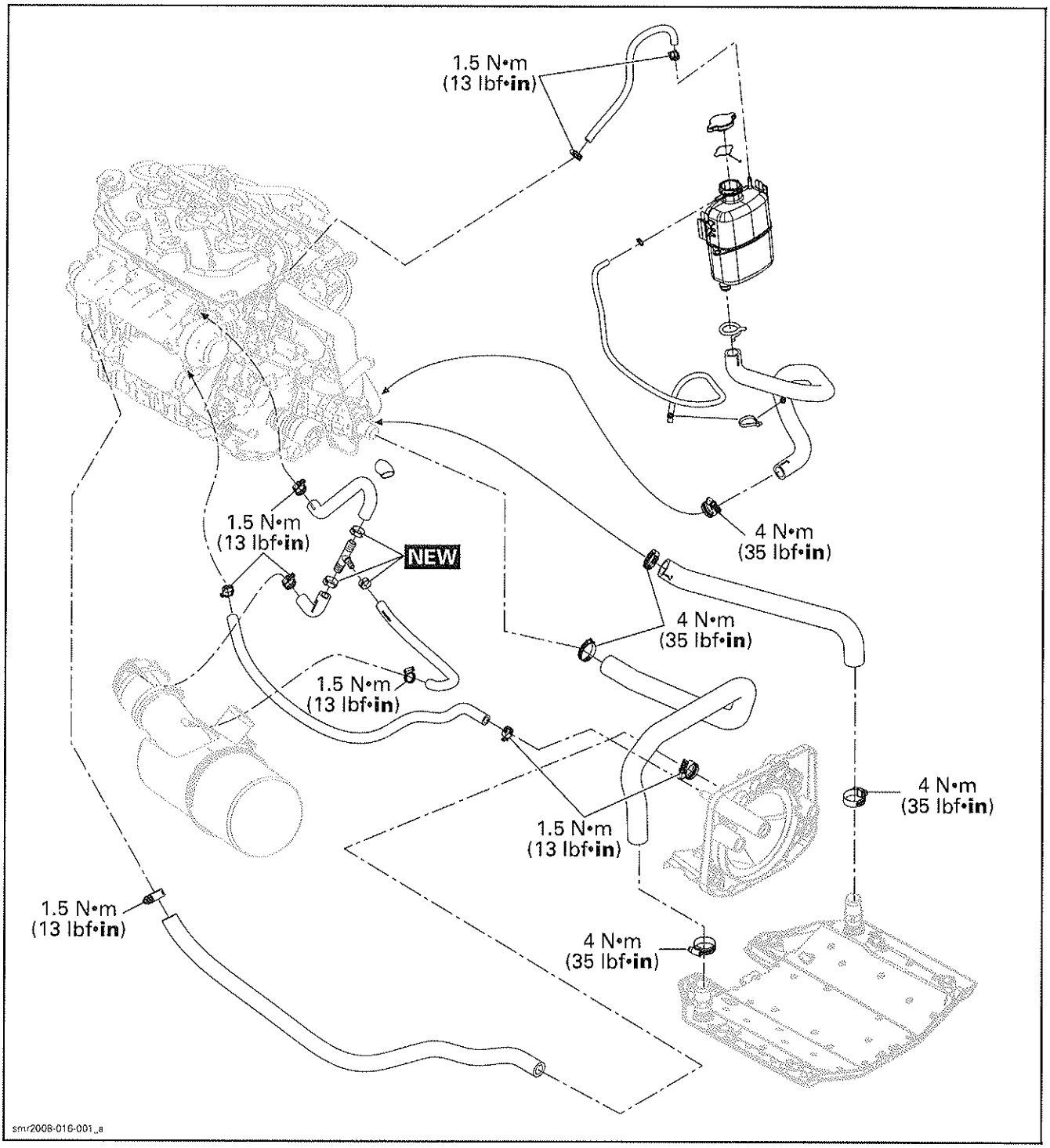
Description	Part Number	Page
BRP premixed antifreeze	219 700 362	135
Loctite 243 (blue)	293 800 060	139

CLOSED LOOP COOLING SYSTEM

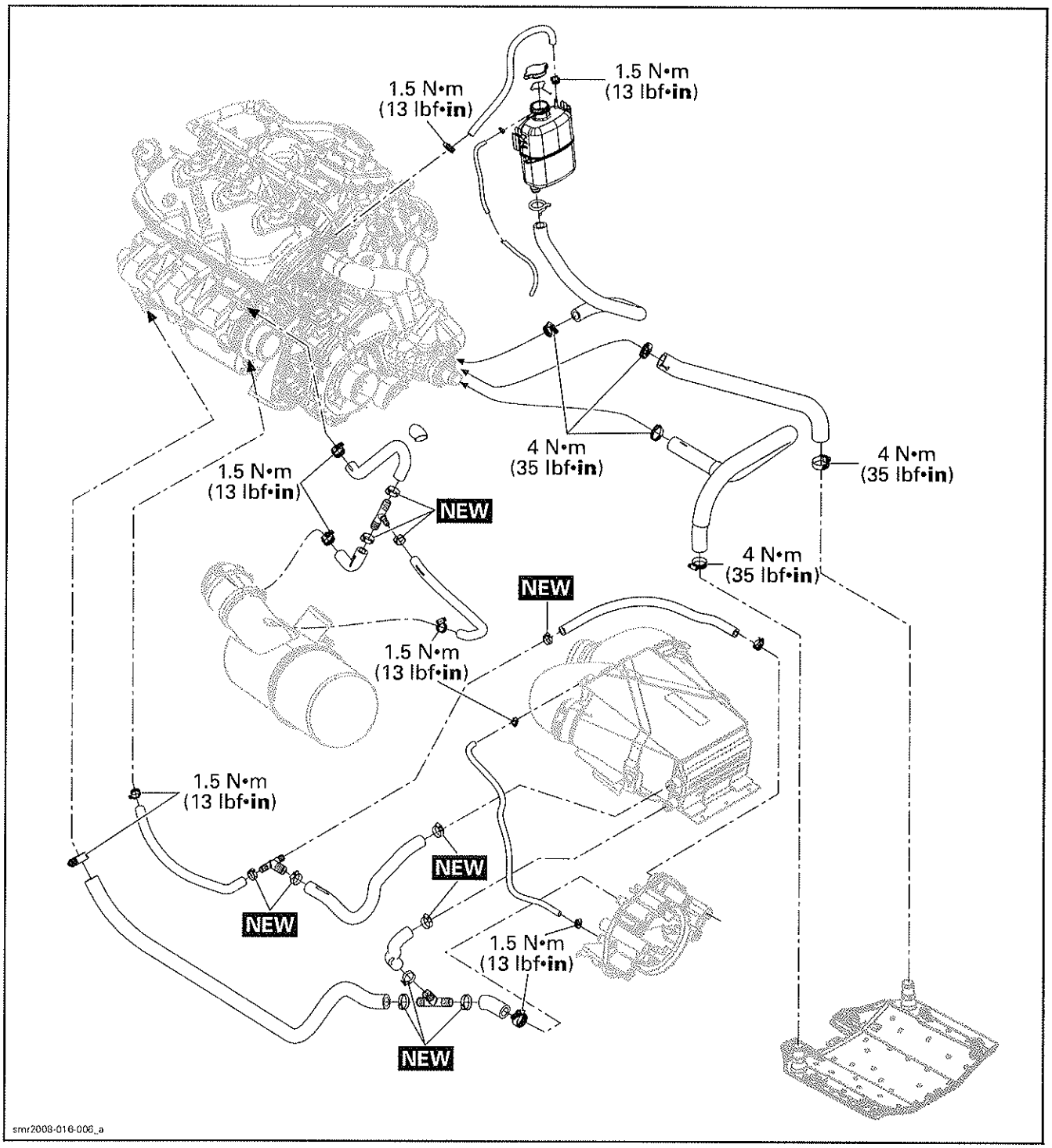


VEHICLE COMPONENTS

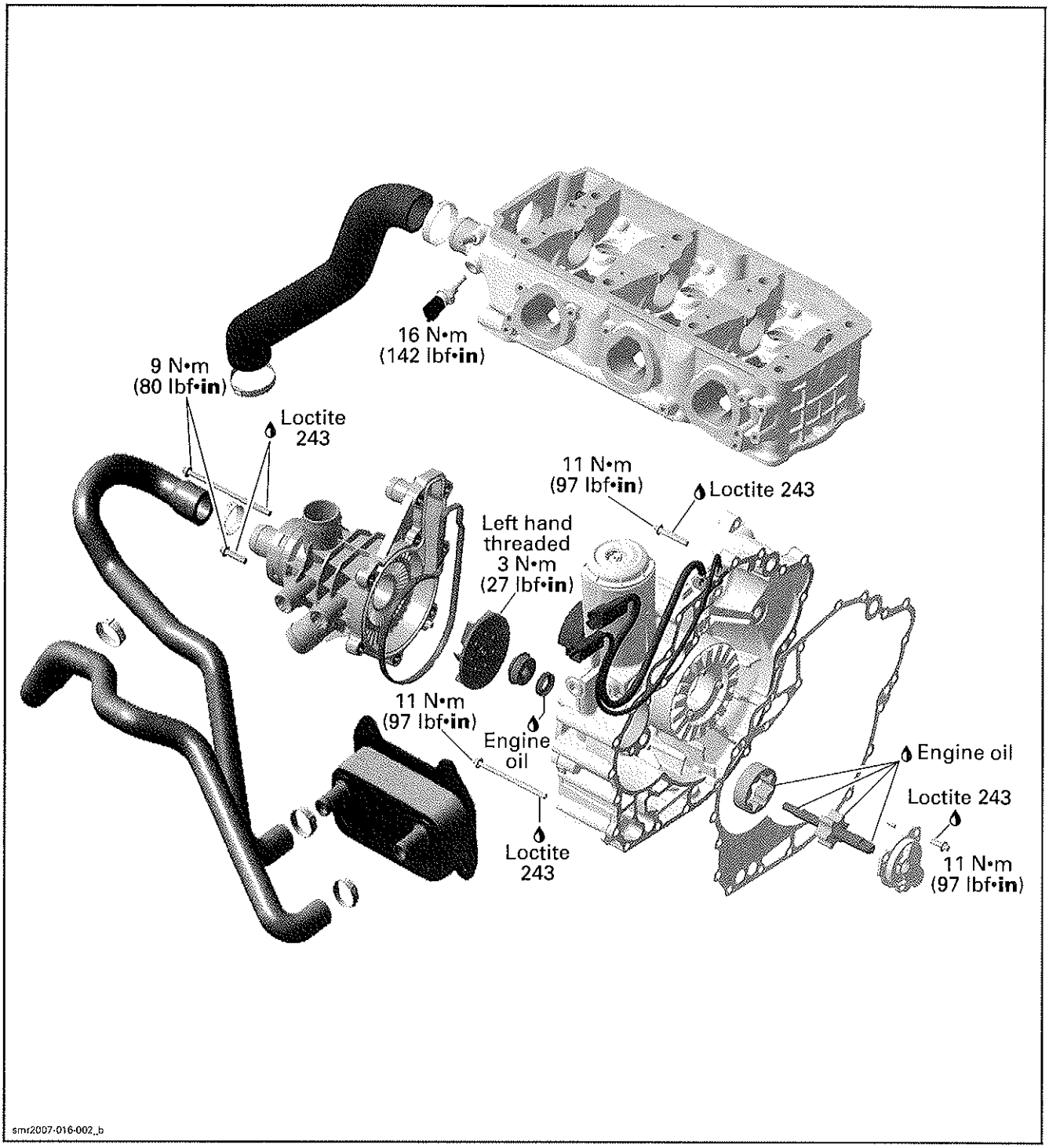
All except 255 Engines



255 Engines



ENGINE COMPONENTS



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

CIRCUIT

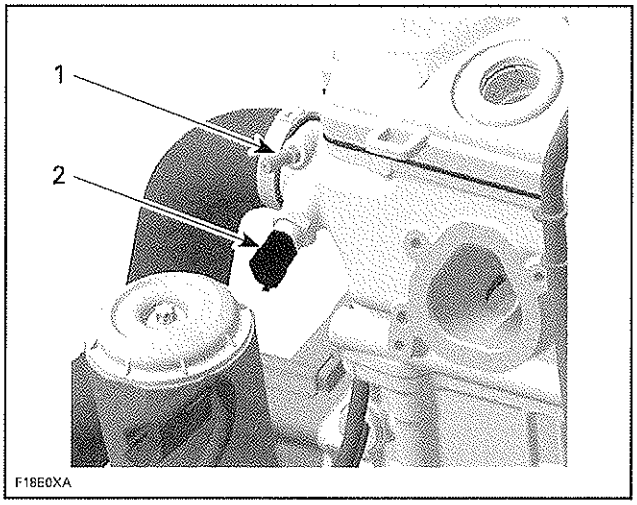
A closed loop cooling system is utilized on the 1503 4-TEC engines, which offers an efficient engine cooling while keeping dirt and salt water out of the cooling system. This system keeps the temperature constant and prevents internal engine corrosion.

A separate coolant expansion tank ensures that enough engine coolant is in the circuit during any operating condition.

The coolant flow comes from the water pump impeller into the cylinder block. It goes around the cylinders and straight up to the cylinder head. A smaller quantity of engine coolant enters the cylinder block on the exhaust side for a better cooling. In the cylinder head the water channels flow around the exhaust and then the intake valves and leave the engine through a large hose. From there the coolant goes back to the water pump housing and depending on the engine temperature, it flows through the thermostat directly back to the water pump impeller, or it takes its way through the ride plate which operates as a heat exchanger.

Engine coolant is also directed towards the oil cooler (coolant type).

Coolant temperature sensor and bleed nipple are located on the cylinder head.



1. *Bleed nipple*
2. *Coolant temperature sensor (CTS)*

CAUTION: Never modify cooling system arrangement, otherwise serious engine damage could occur.

TECHNICAL SPECIFICATIONS

TYPE	Closed loop cooling system.
COOLANT FLOW	Flow from water pump.
TEMPERATURE CONTROL	Thermostat.
SYSTEM BLEEDING	Self-bleed type through expansion tank (hose at uppermost point of circuit).
MONITORING BEEPER	Turns on at 100°C (212°F) on naturally aspirated engines. Turns on at 110°C (230°F) on supercharged engines.
COOLANT LIFE CYCLE	100 hours or 1 year. Should be replaced before storage.

INSPECTION

PRESSURE CAP

Using a pressure cap tester, check pressure cap efficiency. If the efficiency is feeble, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

HOSES AND CLAMPS

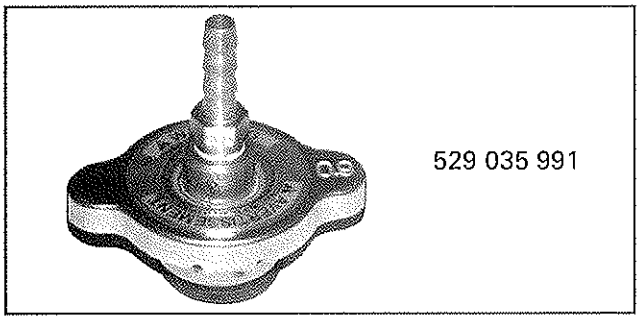
Check general condition of hoses and clamp tightness.

COOLING SYSTEM LEAK TEST

⚠ WARNING

To avoid potential burns, do not remove the expansion tank cap or loosen the ride plate drain plug if the engine is hot.

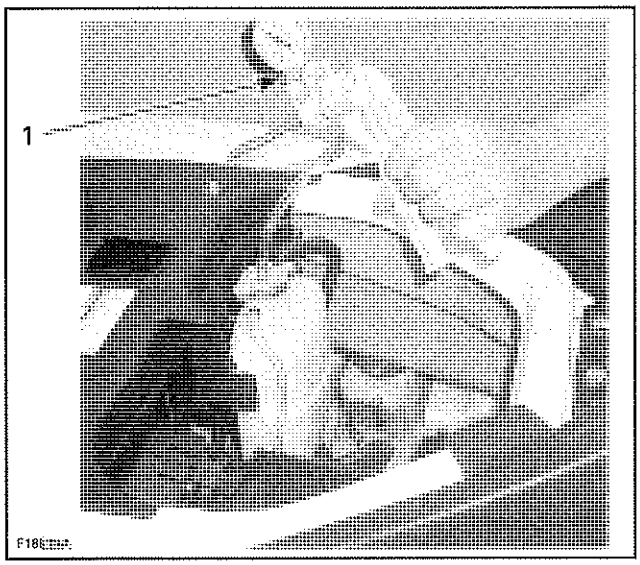
Install the test cap (P/N 529 035 991) on the coolant expansion tank.



529 035 991

NOTE: It is not necessary to install a hose pincher on overflow hose.

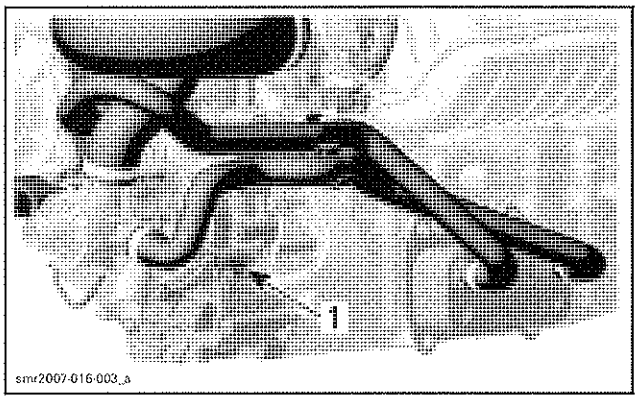
Connect the vacuum/pressure pump (P/N 529 021 800) to test cap and pressurize system through coolant expansion tank to 90 kPa (13 PSI).



TYPICAL
1. Vacuum/pressure pump

Check all hoses, ride plate, engine and oil cooler for coolant leaks. Spray a soap/water solution and look for air bubbles.

Check the leak indicator hole if there is oil or coolant. If so, replace appropriate water pump shaft seal.



1. Leak indicator hole

MAINTENANCE

COOLANT REPLACEMENT

⚠ WARNING

To avoid potential burns, do not remove the expansion tank cap or loosen the ride plate drain plug if the engine is hot.

Recommended Coolant

Use BRP premixed antifreeze (P/N 219 700 362) or a blend of 50% antifreeze with 50% demineralized water.

NOTE: Using a blend of 40% antifreeze with 60% demineralized water will improve the cooling efficiency when watercraft is used in particularly hot weather and/or hot water condition.

CAUTION: Pure antifreeze will freeze at a higher temperature than the optimal water/antifreeze mix. A blend of 40% antifreeze with 60% demineralized water will improve the cooling efficiency. Using water tap instead of demineralized water, would contribute to make deposits in cooling system and to reduce antifreeze efficiency. This could lead to engine overheating.

To prevent antifreeze deterioration, always use the same brand. Never mix different brands unless cooling system is completely flushed and refilled.

CAUTION: To prevent rust formation or freezing condition in cold areas, always replenish the system with 50% antifreeze and 50% demineralized water. Pure antifreeze will freeze at a higher temperature than the optimal water/antifreeze mix. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines. Using water tap instead of demineralized water, would contribute to make deposits in cooling system and to reduce antifreeze efficiency. This could lead to engine overheating.

Draining the System

⚠ WARNING

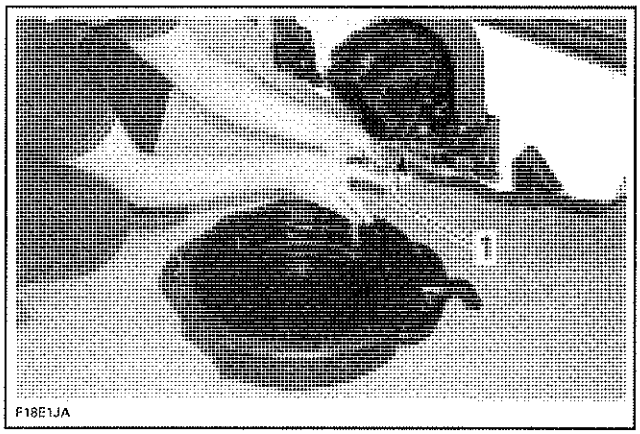
Never drain or refill cooling system when engine is hot.

Remove the coolant expansion tank cap.

Install a drain pan under jet pump nozzle.

Unscrew the cooling system drain plug at the rear of ride plate.

NOTE: Raising the front of the vehicle will contribute to drain the cooling system.



1. Cooling drain plug

Dispose coolant as per local regulations.

Do not reinstall drain plug at this time.

Cleaning the System

CAUTION: Cleaning the cooling system as per the following procedure is required when engine overheats (assuming everything else is operating normally) or each time coolant is replaced.

Drain the cooling system. Clean thoroughly using the Valvoline Zerex Super Cleaner (or equivalent).

Add the cleaning product in coolant expansion tank then fill cooling system with demineralized water.

Reinstall cap on coolant expansion tank.

Install watercraft in a water tank or ride on a water plane. Start engine and run for approximately 15 minutes mostly at full throttle.

IMPORTANT: Ensure thermostat opens so that the cleaning product flows in ride plate properly.

Stop engine and let the cleaning product work for 12 to 16 hours.

Thereafter, engine can be run one last time to soak off deposits.

Drain and thoroughly rinse the cooling system with clean fresh water.

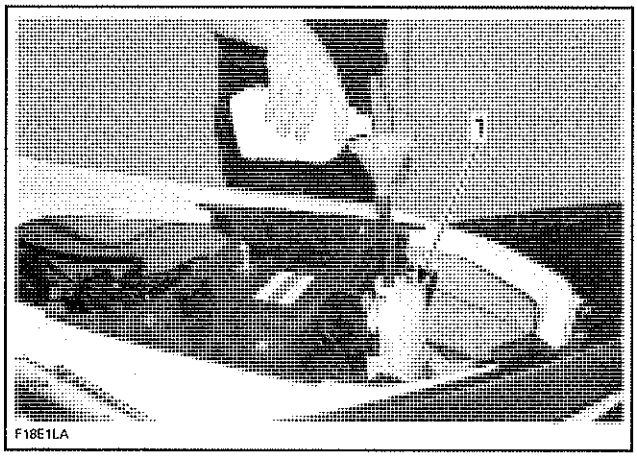
Refill cooling system as described below.

Refilling the System

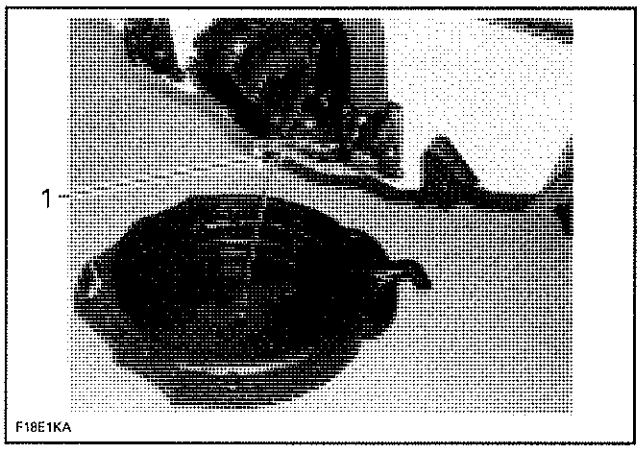
Watercraft should be level, engine cold and drain plug removed for refilling.

Place a container under drain plug to collect antifreeze.

Ask someone to pour recommended antifreeze in expansion tank while watching antifreeze and air bubble flowing out through drain hole. When no air bubbles escape, reinstall drain plug. Torque to 8 N•m (71 lbf•**in**).

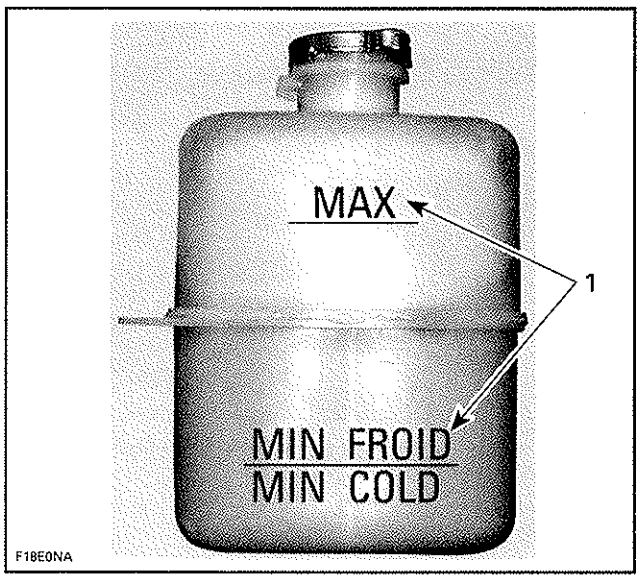


1. Pour antifreeze/water mix in expansion tank



1. Watch air bubbles flowing here

Continue to pour and fill expansion tank between marks.



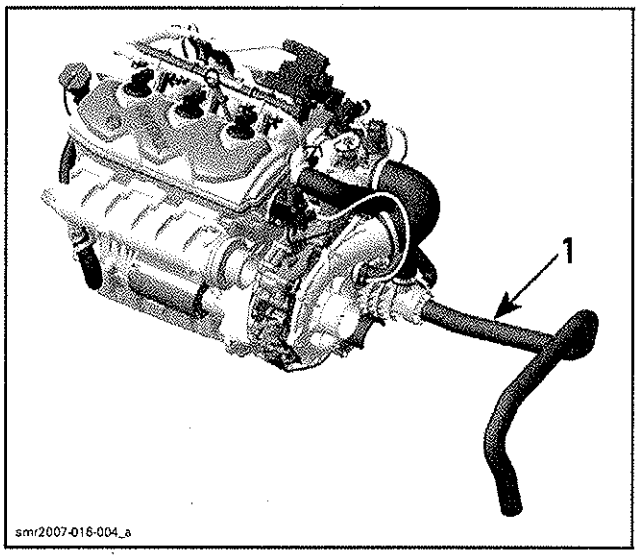
1. Level between marks when engine is cold

Do not install pressure cap at this time.

Properly cool exhaust system by installing a garden hose. Refer to *STORAGE* section.

Start engine and let run for 2 minutes. Stop engine and wait 15 minutes to cool down. Refill tank as necessary.

Repeat this run-stop cycle 2 - 3 times until thermostat opens and stop engine.



1. This hose becomes hot when thermostat opens

Last, refill expansion tank and install pressure cap.

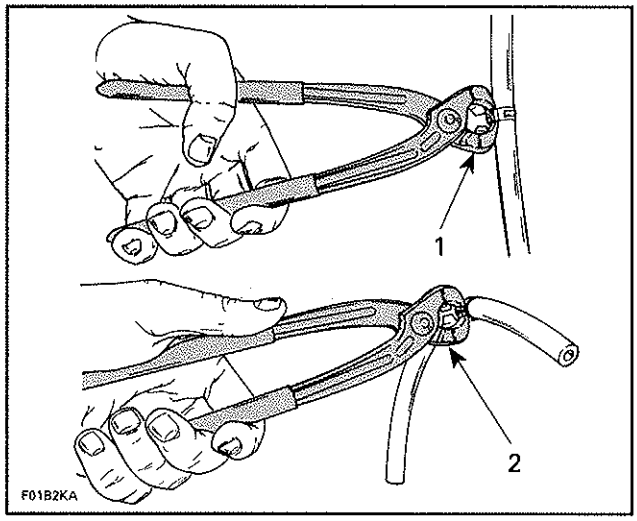
When engine has completely cooled down, recheck coolant level coolant tank and top up if necessary.

PROCEDURES

CLAMPS

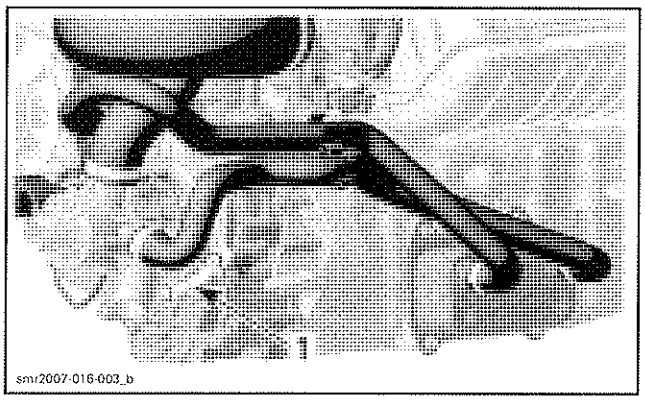
Clamp Replacement

To cut or secure Oetiker clamps of cooling system hoses, use the pliers Oetiker 1099 (P/N 295 000 070).



1. Cutting clamp
2. Securing clamp

WATER PUMP HOUSING



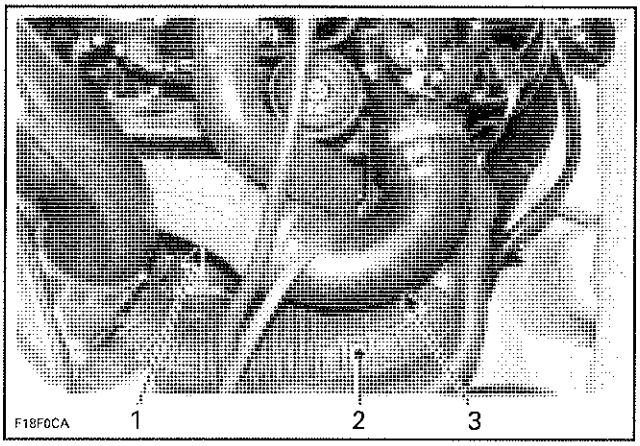
1. *Water pump housing*

Water Pump Housing Removal

215 and 255 Engines

On **255 engine models**, remove both air hoses from intercooler to reach supercharger.

Remove supercharger inlet and outlet hoses to make room.



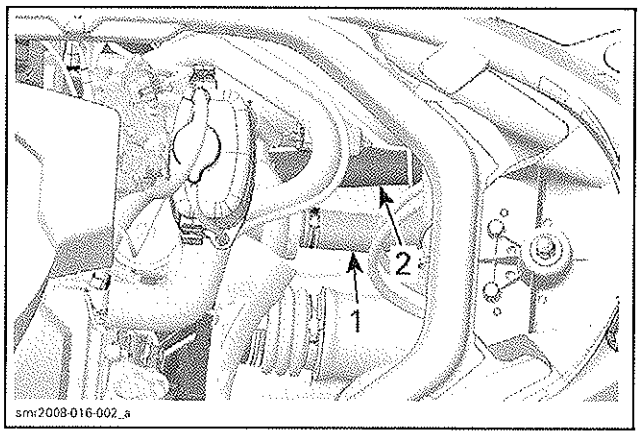
1. *Supercharger*
2. *Inlet hose*
3. *Outlet hose*

All Engines

Drain cooling system and engine oil.

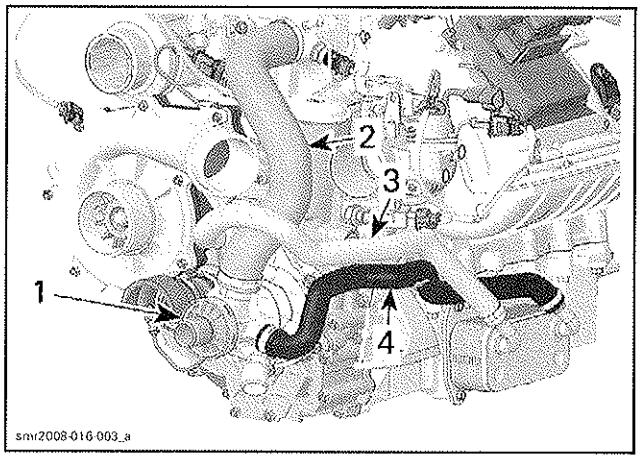
Disconnect the coolant expansion tank hose from water pump housing.

Disconnect ride plate hoses from water pump housing.



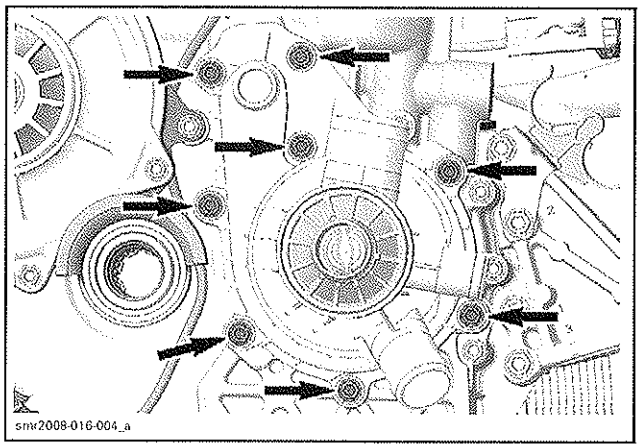
1. *Ride plate inlet hose*
2. *Ride plate outlet hose*

Disconnect the cylinder head outlet hose and oil cooler hoses.



1. *Water pump housing*
2. *Cylinder head hose*
3. *Oil cooler inlet hose*
4. *Oil cooler outlet hose*

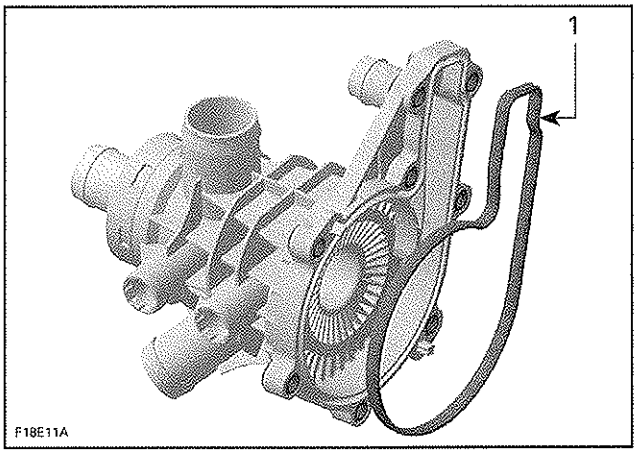
Remove water pump housing screws.



Pull the water pump housing to remove it.

Water Pump Housing Inspection

Check if gasket is brittle, hard or damaged and replace as necessary.

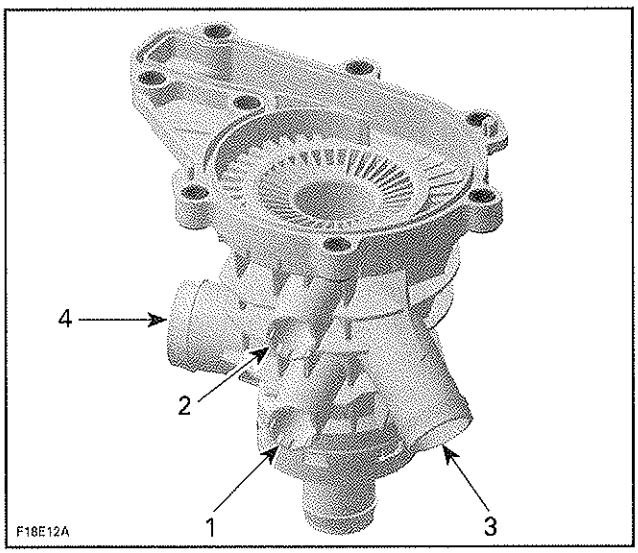


1. Water pump housing gasket

Check if thermostat is in good condition. Refer to *THERMOSTAT* in this section.

Water Pump Housing Leak Test

Plug the connections of the oil cooler return hose, coolant tank hose, ride plate return hose and cylinder head return hose with a rag.



1. Oil cooler return connection
2. Coolant tank hose connection
3. Ride plate return hose connection
4. Cylinder head return hose connection

Fill the water pump housing with water.

If a bigger quantity of coolant leaks out at the ride plate outlet connection, replace the water pump housing.

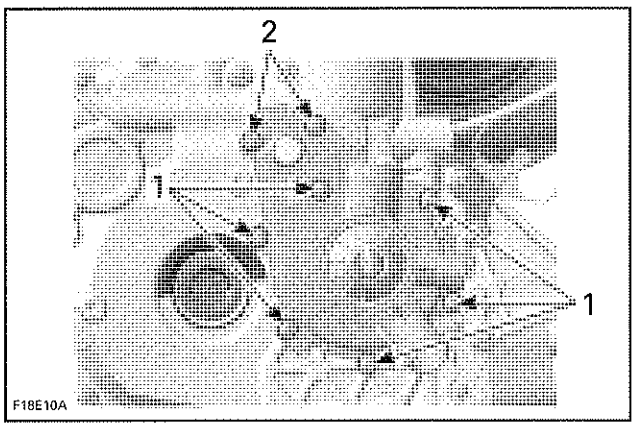
If there is no leak, check the operation of the thermostat.

Water Pump Housing Installation

The installation is the opposite of the removal procedure. However, pay attention to the following.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of water pump housing screws.

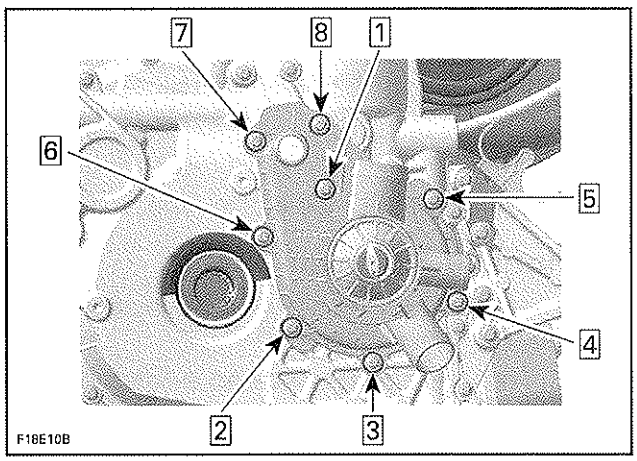
Install screws as per the following illustration.



1. Screws M6 x 25
2. Screws M6 x 105

CAUTION: To prevent leaking, take care that the gaskets are exactly in groove when you reinstall the water pump housing.

Tighten screws to 10 N•m (89 lbf•**in**) using the following sequence.

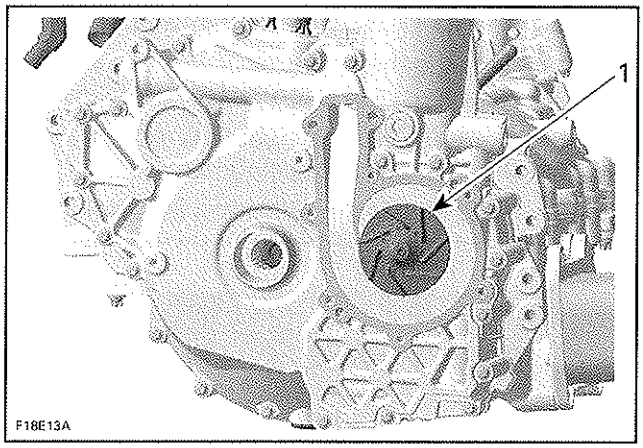


WATER PUMP IMPELLER

Water Pump Impeller Removal

Remove *WATER PUMP HOUSING*, see procedure in this section.

Unscrew the impeller clockwise.



1. Impeller

CAUTION: Coolant/oil pump shaft and impeller have left-hand threads. Remove by turning clockwise and install by turning counterclockwise.

Water Pump Impeller Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Water Pump Impeller Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

CAUTION: Be careful not to damage impeller wings during installation.

Torque impeller to 3 N•m (27 lbf•**in**).

THERMOSTAT

The thermostat is a single action type.

Thermostat Removal

Remove the *WATER PUMP HOUSING*, see procedure above in this section.

NOTE: The thermostat is located inside the water pump housing.

Thermostat Test

To check the operation of the thermostat, put it in water and heat water.

Look inside the cylinder head return hose connection to see the movement of the thermostat. Thermostat should open when water temperature reaches 87°C (188°F).

If there is no operation, replace the water pump housing.

Thermostat Installation

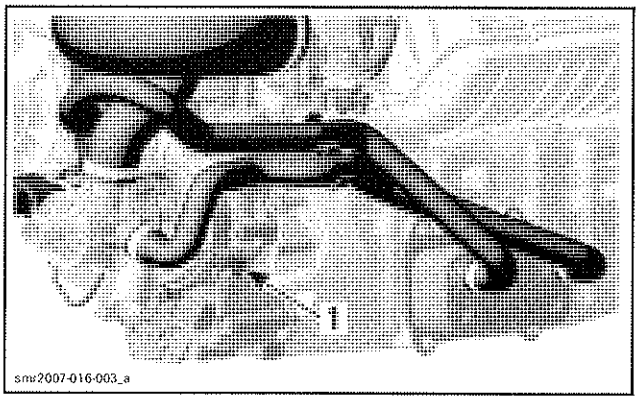
For installation, reverse the removal procedure, paying attention to the following details.

Refer to *WATER PUMP HOUSING* in this section.

ROTARY SEAL

Rotary Seal Inspection

Check leak indicator hole for oil or coolant leak.



1. Leak indicator hole

Coolant leaking out of the hole indicates a defective rotary seal. Leaking oil indicates a faulty oil seal.

However, if seal is disassembled both parts have to be replaced together.

Rotary Seal Removal

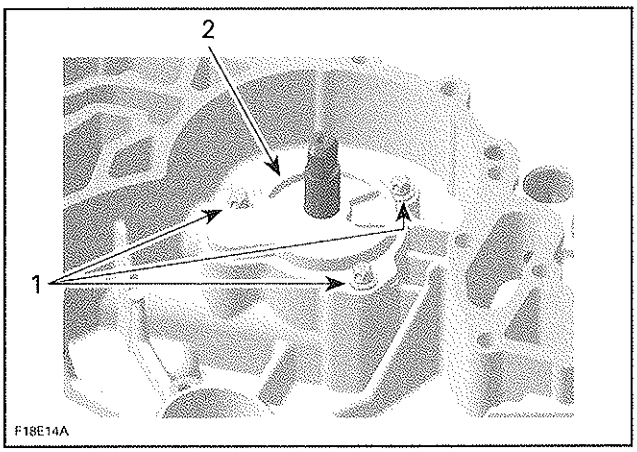
Remove *WATER PUMP HOUSING*, see procedure in this section.

Unscrew the impeller clockwise.

CAUTION: Always unscrew the impeller clockwise otherwise you can damage the components.

Remove PTO cover Refer to *PTO HOUSING/MAGNETO* section.

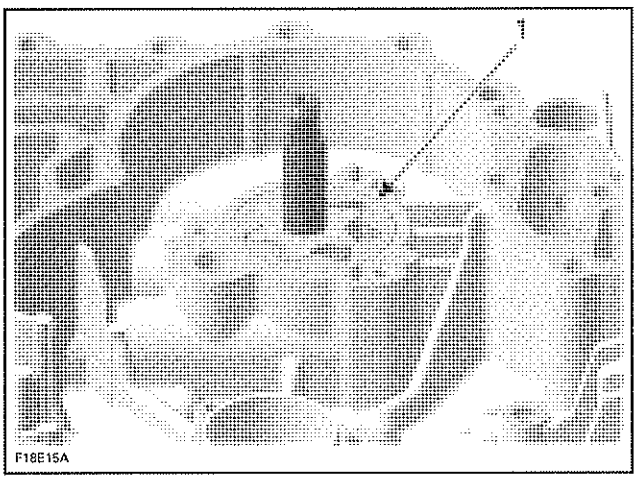
Remove oil pump cover screws.



1. *Oil pump cover screws*
2. *Oil pump cover*

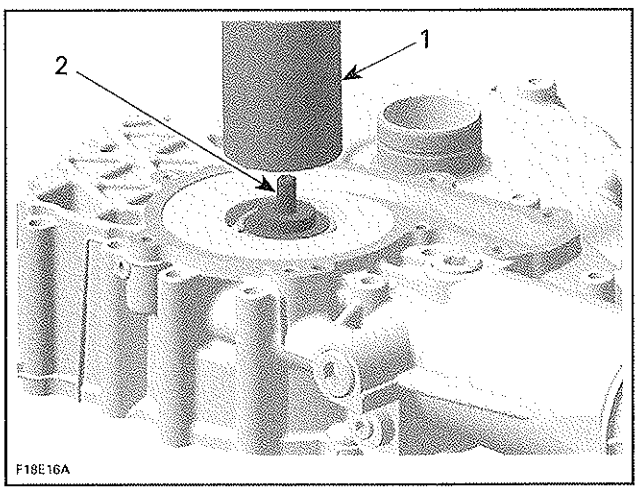
Remove oil pump cover.

Remove outer oil pump rotor.



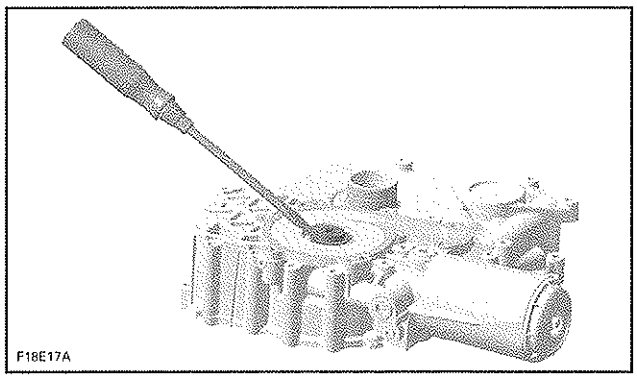
1. *Outer oil pump rotor*

Extract the coolant/oil pump shaft from outside PTO housing cover with a pusher.



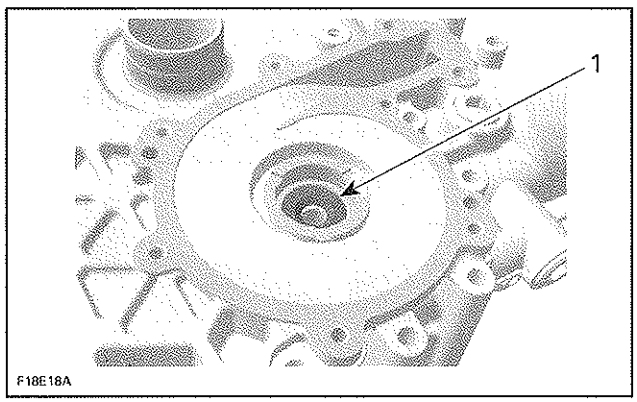
1. *Pusher*
2. *Coolant/oil pump shaft*

Remove rotary seal with a screwdriver.



CAUTION: Be careful not to damage the surface of the rotary seal bore in magneto housing cover.

Always replace also the oil seal behind the rotary seal.



1. *Oil seal*

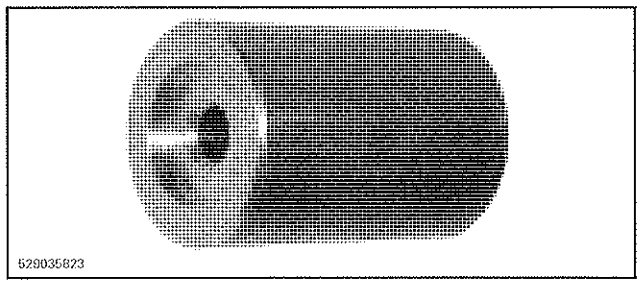
Rotary Seal Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

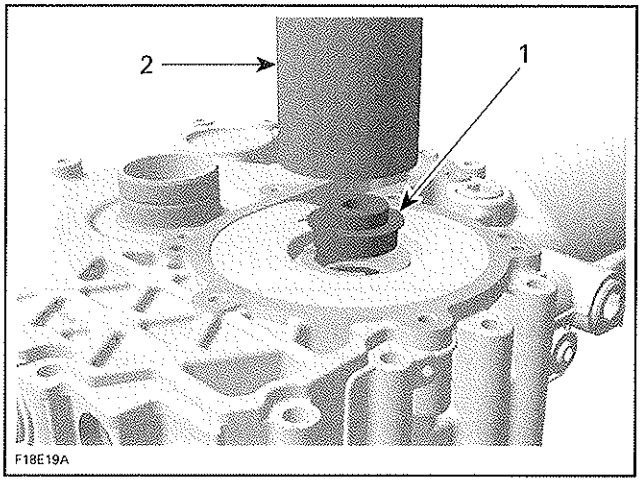
NOTE: Never use oil in the press fit area of the oil seal and rotary seal.

Push water pump shaft oil seal in place by using thumb.

Install the NEW rotary seal using a press and the rotary seal installer (P/N 529 035 823).

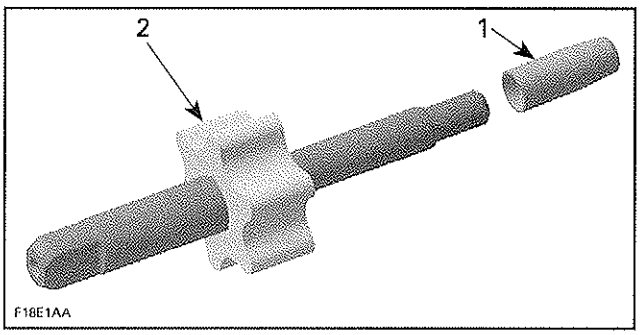


CAUTION: Never use a hammer for the rotary seal or water/oil pump shaft installation. Only use a press to avoid damaging the ceramic component.



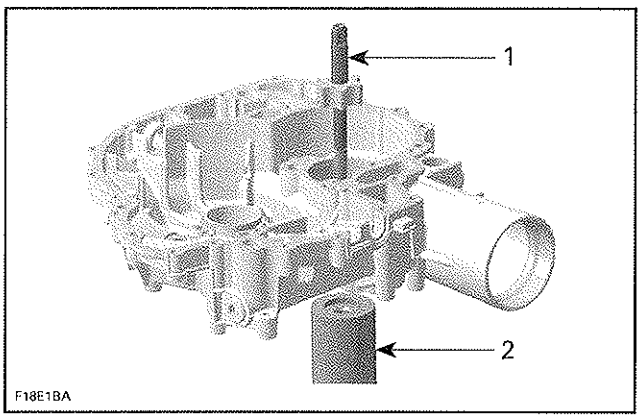
1. *Rotary seal*
2. *Rotary seal installer*

Install the oil seal protector (P/N 529 035 822) on the end of coolant/oil pump shaft.



1. *Oil seal protector*
2. *Coolant/oil pump shaft*

Using the rotary seal installer (P/N 529 035 823) to support the PTO cover, install the coolant/oil pump shaft.



1. *Coolant/oil pump shaft with oil seal protector*
2. *Rotary seal installer*

Install all other removed parts.

CYLINDER HEAD

SERVICE TOOLS

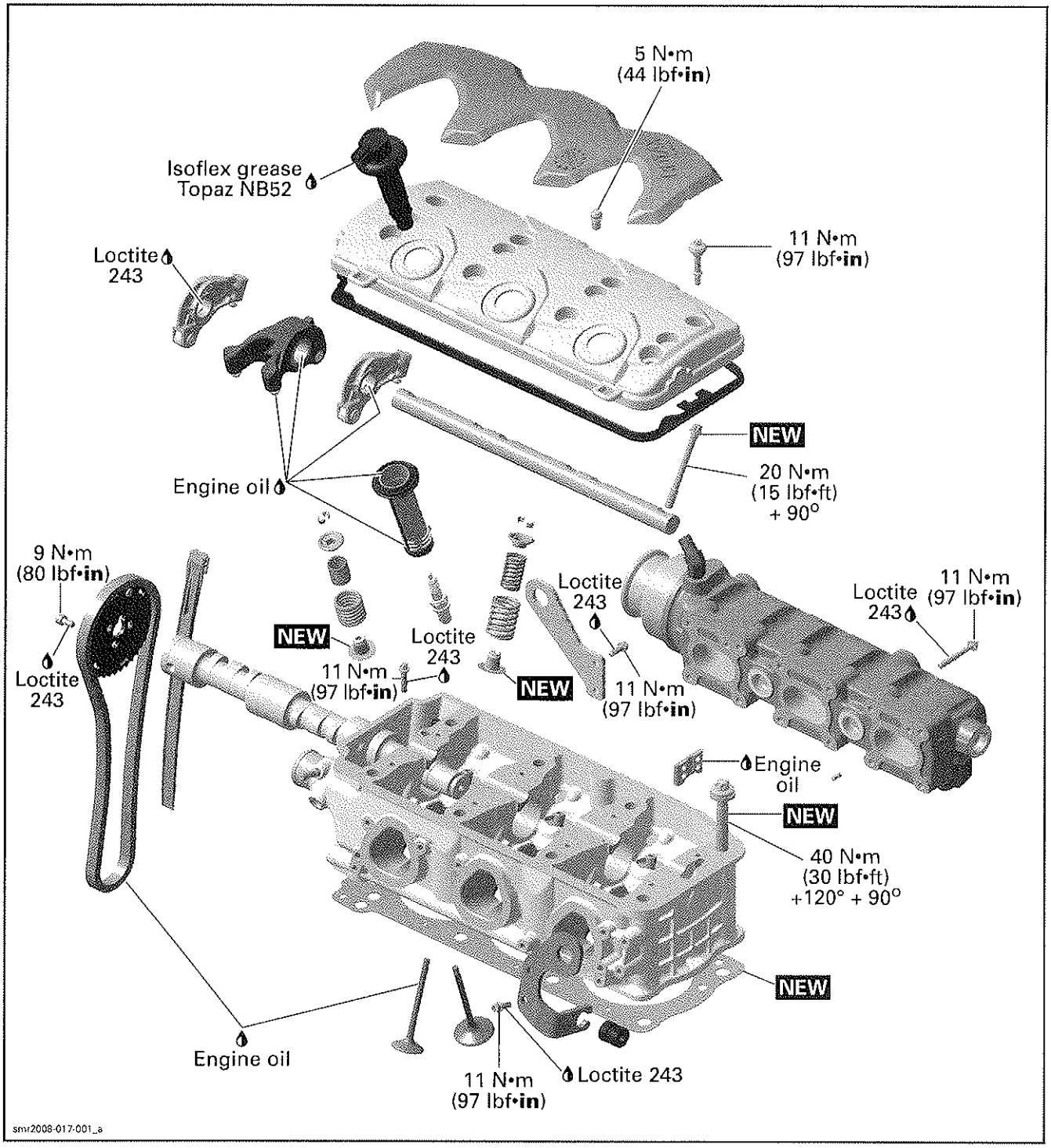
Description	Part Number	Page
valve spring compressor clamp	529 035 724	153
valve spring compressor cup	529 035 725	153
camshaft locking tool	529 035 839	148, 150
valve guide remover	529 036 086	158
valve guide installer	529 036 087	159

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on valve stem seal pliers	YA8230	155

SERVICE PRODUCTS

Description	Part Number	Page
Isoflex grease Topas NB 52	293 550 021	153
Loctite 243 (blue)	293 800 060	145, 150, 152
Molykote G-N	420 297 433	159



GENERAL

NOTE: When diagnosing an engine problem, always perform an engine leak test. This will help pin-point a problem. Refer to *ENGINE LEAK TEST* section for procedures.

Always place the vehicle on level surface.

Always disconnect the negative wire from the battery before working on the engine.

Even if the removal of many parts is not necessary to reach another part, it is recommended to remove these parts in order to check them.

When disassembling parts that are duplicated in the engine, (e.g.: valves, bushings), it is strongly recommended to note their position (cylinder 1, 2 or 3) and to keep them as a "group". If you find a defective component, it would be much easier to find the cause of the failure within the group of parts (e.g.: you found a worn valve guide. A bent spring could be the cause and it would be easy to know which one among the springs is the cause to replace it if you grouped them at disassembly). Besides, since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their "group".

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

PROCEDURES

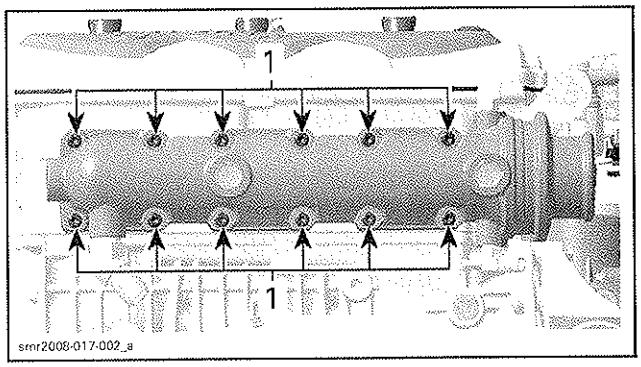
EXHAUST MANIFOLD

Exhaust Manifold Removal

Refer to *EXHAUST SYSTEM* to remove exhaust pipe.

Disconnect cooling hoses from exhaust manifold.

Unscrew the exhaust manifold beginning with the bottom screws. This will help holding the manifold while you remove the screws.



1. Exhaust manifold screws

Remove exhaust manifold.

Exhaust Manifold Inspection

Inspect exhaust manifold condition paying attention for cracks or other damage. Check contact surfaces and hose. Replace any defective part.

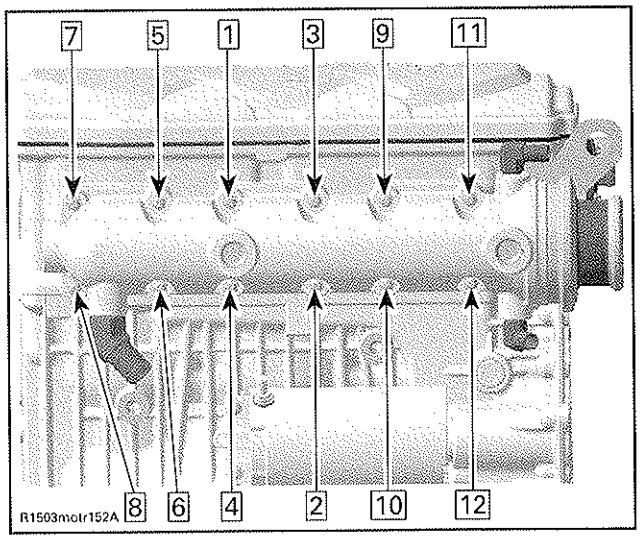
Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

Exhaust Manifold Installation

NOTE: There is no gasket between cylinder block and exhaust manifold.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of exhaust manifold screws.

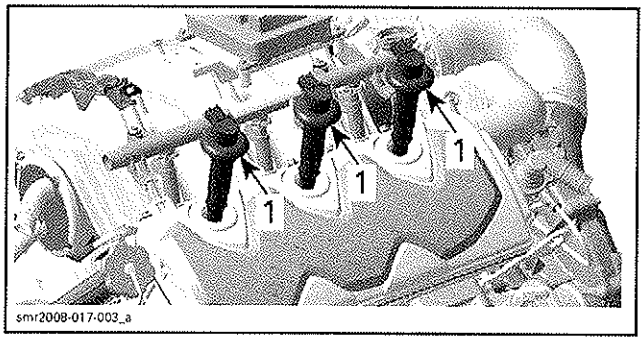
Torque screws to 11 N•m (97 lbf•**in**) as per following illustrated sequence.



CYLINDER HEAD COVER

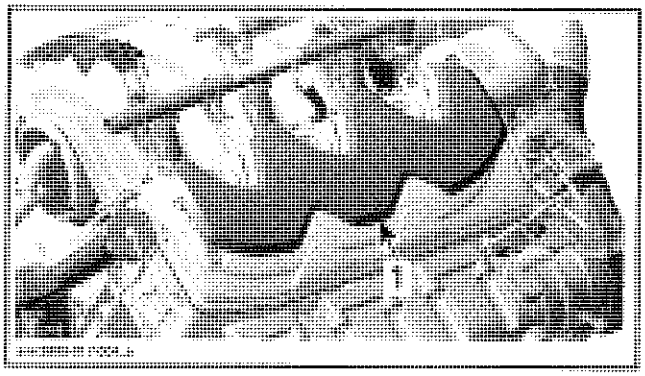
Cylinder Head Cover Removal

Unplug and remove ignition coils.



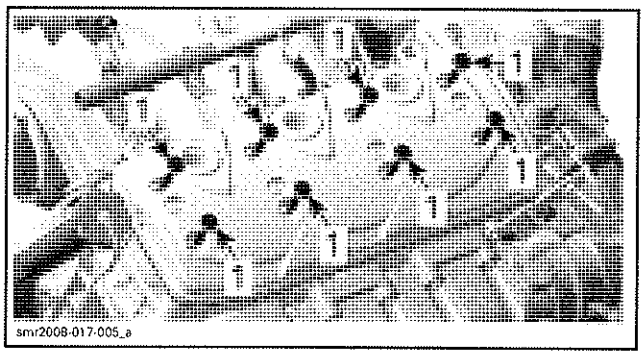
1. *Ignition coils*

Remove the cylinder head cover cowl.



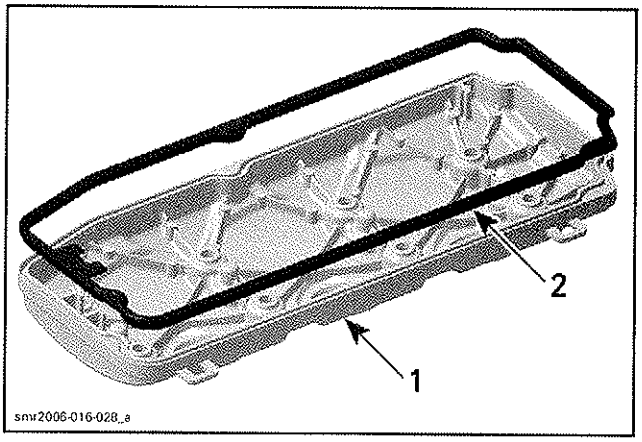
1. *Cylinder head cover cowl*

Remove screws securing the cylinder head cover.



1. *Cylinder head cover screws*

Remove the cylinder head cover and its gasket.



1. *Cylinder head cover*
2. *Gasket*

Cylinder Head Cover Inspection

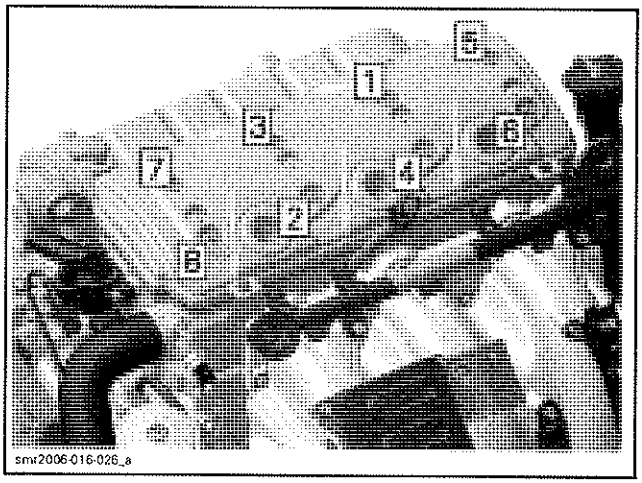
Check if the gasket on the cylinder head cover and the rubber bushing on the cylinder head cover screws are brittle, cracked or hard. If so, replace the gasket or the cylinder head cover screw accordingly.

Cylinder Head Cover Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Properly seat the gasket in the cover groove.

Install the cylinder head cover screws according to following sequence.



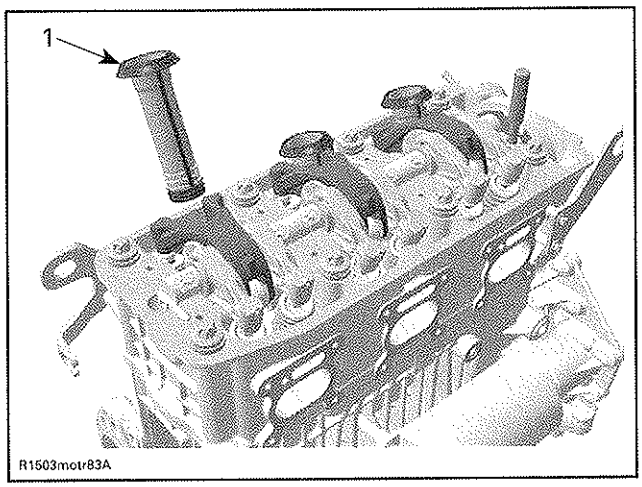
Torque screws to 11 N•m (97 lbf•**in**).

SPARK PLUG TUBES

Spark Plug Tubes Removal

Remove the *CYLINDER HEAD COVER*, see procedure in this section.

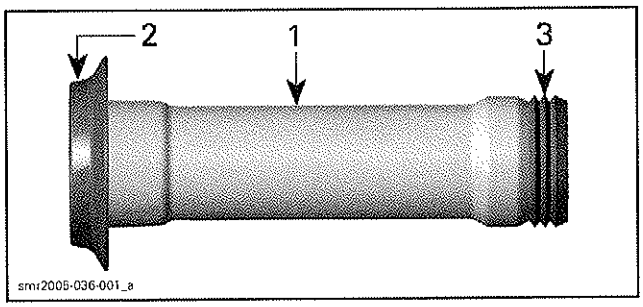
Pull spark plug tubes to remove them.



1. Spark plug tube

Spark Plug Tubes Inspection

Check seals on spark plug tube. If seals are brittle, cracked or hard, replace spark plug tube.



TYPICAL
1. Spark plug tube
2. Seal to the cylinder head cover
3. Seal to the cylinder head

Spark Plug Tubes Installation

For installation, reverse the removal procedure. Pay attention to the following detail.

Apply engine oil on seals.

ROCKER ARMS

Rocker Arms Removal

Lock crankshaft, refer to *CYLINDER BLOCK* section.

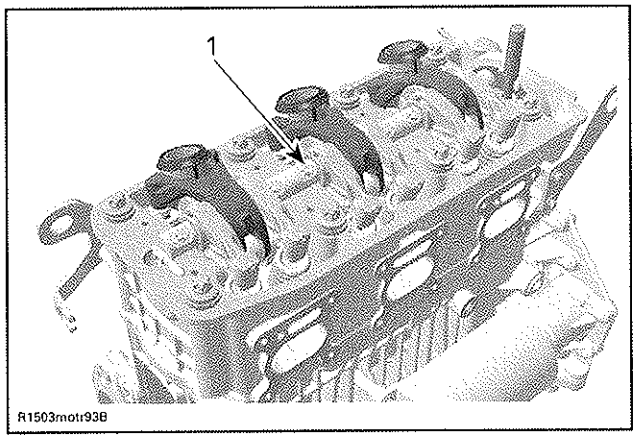
Remove the *CYLINDER HEAD COVER*, see procedure in this section.

Remove the oil separator cover. Refer to *LUBRICATION SYSTEM* section.

NOTE: The removal of oil separator cover is not necessary to remove rocker arms but mandatory for installation.

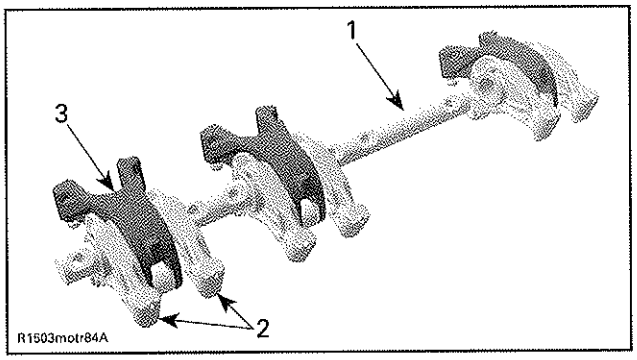
Remove spark plug tubes.

Remove and discard rocker arm shaft screws.



1. Rocker arm shaft screw

Remove rocker arm shaft with rocker arms.

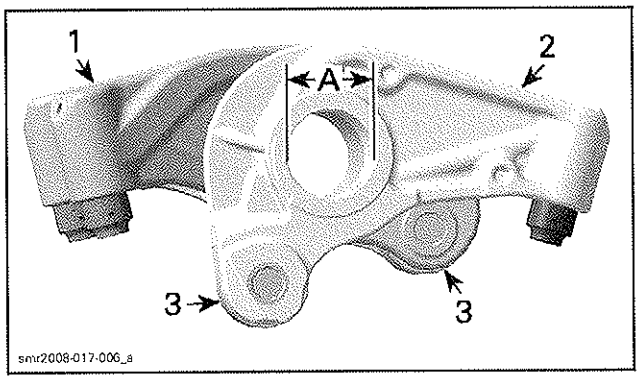


1. Rocker arm shaft
2. Rocker arms (exhaust side)
3. Rocker arm (intake side)

Rocker Arms Inspection

Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly as necessary.



1. Rocker arm (intake side)
2. Rocker arm (exhaust side)
3. Rollers
A. Rocker arm inside diameter

Measure rocker arm inside diameter. If diameter is out of specification, change the rocker arm assembly.

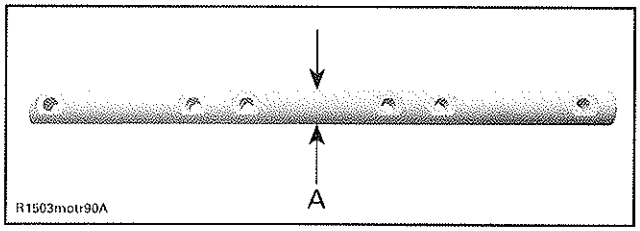
ROCKER ARM INSIDE DIAMETER	
NEW	20.007 - 20.020 mm (.7877 - .7881 in)
SERVICE LIMIT	20.035 mm (.7887 in)

Press the hydraulic lifter with your thumb. If the hydraulic lifter can be fully pressed in, replace rocker arm. Lifter must turn freely in rocker arm bore. Otherwise, replace.

Rocker Arm Shaft

Check for scored friction surfaces, if so, replace parts.

Measure rocker arm shaft diameter.

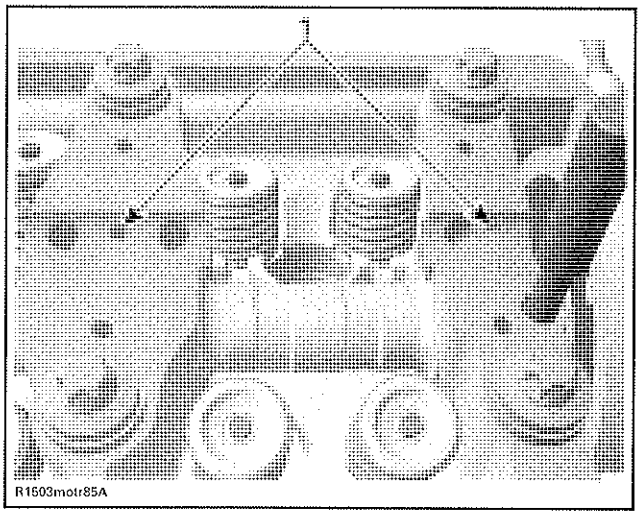


A. Measure rocker arm shaft diameter here

ROCKER ARM SHAFT DIAMETER	
NEW	19.980 - 19.993 mm (.7866 - .7871 in)
SERVICE LIMIT	19.965 mm (.7860 in)

Any area worn excessively will require parts replacement.

Verify and clean oil passages to ensure a good rocker arm shaft lubrication.



1. *Oil supply from the camshaft to the rocker arm shaft, then to the rocker arms and finally to the valve adjustment*

Rocker Arms Installation

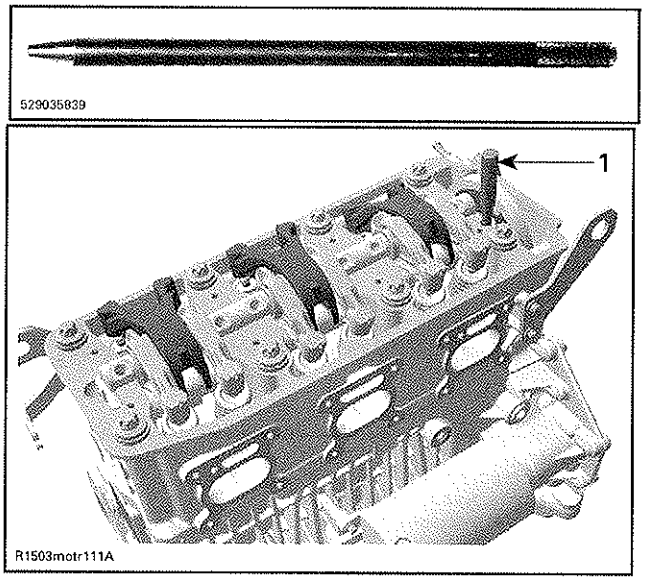
For installation, reverse the removal procedure. Pay attention to the following details.

Apply engine oil on rocker arm shaft.

IMPORTANT: The rocker arm shaft can only be installed in one specific position. Therefore crankshaft as well as camshaft has to be positioned with their locking pins when the piston of cylinder no. 3 is on ignition TDC. Refer to *CYLINDER BLOCK* section for crankshaft and the following for the camshaft locking.

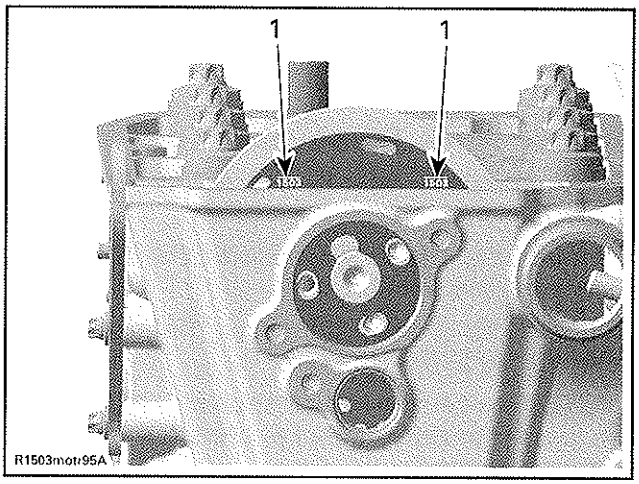
NOTE: Cylinder no. 3 is next to the oil filler tube.

Rotate camshaft so that the camshaft locking tool (P/N 529 035 839) can be pushed in camshaft hole and lock camshaft in place.



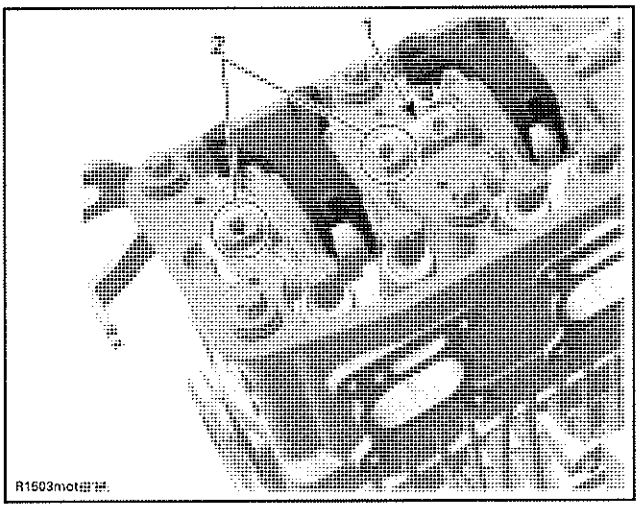
1. *Camshaft locking tool*

Then, the camshaft sprocket lines should be lined up as shown in the following illustration.



1. *Position lines*

Position the rocker arm shaft with the notches on top.

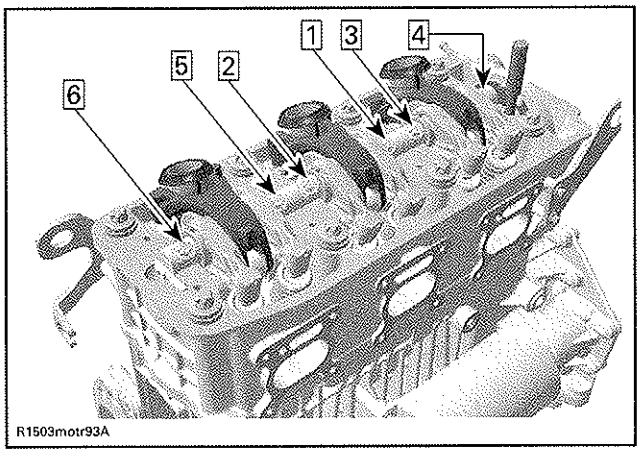


1. *Rocker arm shaft*
2. *Rocker arm shaft notches*

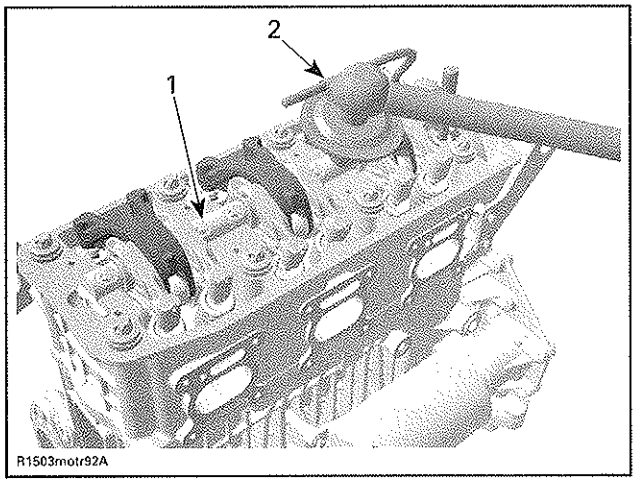
Install **NEW** rocker arm shaft screws. Torque as per following procedure:

CAUTION: This assembly uses stretch screws. As the screws have been stretched from the previous installation, it is very important to use new screws at assembly. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

- Torque screws at first to 10 N•m (89 lbf•**in**) according to following sequence.



- Retorque screws to 20 N•m (15 lbf•ft).
- Finish tightening screws turning an additional 90° rotation with a torque angle gauge.



1. *Rocker arm shaft screw*
2. *Torque angle gauge*

CAMSHAFT TIMING GEAR

NOTE: Although it is not necessary to position crankshaft to TDC for disassembly, it is a good practice to do it, as a troubleshooting step, to know before disassembly if valve timing was appropriate.

Camshaft Timing Gear Removal

Lock crankshaft, refer to *CYLINDER BLOCK* section.

Remove *CYLINDER HEAD COVER*, see procedure above in this section.

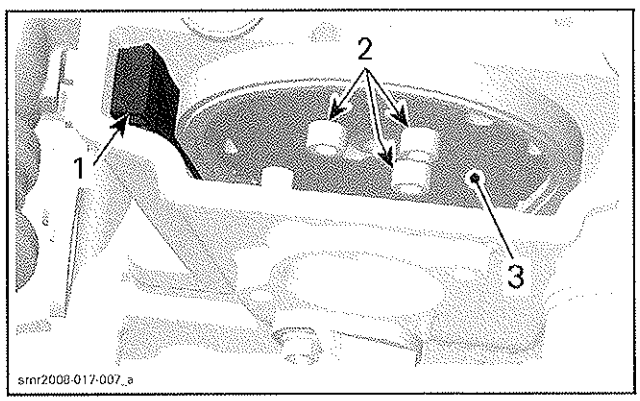
Remove the oil separator cover. Refer to *LUBRICATION SYSTEM* section.

Remove the chain tensioner. Refer to *CYLINDER BLOCK* section.

Remove the chain guide.

Remove the Allen screws securing the camshaft timing gear.

Remove the camshaft timing gear.



1. *Chain guide*
2. *Allen screws*
3. *Camshaft timing gear*

NOTE: Secure timing chain with a retaining wire.

Camshaft Timing Gear Inspection

Check camshaft timing gear for wear or deterioration.

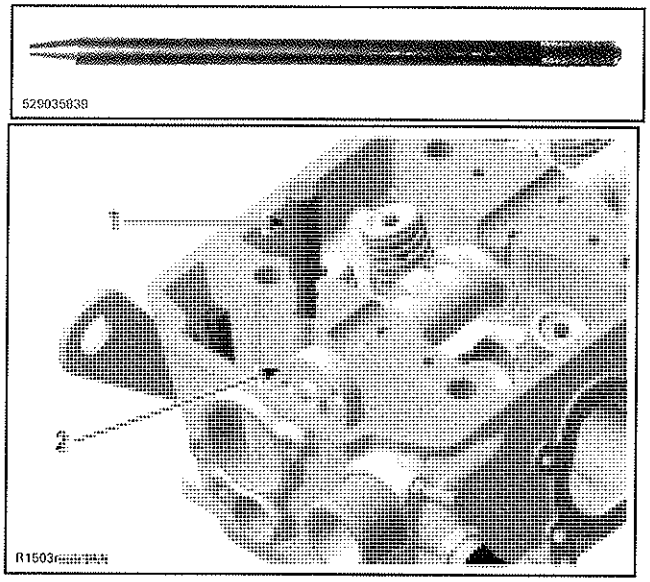
If gear is worn or damaged, replace it as a set (camshaft timing gear and timing chain).

For crankshaft timing gear, refer to *CYLINDER BLOCK* section.

Camshaft Timing Gear Installation

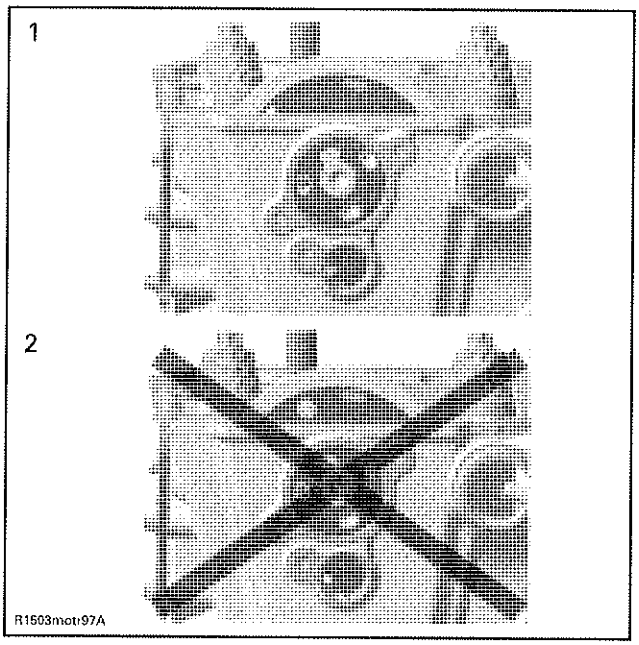
For installation, reverse the removal procedure. Pay attention to the following details.

Using the camshaft locking tool (P/N 529 035 839), lock camshaft on TDC position.



1. Camshaft locking tool
2. Camshaft on TDC position

Install the camshaft timing gear with the writing visible, i.e. to be able to see the position lines when looking from outside of engine.



1. Good (with 1503 aligned)
2. Never

Install timing chain. Refer to *CYLINDER BLOCK* section.

Ensure chain guides are in place.

Loosely install timing chain screws.

Install chain tensioner.

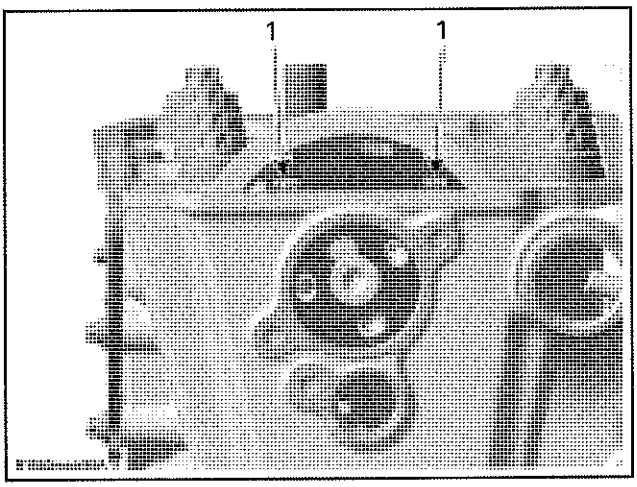
NOTE: There can be 2 different positions to install the timing gear on the camshaft. Basically both positions are working well, since the camshaft and crankshaft are locked in their proper position. Due to some tolerances, there could be one position which fits better than the other one. To check this, perform the following test.

Check if timing chain screws are still loose. If screws are squeezed by the timing gear, remove the chain tensioner again and rotate timing gear by one tooth clockwise. Then install the chain tensioner again.

One at a time, remove timing chain screws and apply Loctite 243 (blue) (P/N 293 800 060) on threads.

Tighten timing chain screws to 9 N•m (80 lbf•**in**).

CAUTION: Crankshaft and camshaft must be locked on TDC position to place camshaft timing gear and timing chain in the proper position. To double check, take a look at the timing gear lines. They must be parallel to the cylinder head surface.



1. Position lines

Remove locking tools.

CAUTION: Ensure to remove locking tools when finished.

Install all other removed parts.

CYLINDER HEAD

Cylinder Head Removal

Lock crankshaft, refer to *CYLINDER BLOCK* section.

Drain coolant, refer to *COOLING SYSTEM* section.

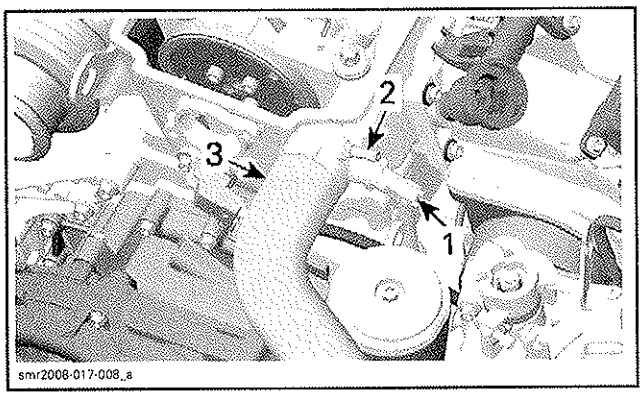
Unscrew TOPS valve from cylinder head. Refer to *LUBRICATION SYSTEM* section.

Unplug the camshaft position sensors (CAPS).

Unplug the coolant temperature sensor (CTS).

Disconnect bleeding hose.

Disconnect the cylinder head outlet hose.



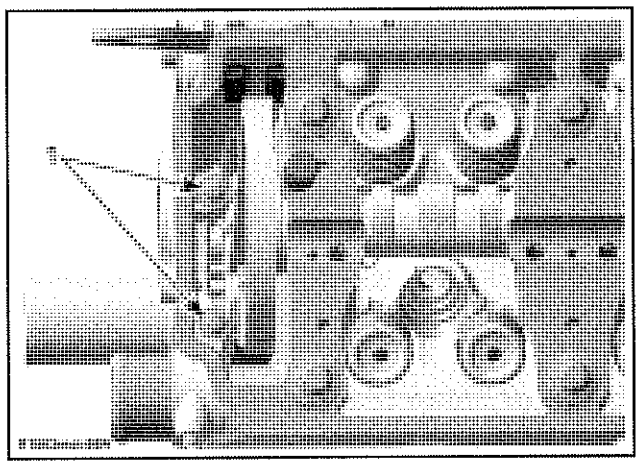
1. Coolant temperature sensor (CTS)
2. Bleeding nipple
3. Cylinder head outlet hose

Remove the exhaust manifold. Refer to *EXHAUST SYSTEM* section.

Remove the intake manifold. Refer to *INTAKE MANIFOLD AND INTERCOOLER* section.

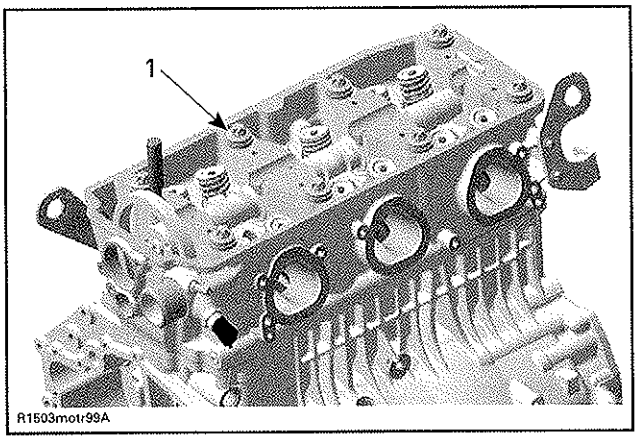
Remove the *CAMSHAFT TIMING GEAR*, see procedure in this section.

Remove the cylinder head screws M6.



1. Cylinder head screws M6

Remove the cylinder head screws M11 securing cylinder head to cylinder block.



1. Cylinder head screws M11

Pull up cylinder head.

Remove gasket.

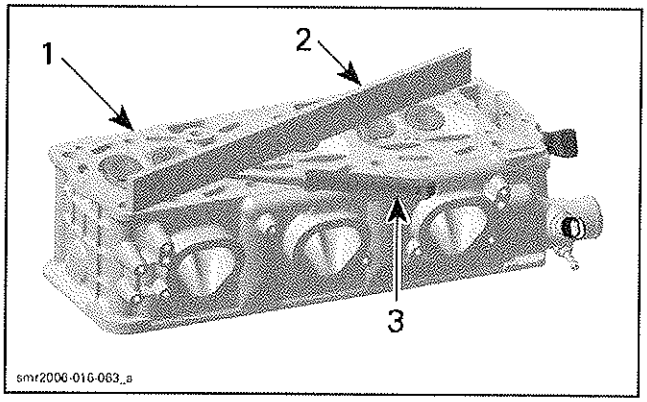
Cylinder Head Cleaning

Remove carbon deposits from combustion chamber, exhaust port and piston top.

Cylinder Head Inspection

Check for cracks between valve seats and warpage of cylinder head, if so, replace cylinder head.

Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.



1. *Cylinder head*
2. *Flat bar*
3. *Feeler gauge*

If warpage of cylinder head is more then 0.15 mm (.006 in) replace cylinder head.

Cylinder Head Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Ensure dowel pins are in place.

Install NEW cylinder head gasket.

CAUTION: Each installation of the cylinder head requires a new cylinder head gasket. Using a gasket twice will cause engine damage, even if the engine had not run.

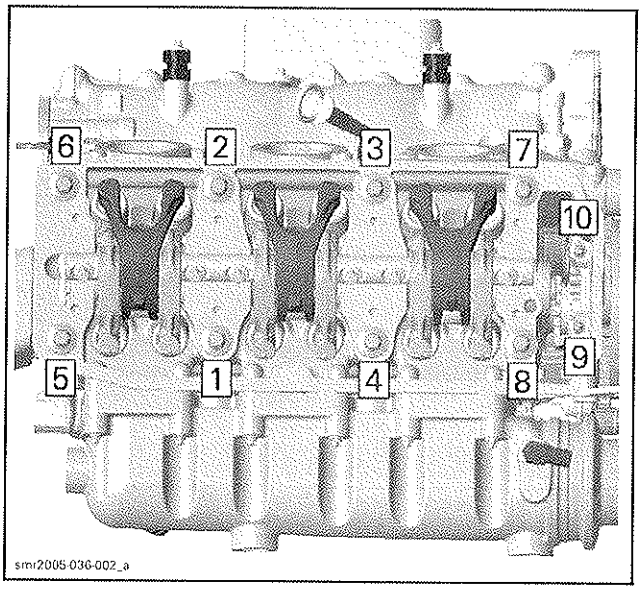
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of screws M6.

Install screws M6 and manually tighten them.

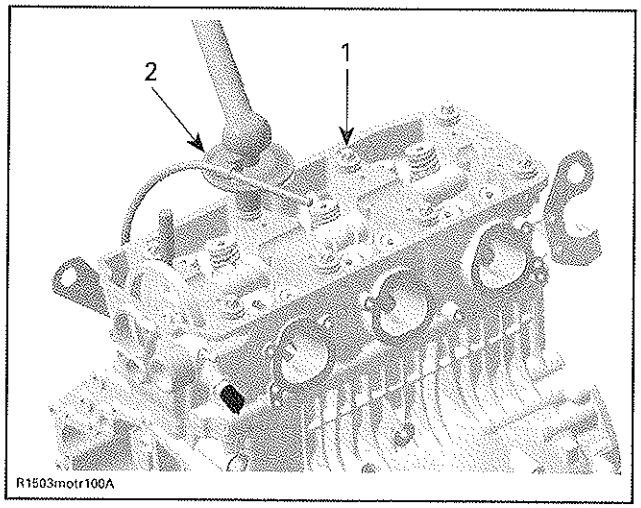
Install NEW screws M11and tighten them manually.

CAUTION: This assembly uses stretch screws. As the screws M11 have been stretched from the previous installation, it is very important to replace the old screws by new ones at assembly. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

Using the following sequence, tighten screws as described below.



- First torque screws M11 to 40 N•m (30 lbf•ft).
- Then tighten screws M11 turning a 120° rotation with a torque angle gauge and finish tightening with an additional 90° rotation.
- Torque screws M6 to 11 N•m (97 lbf•**in**).



1. *Cylinder screws M11*
2. *Angle torque wrench*

Remove crankshaft locking tool.

Install all removed parts.

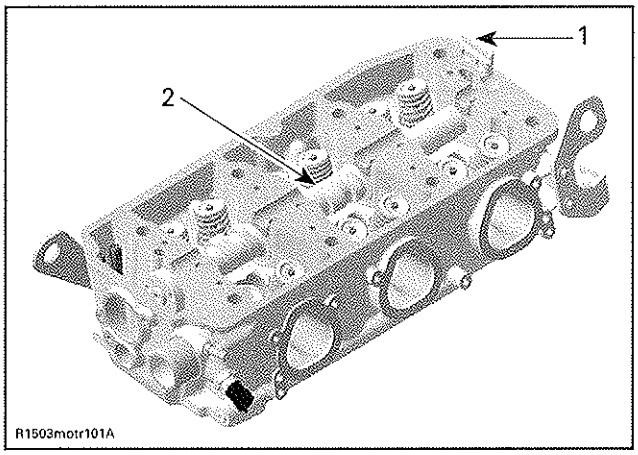
CAMSHAFT

Camshaft Removal

Remove the *CAMSHAFT TIMING GEAR*, see procedure in this section.

Remove the *ROCKER ARM*, see procedure in this section.

Remove the camshaft lock to remove the camshaft.



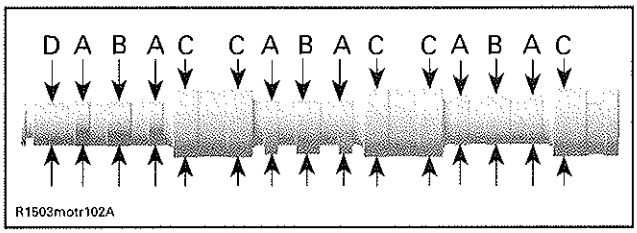
1. *Camshaft lock*
2. *Camshaft*

Camshaft Inspection

Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.

Measure camshaft bearing journal and lobe height using a micrometer.

Measure clearance between both ends of camshaft and cylinder head.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft bearing journal
D. Camshaft bearing journal — engine front

CAMSHAFT LOBE HEIGHT — EXHAUST VALVE	
NEW	31.699 - 31.809 mm (1.248 - 1.252 in)
SERVICE LIMIT	31.670 mm (1.247 in)
CAMSHAFT LOBE HEIGHT — INTAKE VALVE	
NEW	31.480 - 31.590 mm (1.239 - 1.244 in)
SERVICE LIMIT	31.450 mm (1.238 in)
CAMSHAFT BEARING JOURNAL	
NEW	39.892 - 39.905 mm (1.5705 - 1.5711 in)
SERVICE LIMIT	39.860 mm (1.5693 in)
CAMSHAFT BEARING JOURNAL (ENGINE FRONT)	
NEW	24.939 - 24.960 mm (.9818 - .9826 in)
SERVICE LIMIT	24.910 mm (.9807 in)

CAMSHAFT BEARING INNER DIAMETER	
NEW	40.000 to 40.016 mm (1.5748 to 1.5754 in)
SERVICE LIMIT	40.050 mm (1.5767 in)
CAMSHAFT BEARING INNER DIAMETER (ENGINE FRONT)	
NEW	25.000 - 25.013 mm (.9842 - .9848 in)
SERVICE LIMIT	25.050 mm (.9862 in)

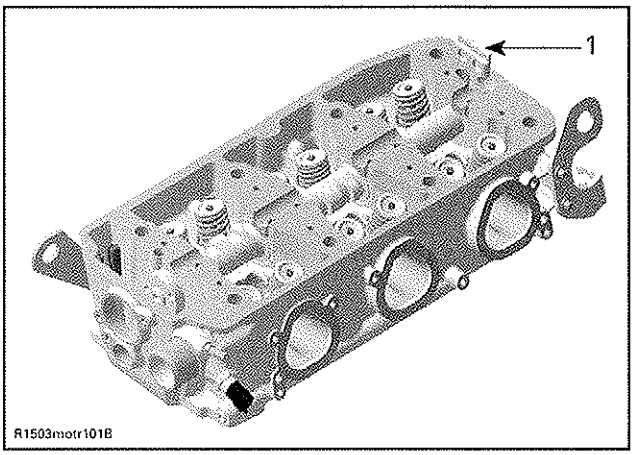
Replace parts that are not within specifications.

Camshaft Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Grease the camshaft bearing journals well by using the Isoflex grease Topas NB 52 (P/N 293 550 021) or a similar product.

Install camshaft then place the camshaft lock in the slot.



1. *Camshaft lock position*

For other parts, refer to proper installation procedure.

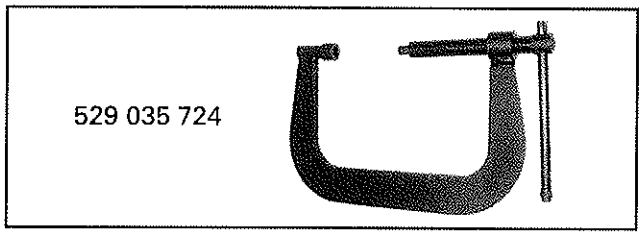
VALVE SPRINGS

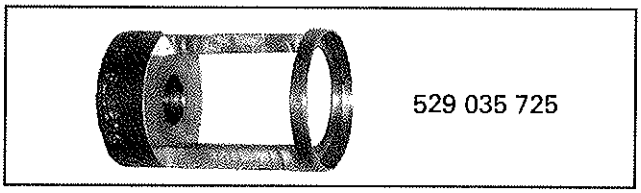
Valve Springs Removal

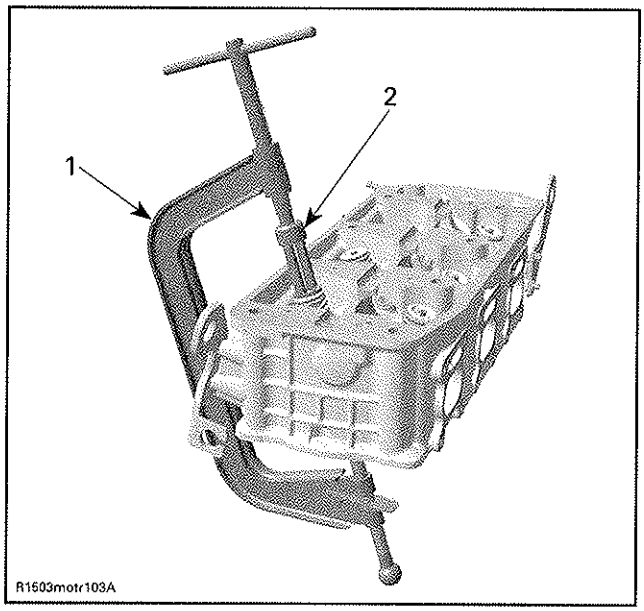
Remove rocker arm shaft. Refer to *ROCKER ARM* procedure in this section.

Remove *CYLINDER HEAD*, see procedure in this section.

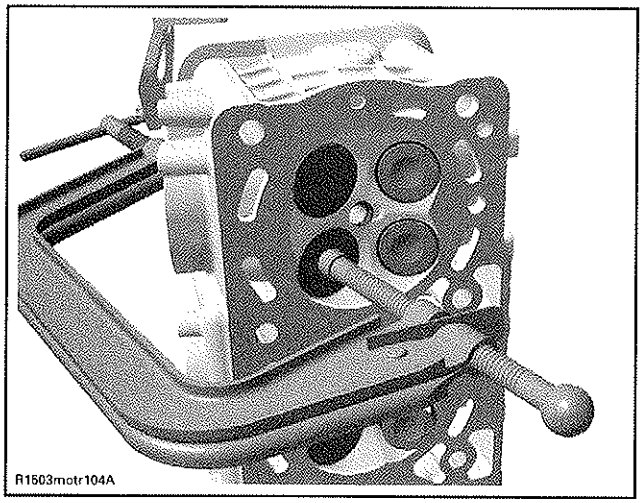
Compress valve springs, using th evalve spring compressor clamp (P/N 529 035 724) and the valve spring compressor cup (P/N 529 035 725).







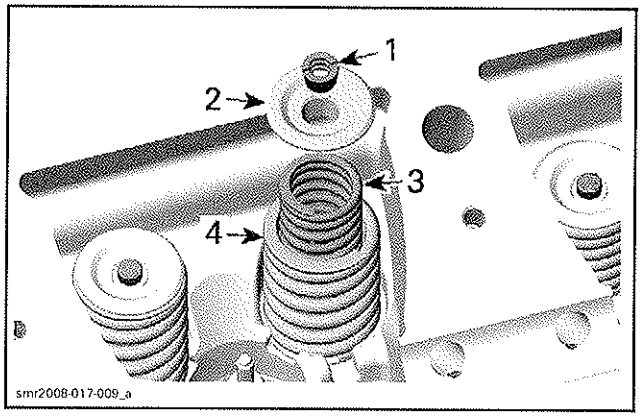
1. Valve spring compressor clamp
2. Valve spring compressor cup



LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters.

Withdraw valve spring compressor, valve spring retainer and valve springs.



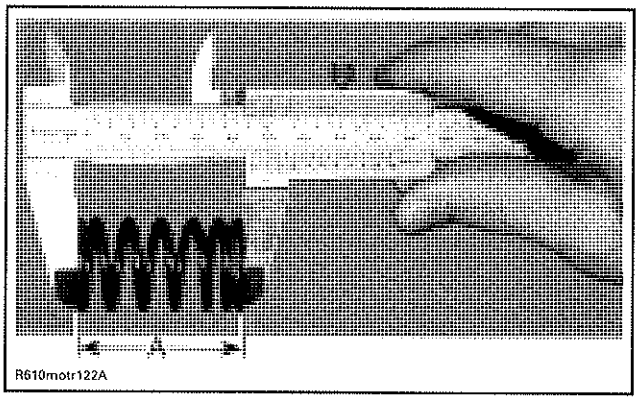
1. Valve cotters
2. Valve spring retainer
3. Inner valve spring
4. Outer valve spring

Valve Springs Inspection

Check valve springs for rust, corrosion or other visible damages. If so, replace faulty valve springs.

Check valve springs for free length and straightness.

Replace valve springs if not within specifications.



A. Valve spring length

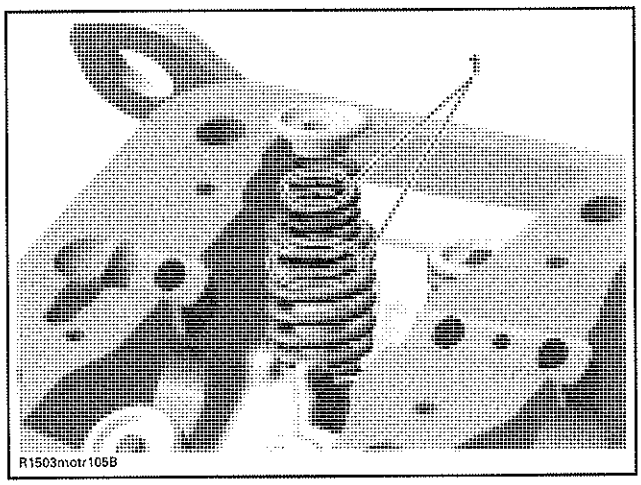
OUTER VALVE SPRING FREE LENGTH	
NEW NOMINAL	45.45 mm (1.789 in)
SERVICE LIMIT	43 mm (1.693 in)
INNER VALVE SPRING FREE LENGTH	
NEW NOMINAL	41.02 mm (1.615 in)
SERVICE LIMIT	38.8 mm (1.499 in)

Valve Springs Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Colored area of the valve spring must be placed on top.

NOTE: Valve cotters must be properly engaged in valve stem grooves.



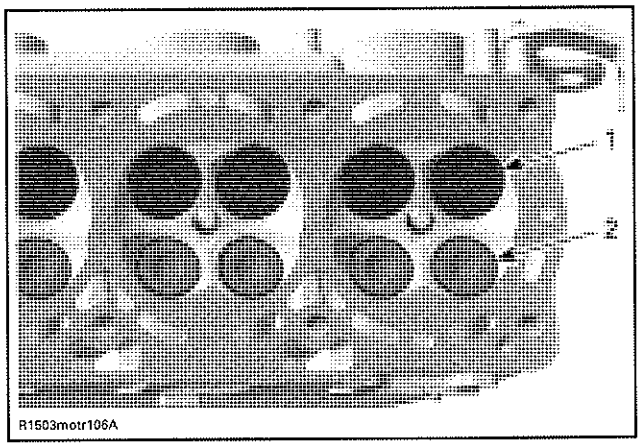
1. Position of the valve spring

VALVES

Valves Removal

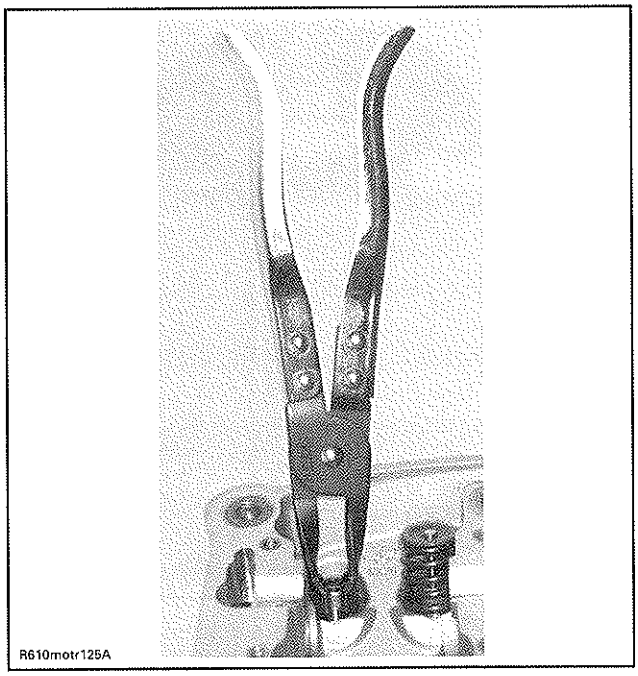
Remove valve spring.

Push valve stem then pull valves out of valve guides.



1. Intake valve 38 mm
2. Exhaust valve 31 mm

Remove valve stem seal with a valve stem seal pliers such as the Snap-on valve stem seal pliers (P/N YA8230).



Valves Inspection

Valve Stem Seal

Inspection of valve stem seals is not needed because new seals should always be installed whenever cylinder head is removed.

Valve

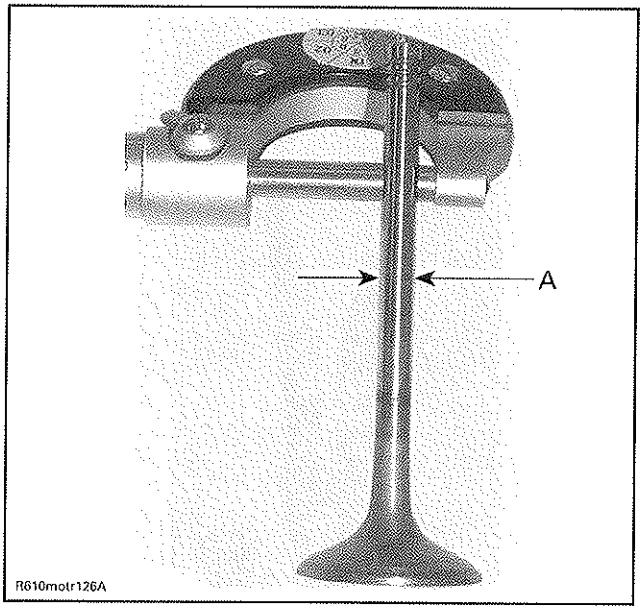
Inspect valve surface, check for abnormal stem wear and bending. If so, replace by a new one.

Valve Stem and Valve Guide Clearance

Measure valve stem and valve guide in three places, using a micrometer and a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Change valve if valve stem is out of specification or has other damages such as wear or friction surface.



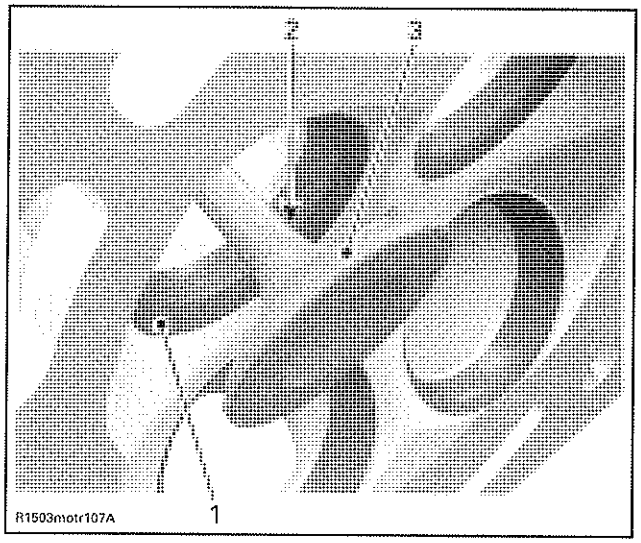
A. Valve stem diameter

VALVE STEM DIAMETER	
NEW	
Exhaust	5.946 - 5.960 mm (.2341 - .2346 in)
Intake	5.961 - 5.975 mm (.2347 - .2352 in)
SERVICE LIMIT	
Exhaust	5.93 mm (.233 in)
Intake	

Replace valve guide if it is out of specification or has other damages such as wear or friction surface. Refer to valve guide replacement below.

VALVE GUIDE INNER DIAMETER	
NEW	
Exhaust	5.994 - 6.018 mm (.2359 - .2369 in)
Intake	
SERVICE LIMIT	
Exhaust	6.060 mm (.2386 in)
Intake	

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

Ensure to seat valves properly. Apply some lapping compound on valve face and work valve on its seat with a lapping tool.

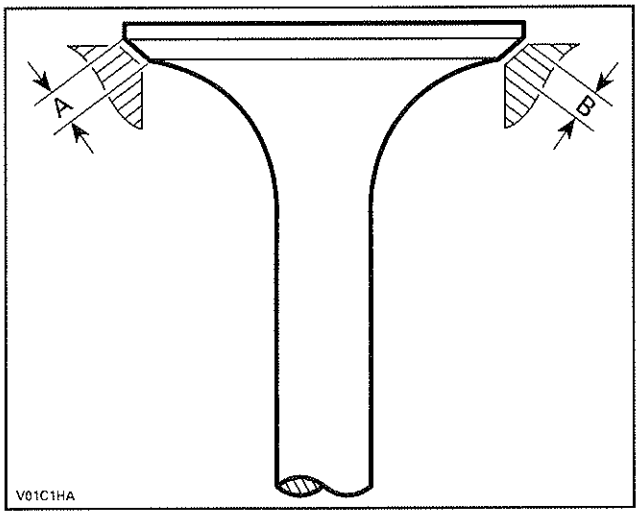
Measure valve face contact width.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width, using a caliper.

VALVE SEAT CONTACT WIDTH	
NEW	
Exhaust	1.25 - 1.55 mm (.049 - .061 in)
Intake	1.10 - 1.30 mm (.043 - .051 in)
SERVICE LIMIT	
Exhaust	2 mm (.078 in)
Intake	1.8 mm (.07 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.

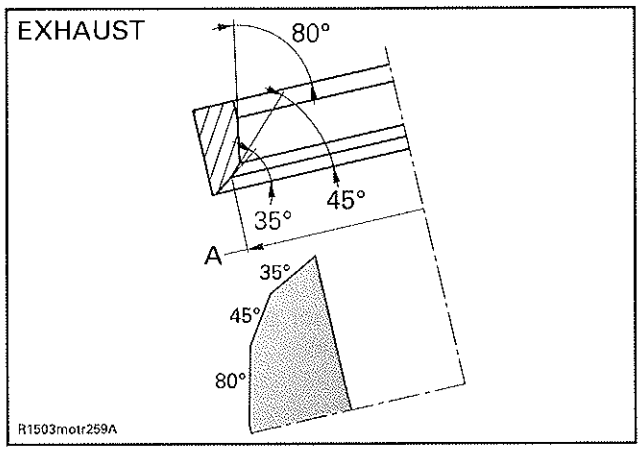


A. Valve face contact width
B. Valve seat contact width

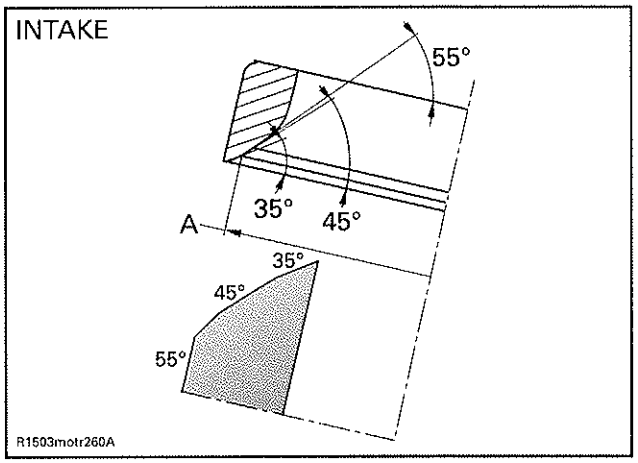
Valve Seat Grinding

NOTE: The valve seats may be reground with a valve seat grinder which centers on the valve guide.

- Grind the valve seat at 45°. Remove no more material than absolutely necessary to clean the seat up.
- Using a 35° stone, narrow the valve seat until the appropriate outer diameter is obtained.



A. Valve seat outer diameter EXHAUST



A. Valve seat outer diameter INTAKE

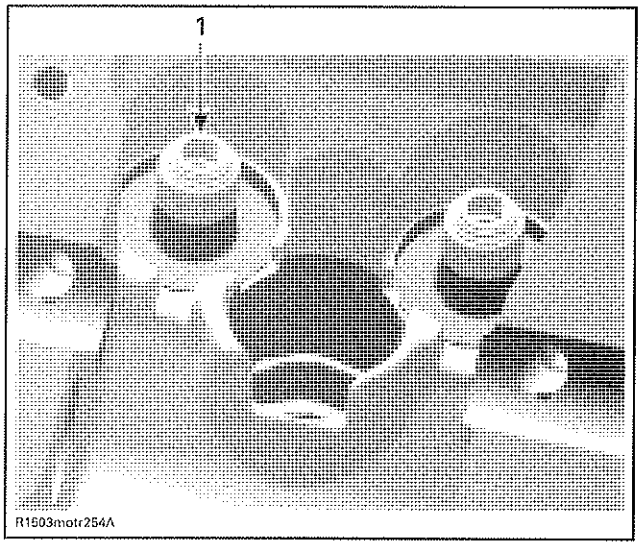
VALVE SEAT OUTER DIAMETER	
Intake	37.35 mm (1.4705 in)
Exhaust	30.3 mm (1.1929 in)

- Using a 55° stone for the intake and an 80° stone for the exhaust valve, reduce the valve seat contact width to the appropriate value mentioned above.
- Finally, coat the valve seating surface with a fine paste of valve grinding compound using a manual valve grinding mandrel. Lightly grind the valves until a smooth, even, uniform sealing surface of the appropriate inside and outside diameter is obtained on both the valve and the seat. Use only a hand held valve grinding mandrel with a suction cup, rotating the valve back and forth through about 45°, and then advancing the valve 45° before repeating this operation.

Valves Installation

For installation, reverse the removal procedure. Pay attention to the following details.

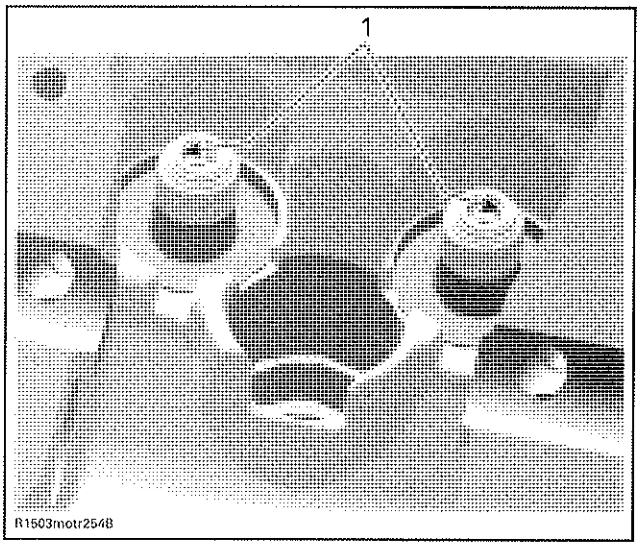
Install NEW valve stem seal.



1. Valve stem seal

Apply engine oil on valve stem and install valve.

CAUTION: Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

After springs are installed, ensure valve springs and valve spring retainer are properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

CAUTION: An improperly locked valve spring will cause engine damage.

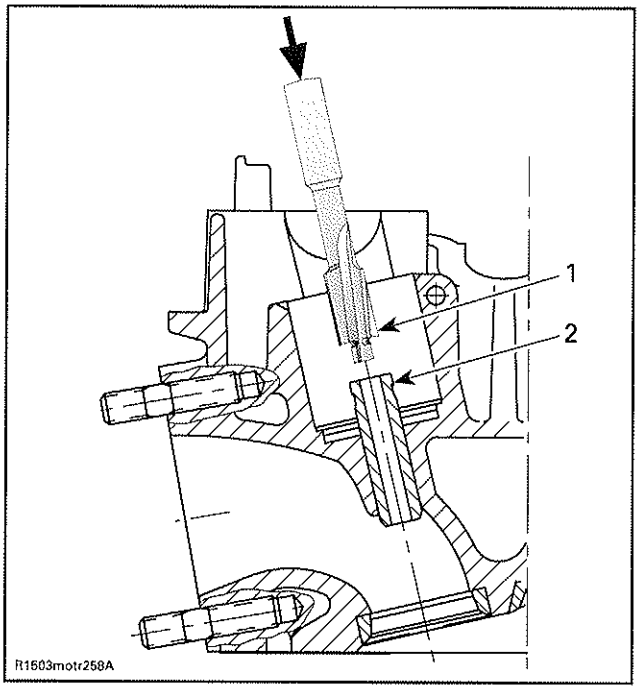
VALVE GUIDES

Valve Guide Replacement

CAUTION: Do not heat cylinder head for this procedure.

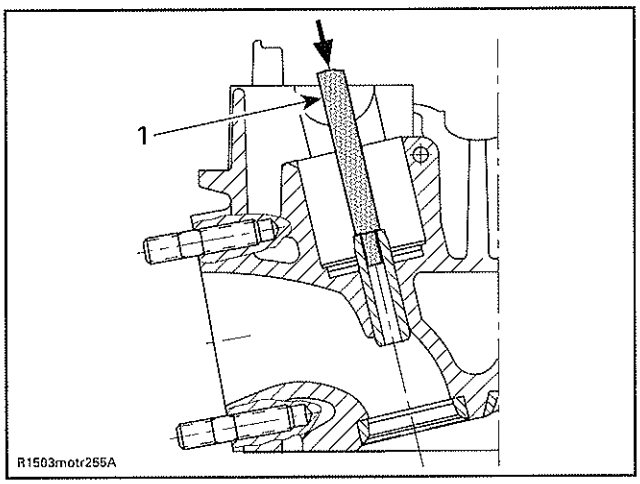
CAUTION: The sharp edge near the top of the valve guide must be machined away. Otherwise it will foul the valve guide hole in the cylinder head and destroy the cylinder head, as the valve guide is removed.

Use a special reamer as far as the top of the notch.



TYPICAL
1. Special reamer
2. Notch

Chase valve guide out of the cylinder head towards combustion chamber by using valve guide remover (P/N 529 036 086).

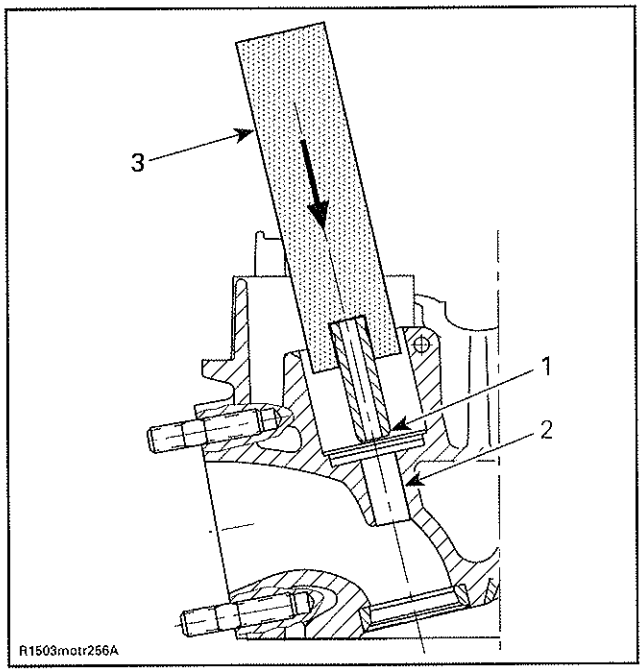


TYPICAL
1. Punch

Check valve guide bore for abreased material. The inlet and exhaust valve guides have the same length and are interchangeable.

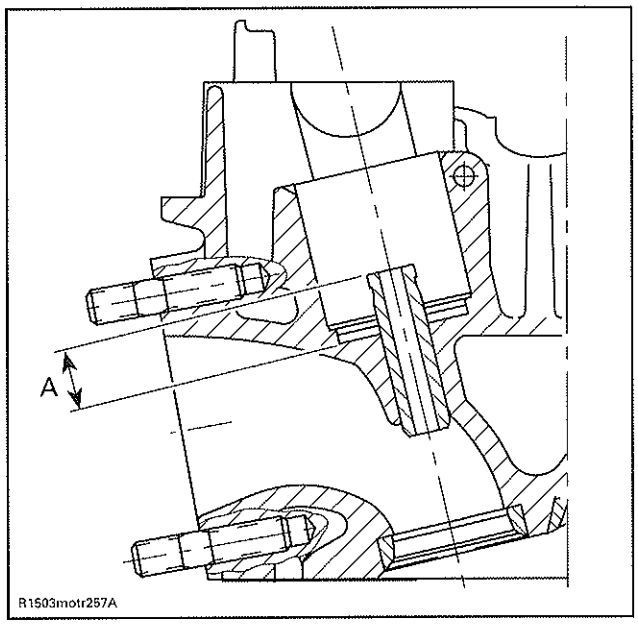
NOTE: If valve guide has caused scoring during extraction, replace the cylinder head.

Grease the bore in cylinder head and the leading end of valve guide with Molykote G-N (P/N 420 297 433).



TYPICAL
1. Valve guide leading end
2. Cylinder head bore
3. Jig

With the valve guide installer (P/N 529 036 087), press the valve guide into the COLD cylinder head as shown.



TYPICAL
A. Protrusion

VALVE GUIDE PROTRUSION	
MINIMUM	12.4 mm (.4882 in)
MAXIMUM	12.8 mm (.5039 in)

NOTE: After installing new guides, they must be reamed with a standard 6 mm reamer tool. These are available from various tool suppliers.

Clean cylinder head carefully. Check that the valve seat is concentric with the new guide axis (check contact surface with engineer's blue).

CYLINDER BLOCK

SERVICE TOOLS

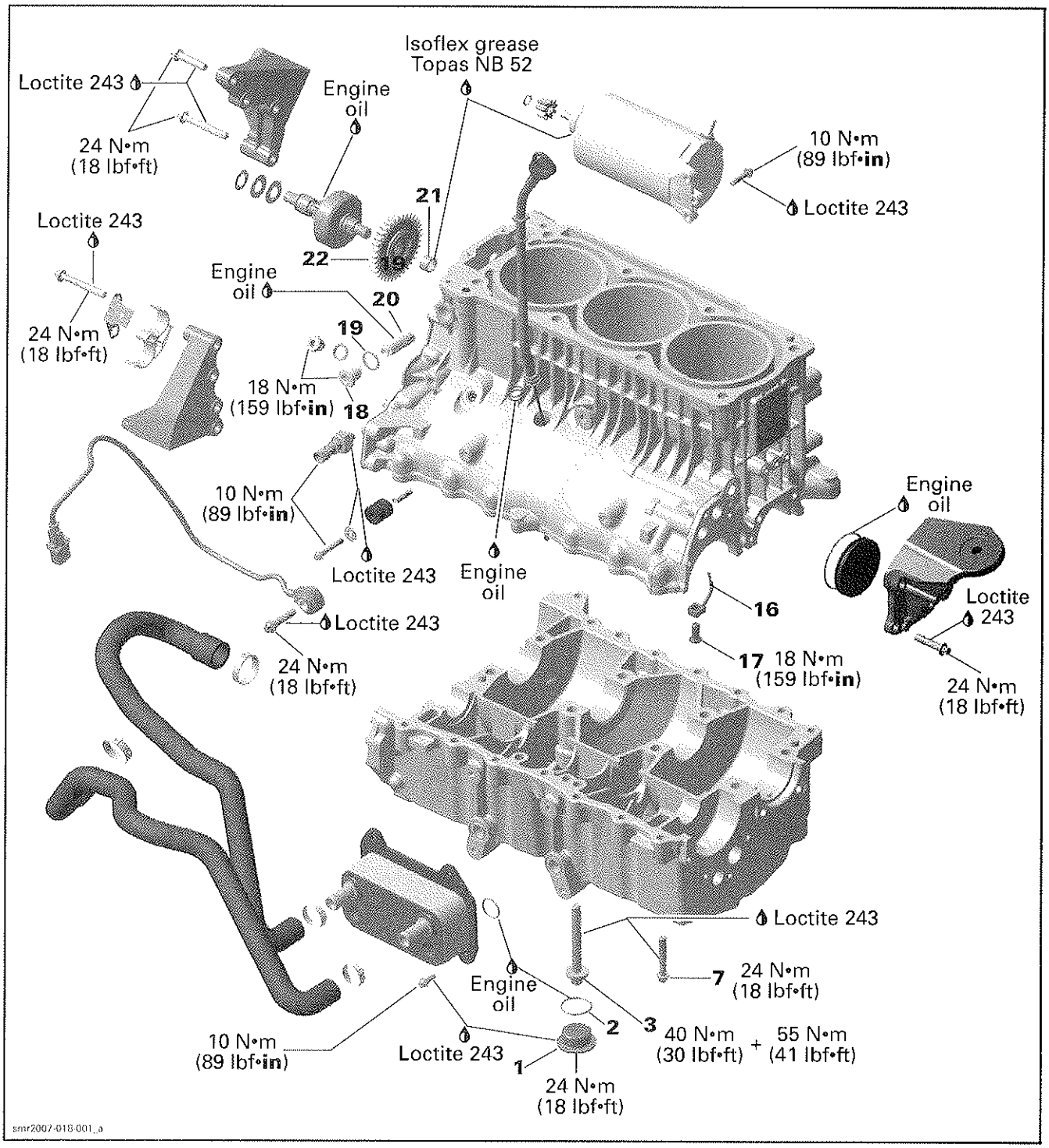
Description	Part Number	Page
pusher	420 876 502	180
handle	420 877 650	180
piston circlip installer	529 035 765	168
crankshaft locking tool	529 035 821	171, 175, 177, 182

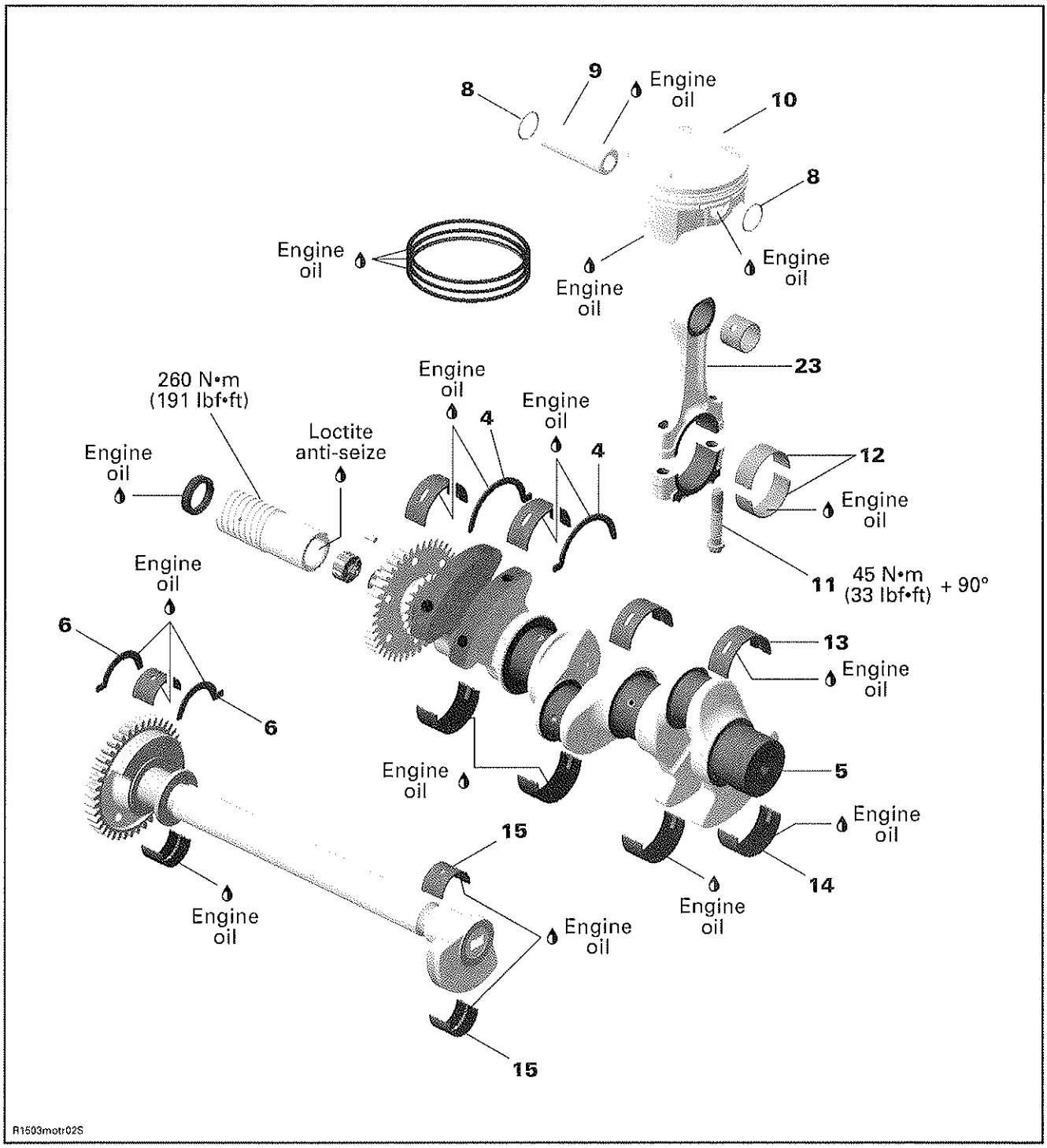
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on small slide hammer	CJ93B	178
Snap-on piston ring compressor pliers	RC980	169

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	181
Loctite 5910	293 800 081	181
Loctite chisel (gasket remover)	413 708 500	181





GENERAL

When disassembling parts that are duplicated in the engine, (e.g.: pistons, connecting rods etc.), it is strongly recommended to note their position (cylinder 1, 2 or 3) and to keep them as a "group". If you find a defective component, it would be much easier to find the cause of the failure within the group of parts. Besides, since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their "group".

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

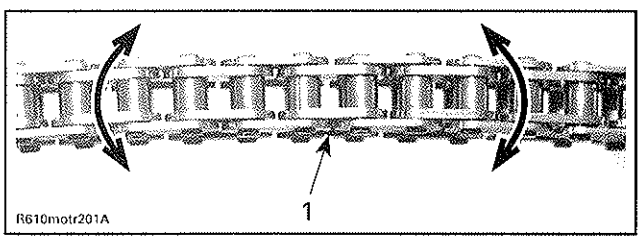
PROCEDURES

TIMING CHAIN

Timing Chain Inspection

Check timing chain on camshaft gear for excessive radial play.

Check chain condition for wear and rollers condition.



1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft timing gear and timing chain).

Timing Chain Removal

Remove:
- Engine oil (refer *LUBRICATION SYSTEM* section)
- Engine from vehicle (refer to *ENGINE REMOVAL/INSTALLATION* section)
- Cylinder head (refer to *CYLINDER HEAD* section)
- PTO housing (refer to *PTO HOUSING AND MAGNETO* section)
- Crankshaft (refer to *CRANKSHAFT* in this section)
- Timing chain.

Timing Chain Installation

The installation is essentially the reverse of the removal procedure but, pay attention to the following details.

Ensure to perform proper valve timing. Lock crankshaft and camshaft at TDC (refer to *CYLINDER HEAD* section for the camshaft locking procedure).

Install chain then, install chain tensioner.

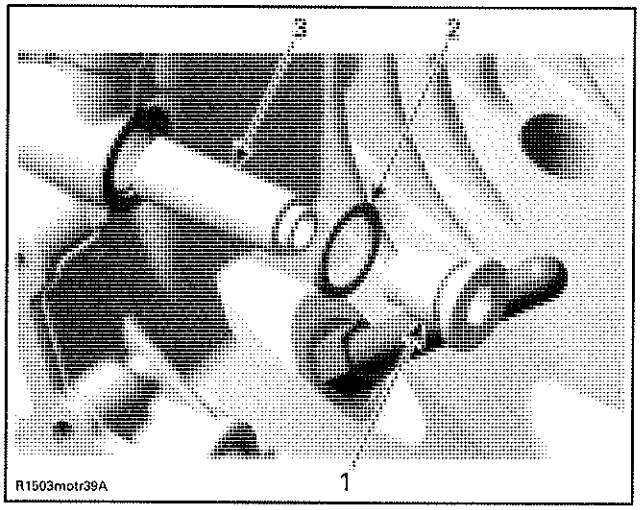
CAUTION: Improper valve timing will damage engine components.

CHAIN TENSIONER

Chain Tensioner Removal

NOTE: Removal of the intake manifold allows easier access to the chain tensioner, but is not necessary. Refer to *INTAKE MANIFOLD AND INTERCOOLER (215)* section.

Remove:
- Chain tensioner plug screw **no. 18** with gasket ring **no. 19**
- Chain tensioner **no. 20**.



1. *Plug screw*
2. *Gasket ring*
3. *Chain tensioner*

Chain Tensioner Inspection

Check chain tensioner for excessive wear or cracks. Also check free movement of the chain tensioner piston.

Chain Tensioner Installation

The installation is essentially the reverse of the removal procedure but, pay attention to the following details.

Torque chain tensioner plug screw to 18 N•m (159 lbf•**in**).

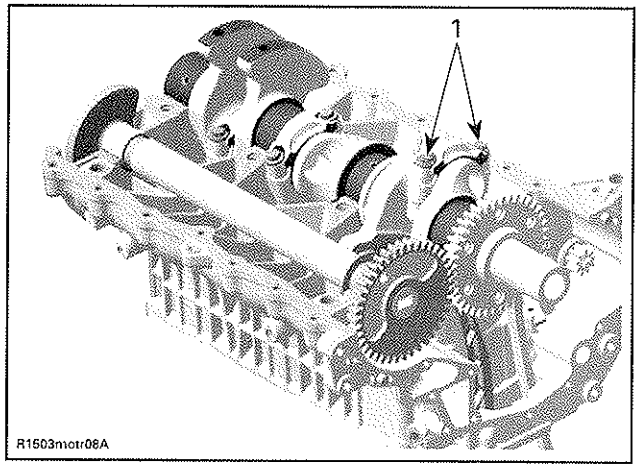
PISTONS/CONNECTING RODS

Pistons/Connecting Rods Removal

Disassemble *CYLINDER BLOCK* as per procedure in this section.

NOTE: It is recommended to measure connecting rod big end axial play prior to remove connecting rod. Refer to *INSPECTION* below.

Remove connecting rod cap screws.

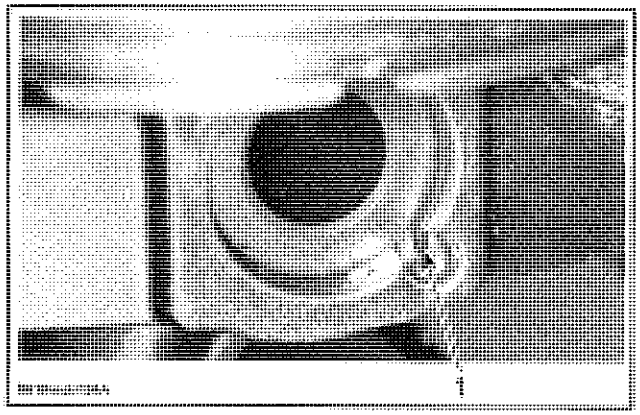


1. *Connecting rod screws*

NOTE: Before removing the connecting rod caps, mark them to remember the right position when reassembling.

Pull piston with connecting rod out of the cylinders.

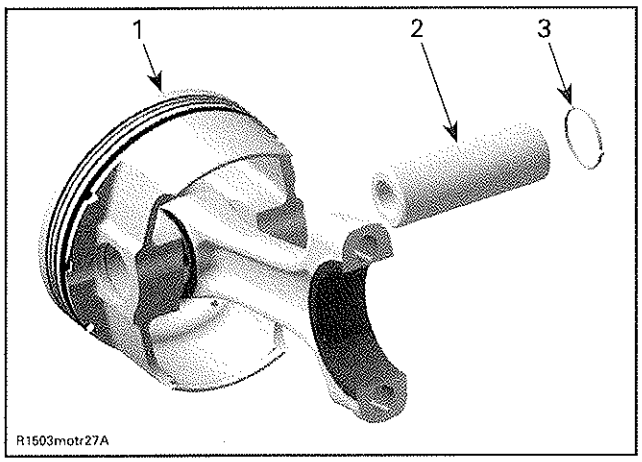
Remove one piston circlip **no. 8** and discard it.



1. *Piston circlip*

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin **no. 9** out of piston.



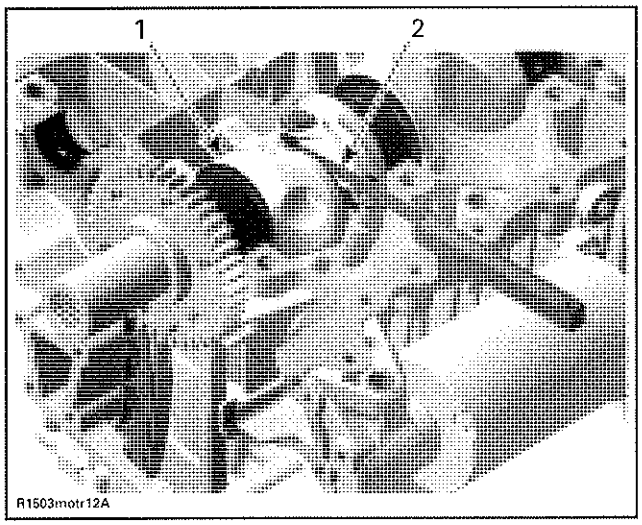
1. *Piston*
2. *Piston pin*
3. *Circlip*

Detach piston **no. 10** from connecting rod **no. 5**.

Connecting Rods Inspection

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rod and crankshaft counterweight. If the distance exceeds specified tolerance, replace the worn part.

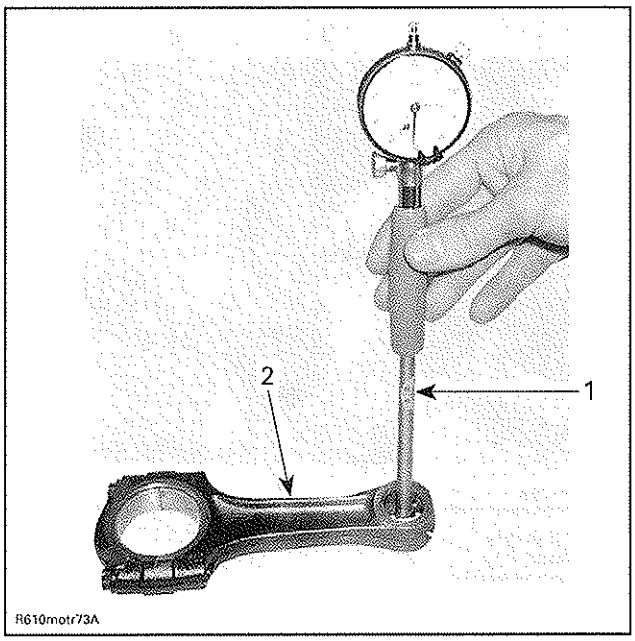


1. *Crankshaft*
2. *Feeler gauge*

CONNECTING ROD BIG END AXIAL PLAY mm (in)	
NEW	0.150 - 0.302 (.006 - .012)
SERVICE LIMIT	0.500 (.020)

Connecting Rod Small End Radial Play

Measure connecting rod small end.



1. *Bore gauge*
2. *Connecting rod*

CONNECTING ROD SMALL END DIAMETER mm (in)	
NEW	23.01 - 23.02 (.9059 - .9063)
SERVICE LIMIT	23.07 (.908)

If the connecting rod small end diameter is out of specification, replace small end bearing sleeve.

NOTE: For small end bearing sleeve replacement contact a machine shop. After installing a NEW small end bearing sleeve on the connecting rod, the inner diameter and the oil holes need to be machined to specification.

Measure piston pins (refer to *PISTON PINS INSPECTION* further). Compare to inside diameter of connecting rod to obtain connecting rod small end radial play.

CONNECTING ROD SMALL END RADIAL PLAY mm (in)	
SERVICE LIMIT	0.080 (.0035)

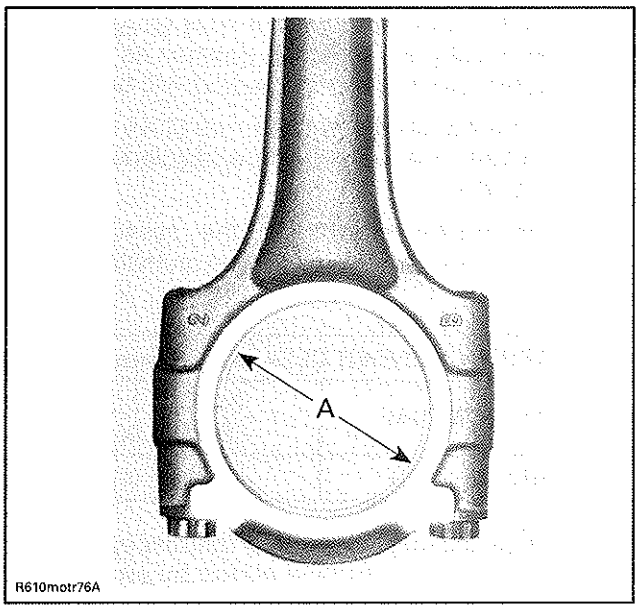
Connecting Rod Big End Radial Play

Measure inside diameter of connecting rod big end. Compare to crankshaft pin.

To measure the connecting rod big end diameter, use the OLD screws **no. 11**.

Install the OLD bearings **no. 12** as they were mounted initially.

Do the torque procedure as described below.



A. Connecting rod big end bearing

CONNECTING ROD BIG END DIAMETER mm (in)	
SERVICE LIMIT	45.080 (1.774)

CONNECTING ROD BIG END RADIAL PLAY mm (in)	
SERVICE LIMIT	0.09 (.0035)

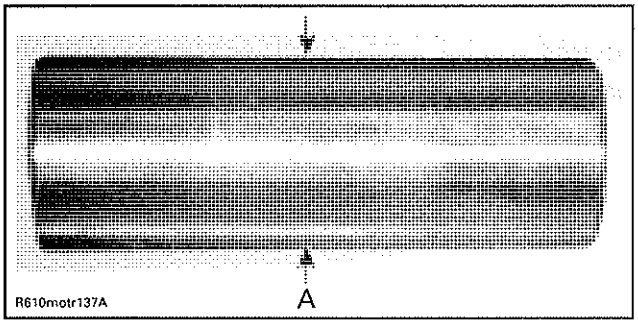
Use NEW bearings no. 12, when connecting rod big end diameter is out of specification.

Piston Pins Inspection

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement position.



A. Piston pin diameter in the area of the bushing

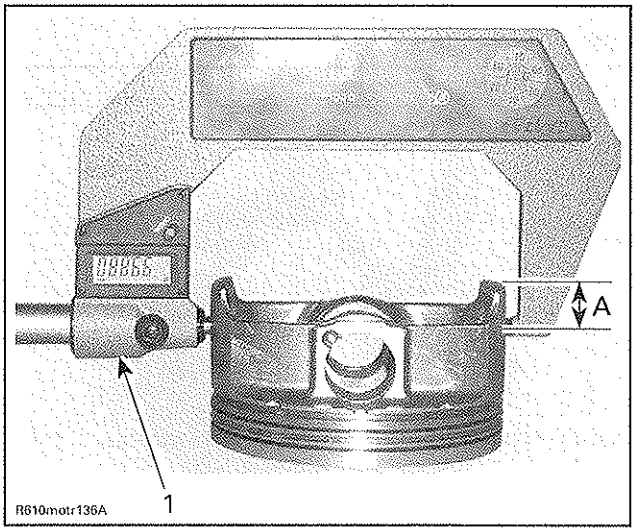
PISTON PIN DIAMETER mm (in)	
NEW	22.996 - 23.000 (.9053 - .9055)
SERVICE LIMIT	22.990 (.904)

Measure connecting rod small end diameter (refer to *CONNECTING RODS INSPECTION* above) to check connecting rod small end radial play.

Pistons Inspection

Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 18 mm (.709 in) perpendicularly (90°) to piston pin axis.



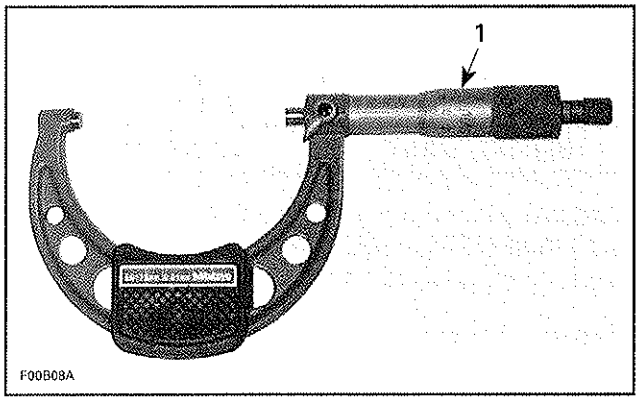
1. Measuring perpendicularly (90°) to piston pin axis
A. 18 mm (.709 in)

The measured dimension should be as described in the subsequent table. If not, replace piston.

PISTON MEASUREMENT mm (in)	
NEW NOMINAL	99.951 - 99.969 (3.935 - 3.936)
SERVICE LIMIT	99.90 (3.933)

Piston/Cylinder Wall Clearance

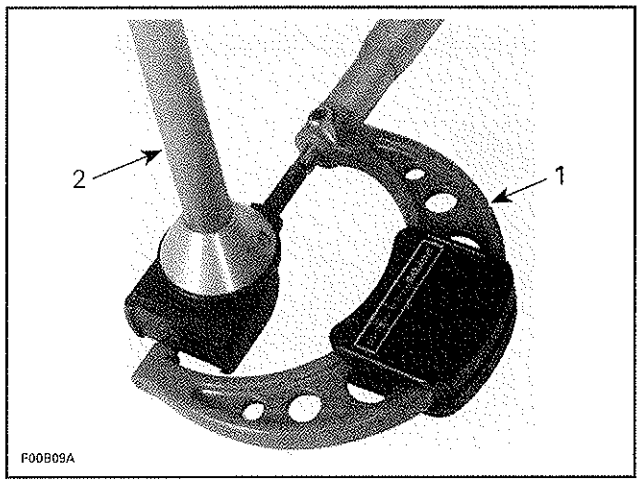
Adjust and lock a micrometer to the piston dimension.



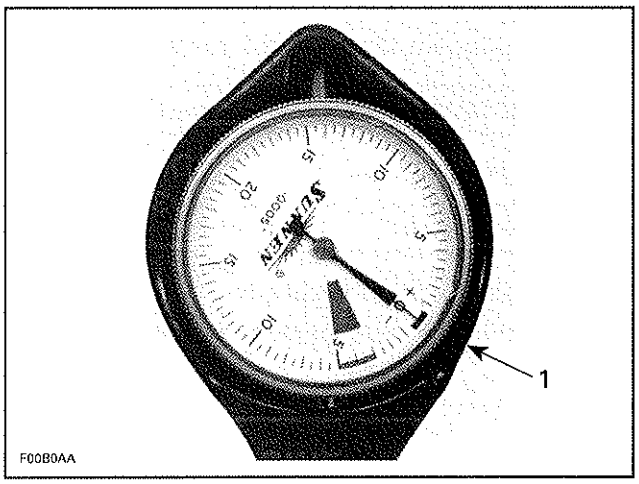
1. Micrometer set to the piston dimension

NOTE: Make sure used piston is not worn.

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



TYPICAL
1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Position the dial bore gauge 62 mm (2.44 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE mm (in)	
NEW NOMINAL	0.024 - 0.056 (.0009 - .0022)
SERVICE LIMIT	0.090 (.004)

If clearance exceeds specified tolerance, re-hone cylinder sleeve and replace piston by an oversize one.

NOTE: It is not necessary to have all pistons replaced with an oversize if they are not all out of specification. Mixed standard size and oversize piston are allowed.

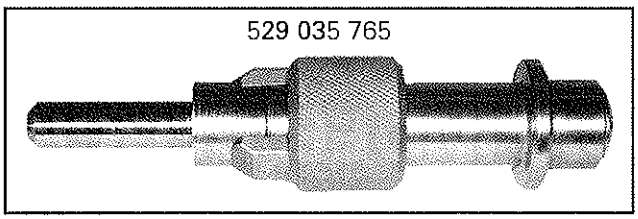
Pistons/Connecting Rods Assembly

For installation, reverse the removal procedure. Pay attention to the following details.

Apply engine oil on the piston pin.

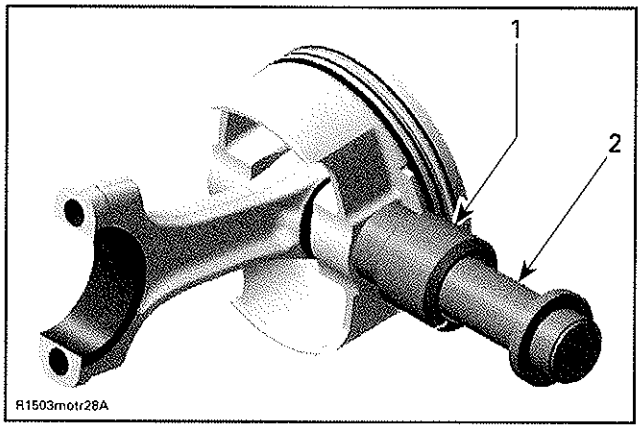
Insert piston pin into piston and connecting rod.

Use the piston circlip installer (P/N 529 035 765) to assemble the piston circlip.

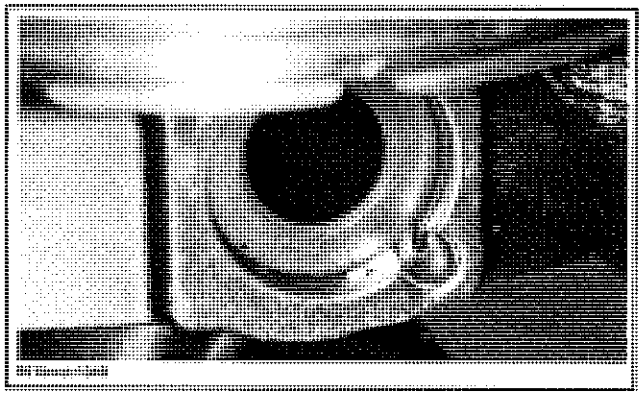


CAUTION: Secure piston pin with new piston circlips.

NOTE: Take care that the hook of the piston circlip is positioned properly.



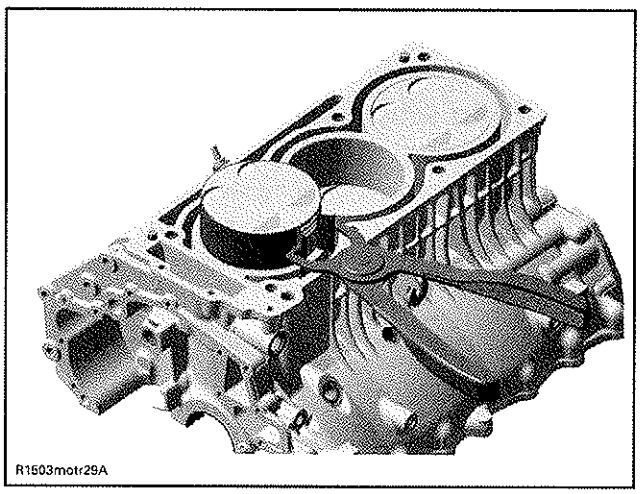
1. *Sleeve with piston circlip inside*
2. *Assembly jig from piston clip installer*



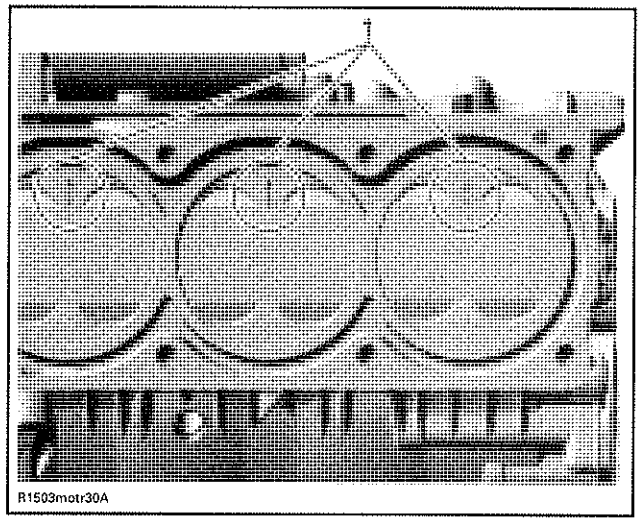
CORRECT POSITION OF THE PISTON CIRCLIP

Pistons/Connecting Rods Installation

Using a piston ring compressor such as the Snap-on piston ring compressor pliers (P/N RC980), slide piston into cylinder.

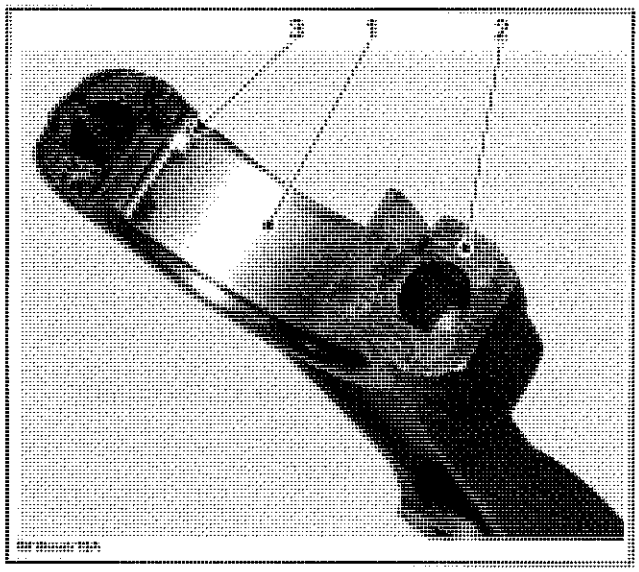


CAUTION: Install piston with punched arrow toward exhaust side.



1. *Arrow toward exhaust side*

Correctly install bearings and carefully clean split surface on both sides (cracked area).

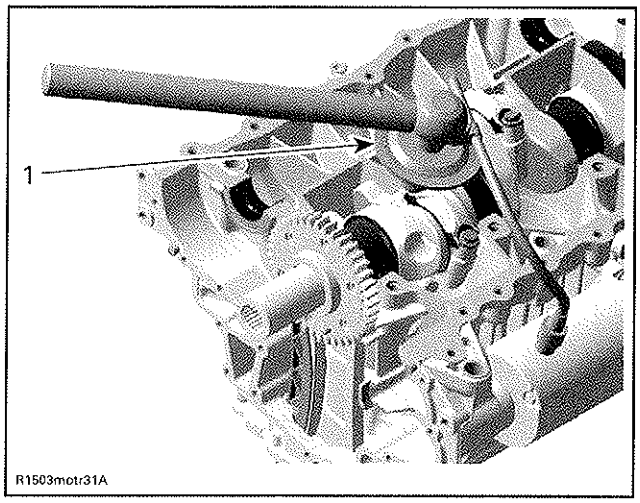


1. *Half bearing of connecting rod big end*
2. *Split surface of the connecting rod*
3. *Protrusion of bearing in line with connecting rod groove*

Torque NEW connecting rod screws no. 11 as per following procedure:

- Install screws and torque to 45 N•m (33 lbf•ft). Do not apply any threadlocker product.
- Finish tightening the screws with an additional 90° turn using an angle torque wrench.

CAUTION: Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. Knowing that the screws have been stretched from the previous installation, it is very important to use new screws at assembly.



1. Angle torque wrench

PISTON RINGS

Piston Ring Removal

Remove piston as described above.

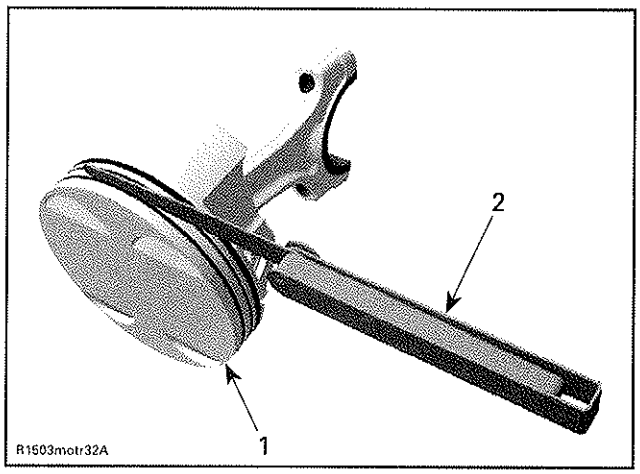
Remove rings.

Piston Ring Inspection

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE mm (in)	
NEW	
RECTANGULAR	0.025 - 0.070 (.0010 - .0028)
TAPER-FACE	0.015 - 0.060 (.0006 - .0024)
OIL SCRAPER RING	0.020 - 0.055 (.0008 - .0021)
SERVICE LIMIT	
ALL	0.15 (.006)



1. Piston
2. Filler gauge

Ring End Gap

RING END GAP mm (in)	
NEW	
RECTANGULAR	0.35 - 0.50 (.014 - .020)
TAPER-FACE	
OIL SCRAPER RING	
SERVICE LIMIT	
ALL	1 (.04)

Measure position for ring end gap in the area of 8 to 16 mm (.315 to .630 in) from top of cylinder.

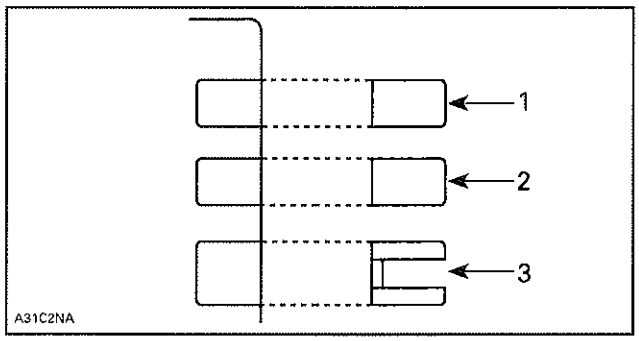
NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds above described specified tolerance.

Piston Ring Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Install the oil scraper ring first, then the taper-face ring with the word "TO" facing up, then the rectangular ring with the word "T" facing up.



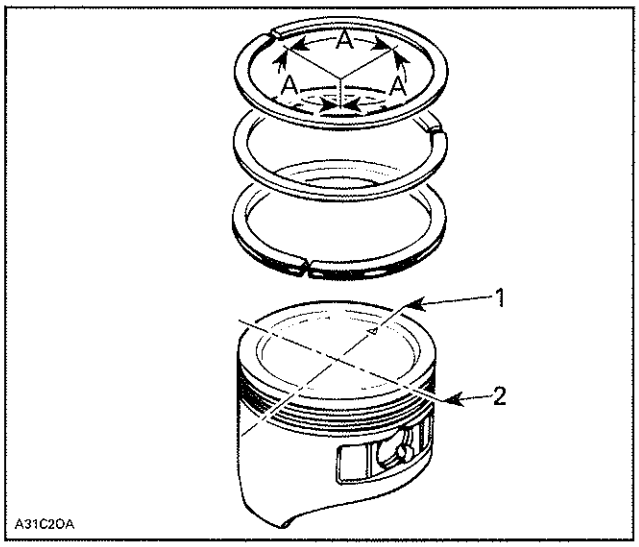
1. *Rectangular ring*
2. *Taper-face ring*
3. *Oil scraper ring*

CAUTION: Ensure that top and second rings are not interchanged.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. *DO NOT align ring gap with piston trust side axis*
2. *DO NOT align ring gap with piston pin bore axis*

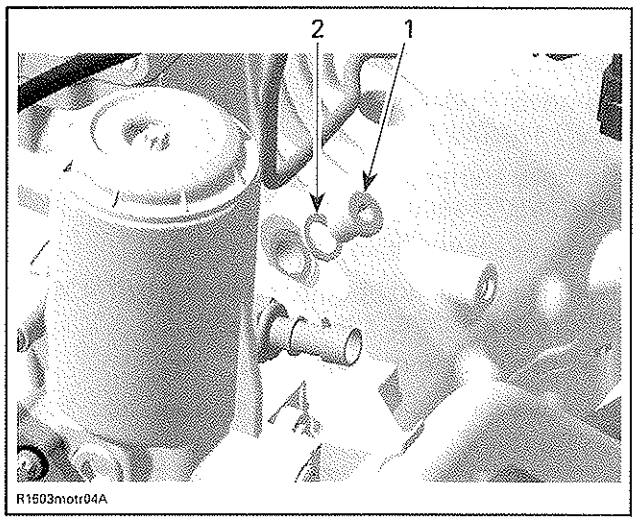
A. 120°

CRANKSHAFT

Crankshaft Locking Procedure

Remove:

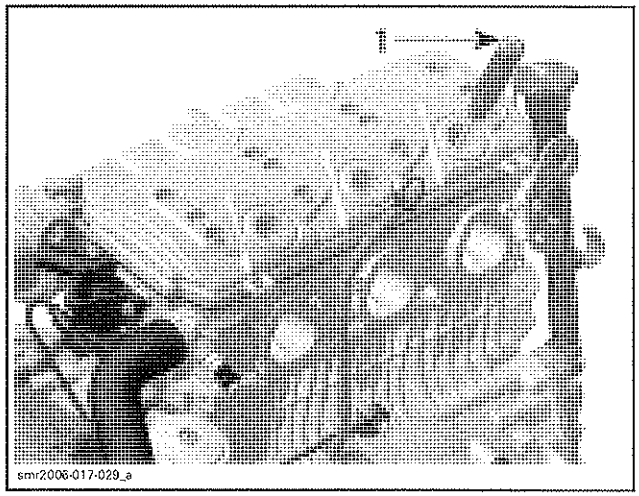
- Intake manifold (refer to *INTAKE MANIFOLD AND INTERCOOLER (215)* section)
- Engine cover
- Spark plugs
- Crankshaft access plug screw.



TYPICAL

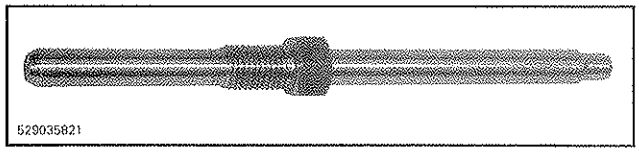
1. *Crankshaft access plug screw*
2. *Gasket ring*

Put a screwdriver or similar tool into the spark plug hole of cylinder no. 3 and feel when the piston reaches TDC.



1. *Screwdriver*

In this position, the crankshaft can be locked by using the crankshaft locking tool (P/N 529 035 821).



When finished, reinstall all removed parts.

Crankshaft Removal

Drain engine oil (refer to *LUBRICATION SYSTEM* section).

Remove engine from vehicle (refer to *ENGINE REMOVAL/INSTALLATION* section).

Remove cylinder head (refer to *CYLINDER HEAD* section).

Remove PTO housing (refer to *PTO HOUSING AND MAGNETO* section).

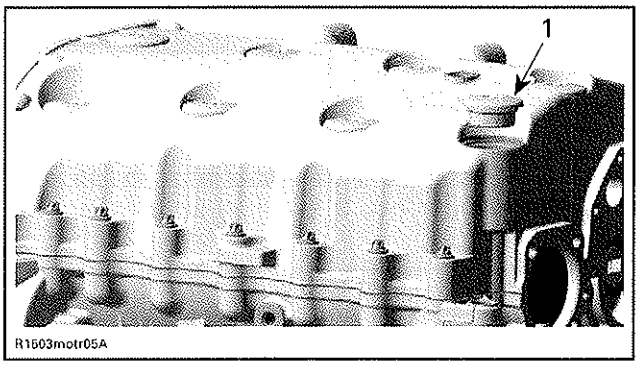
Remove starter gear (refer to *PTO HOUSING AND MAGNETO* section).

Remove starter drive.

Remove oil suction pump (refer to *LUBRICATION SYSTEM* section).

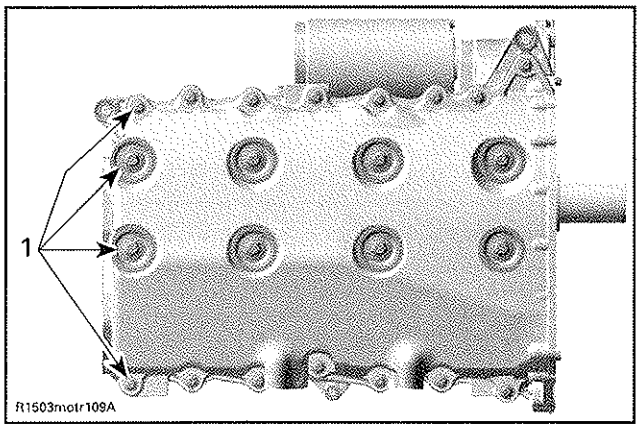
Remove engine mounting brackets.

Remove oil reservoir plug screws **no. 1** with O-ring **no. 2**.



ENGINE UPSIDE DOWN
1. Oil reservoir plug screw with O-ring

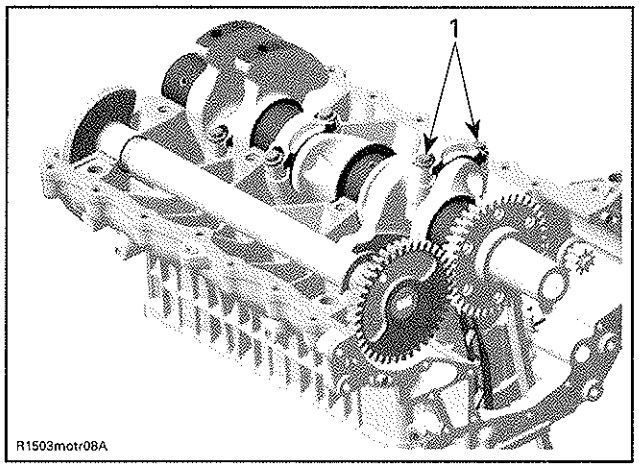
Remove cylinder block screws **no. 3** and **no. 7**.



BOTTOM VIEW OF ENGINE
1. Screws

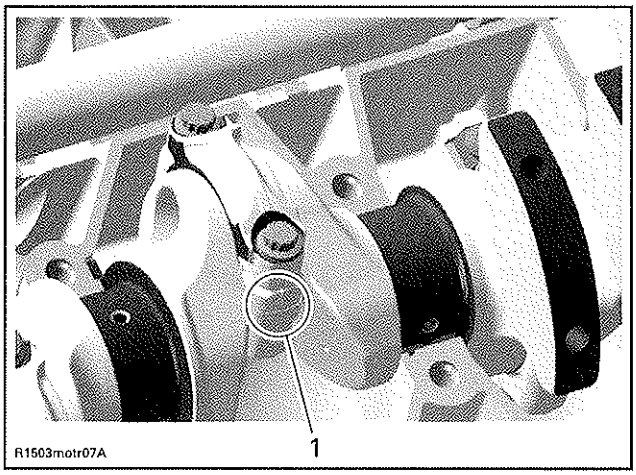
Remove cylinder block lower half.

Remove connecting rod screws.



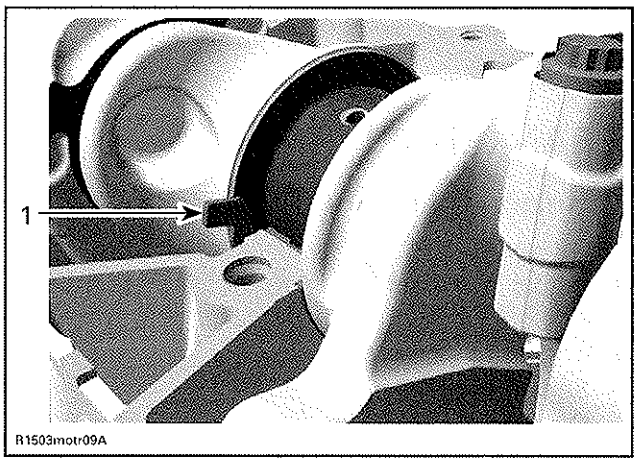
1. Connecting rod screws

NOTE: Before removing the connecting rod caps, mark them to remember the right position when reassembling. It is recommended to measure connecting rod big end axial play prior to remove connecting rod. Refer to *PISTONS/CONNECTING RODS* in this section for the procedure.



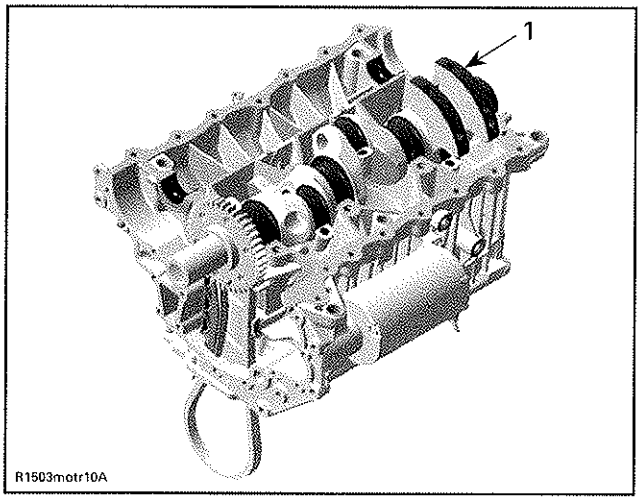
1. Mark on connecting rod

Remove thrust washers **no. 4**.



1. Thrust washer

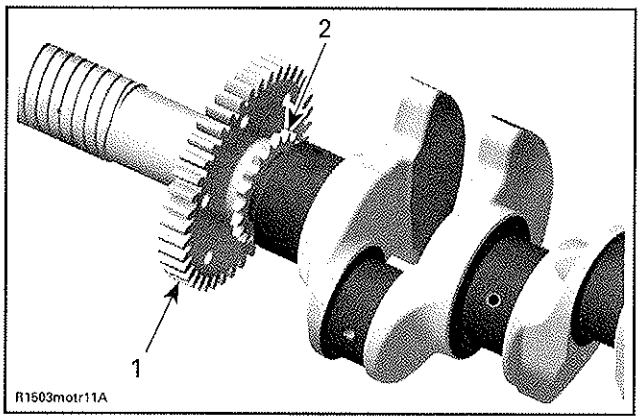
Remove crankshaft no. 5.



1. Crankshaft

Crankshaft Inspection

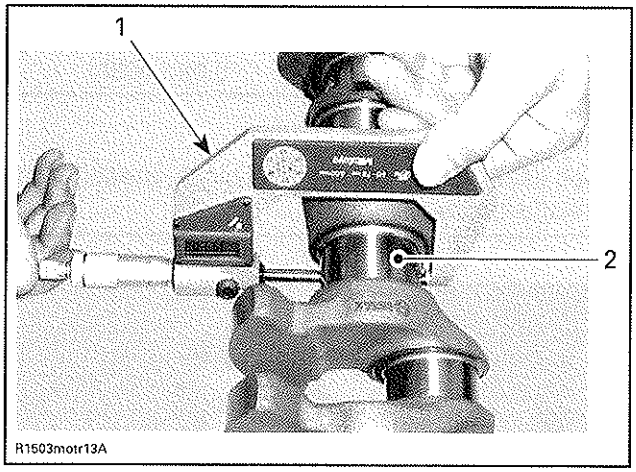
Replace crankshaft if the gears are worn or otherwise damaged.



1. Balancer gear
2. Crankshaft timing gear

Crankshaft Radial Play

Measure all crankshaft journals. Compare to inside diameter of crankshaft bearings (elsewhere in this section).



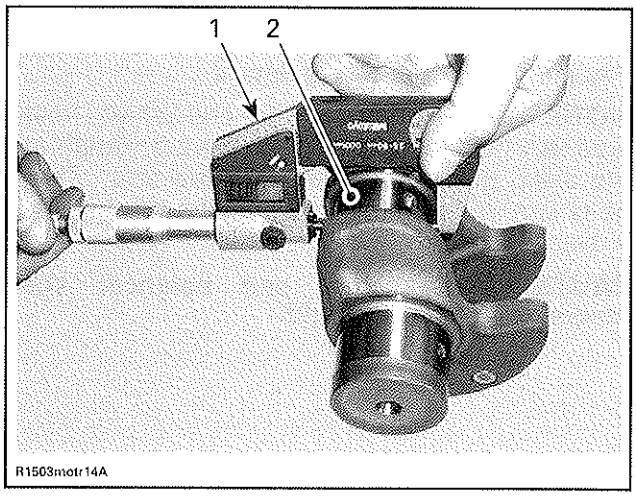
1. Micrometer
2. Crankshaft area for bearing

CRANKSHAFT JOURNAL DIAMETER mm (in)	
NEW	49.991 - 50.01 (1.9681 - 1.9689)
SERVICE LIMIT	49.95 (1.9665)

CRANKSHAFT JOURNAL RADIAL CLEARANCE mm (in)	
SERVICE LIMIT	0.07 (.0028)

Crankshaft Pin

Measure all crankshaft pin diameters. Compare to inside diameter of connecting rod bearings (elsewhere in this section).



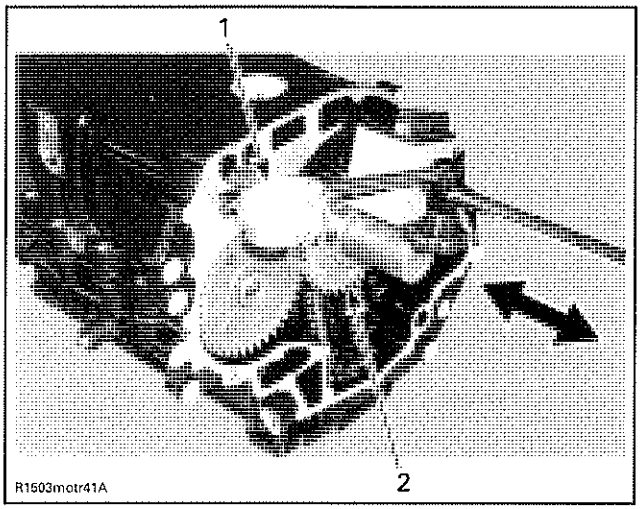
1. Micrometer
2. Crankshaft pin area for bearing

CRANKSHAFT PIN DIAMETER mm (in)	
NEW	45.032 - 45.048 (1.7729 - 1.7735)
SERVICE LIMIT	45.029 (1.7728)

CRANKSHAFT PIN RADIAL CLEARANCE mm (in)	
SERVICE LIMIT	0.09 (.0035)

Crankshaft Axial Clearance

When assembling the cylinder-block, measure the crankshaft axial clearance.



1. *Dial gauge*
2. *Crankshaft*

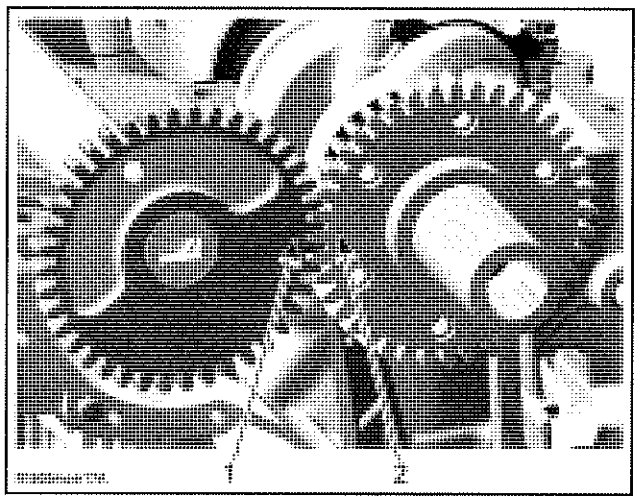
CRANKSHAFT AXIAL CLEARANCE mm (in)	
NEW	0.08 - 0.22 (.003 - .009)
SERVICE LIMIT	0.35 (.014)

Crankshaft Installation

For installation, reverse the removal procedure. Pay attention to following details.

NOTE: Before installing the crankshaft, make sure that the timing chain is on the crankshaft and the chain guide has been installed first. Those parts cannot be installed when the crankshaft is in place.

CAUTION: Crankshaft and balancer shaft marks have to be aligned.



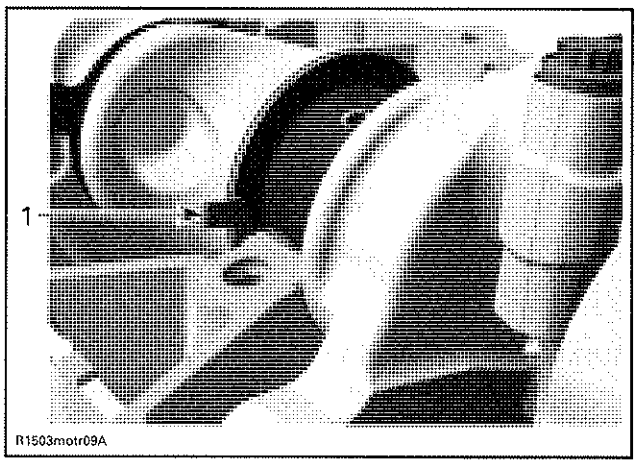
1. *Mark on balancer shaft*
2. *Mark on crankshaft*

For correct installation of the connecting rods, refer to *PISTON/CONNECTING ROD* in this section.

CAUTION: It is absolutely necessary to follow this procedure. Otherwise severe engine damage can occur.

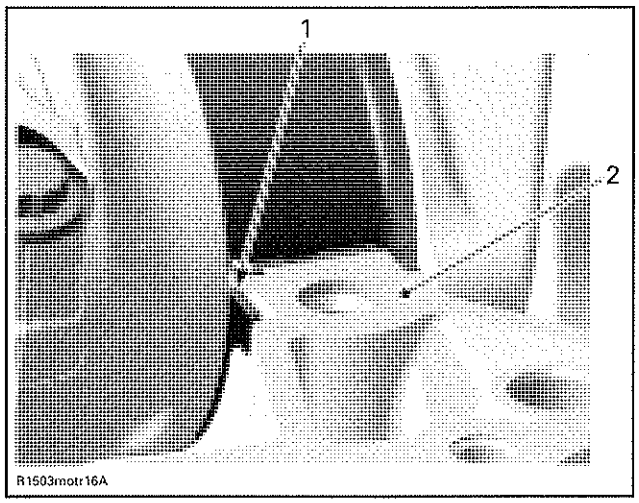
Insert thrust washers no. 4 as soon as crankshaft is in place as per following illustration.

CAUTION: Never forget thrust washers on center of crankshaft to control axial adjustment.



THRUST WASHER INSERT DIRECTION
1. *Thrust washer*

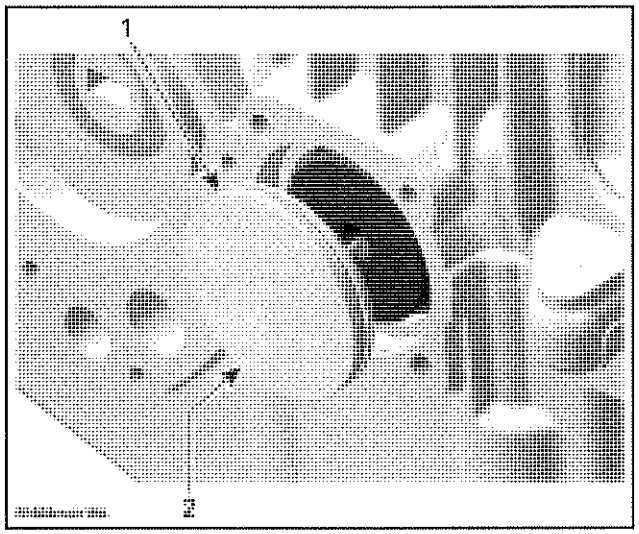
CAUTION: Thrust washers have to be flush with the cylinder block sealing surface.



1. *Thrust washer*
2. *Sealing surface*

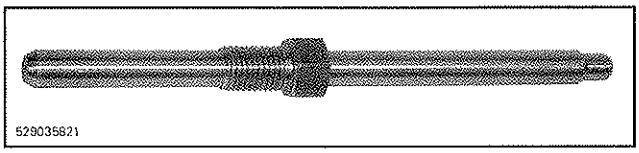
Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this section.

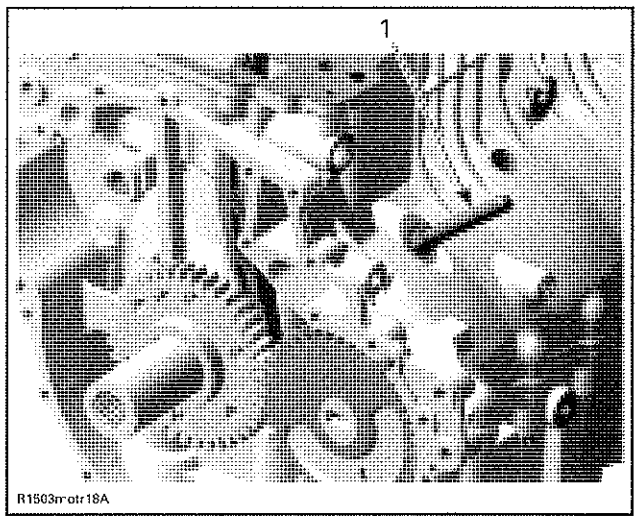
Install the crankshaft cover before mounting the engine bracket. Apply engine oil on O-ring and press cover in. Crankshaft cover has to be flush with cylinder block surface.



1. *O-ring*
2. *Crankshaft cover*

Install the crankshaft locking tool (P/N 529 035 821) right away to position crankshaft at TDC before installing the camshaft and the rocker arms (refer to *CYLINDER HEAD* section).





1. *Crankshaft locking tool*

BALANCER SHAFT

Balancer Shaft Removal

Drain engine oil (refer to *LUBRICATION SYSTEM* section).

Remove engine from vehicle (refer to *ENGINE REMOVAL/INSTALLATION* section).

Remove cylinder head (refer to *CYLINDER HEAD* section).

Remove PTO housing (refer to *PTO HOUSING AND MAGNETO* section).

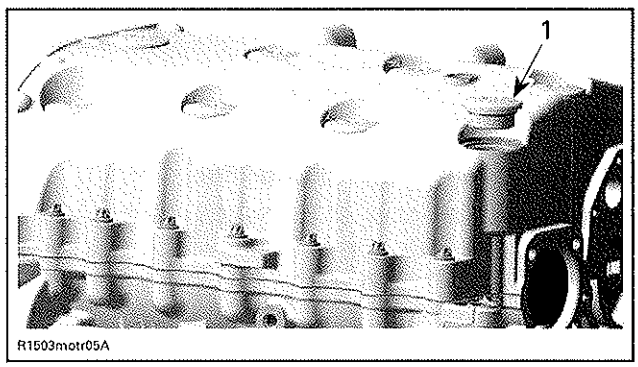
Remove starter gear (refer to *PTO HOUSING AND MAGNETO* section).

Remove starter drive.

Remove oil suction pump (refer to *LUBRICATION SYSTEM* section).

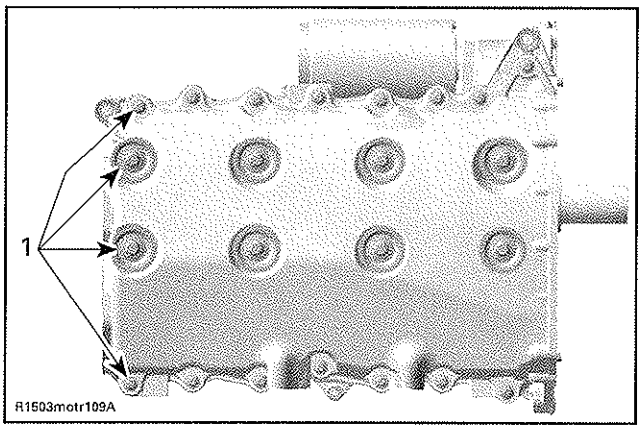
Remove engine mounting brackets.

Remove oil reservoir plug screws **no. 1** with O-ring **no. 2**.



ENGINE UPSIDE DOWN
1. *Oil reservoir plug screw with O-ring*

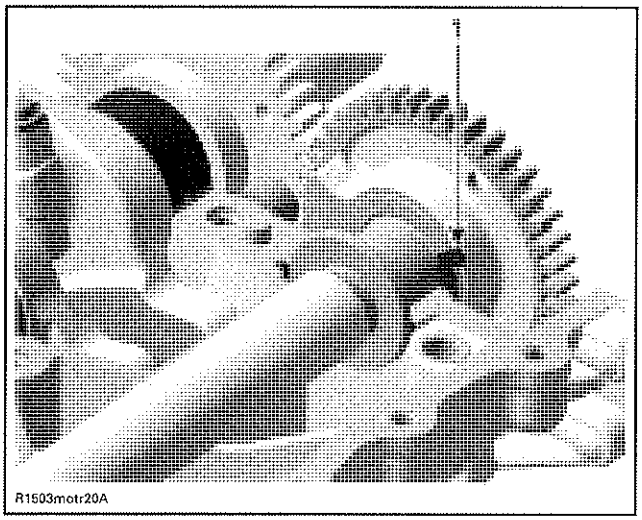
Remove cylinder block screws **no. 3**.



1. Screws

Remove cylinder block lower half.

Remove thrust washers no. 6.



1. Thrust washer

Remove balancer shaft.

Balancer Shaft Inspection

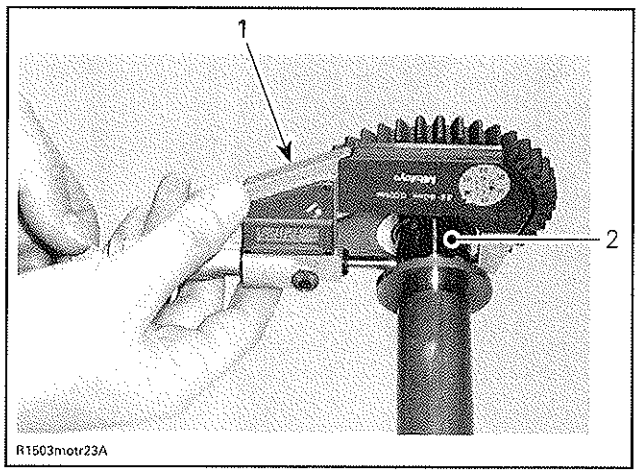
Check balancer shaft and replace if damaged.

If the gear on the balancer shaft is damaged, replace balancer shaft.

Check gear on the crankshaft at the same time and replace crankshaft if necessary (refer to *CRANKSHAFT* above).

Balancer Shaft Bearing Seat Play

Measure all balancer shaft bearing seats. Compare to inside diameter of balancer shaft bearings (elsewhere in this section).



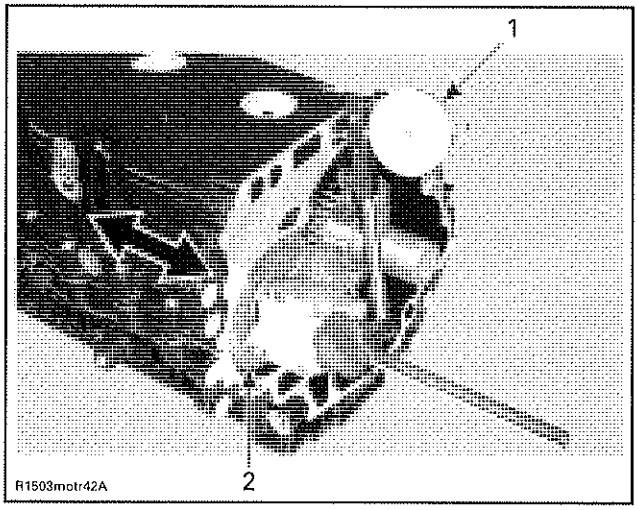
1. Micrometer
2. Balancer shaft area for bearing

BALANCER SHAFT SEAT DIAMETER mm (in)	
NEW	31.984 - 32.000 (1.2592 - 1.2598)
SERVICE LIMIT	31.960 (1.2583)

BALANCER SHAFT SEAT RADIAL CLEARANCE mm (in)	
SERVICE LIMIT	0.07 (.0028)

Balancer Shaft Axial Clearance

When assembling the cylinder-block, measure the balance shaft axial play.



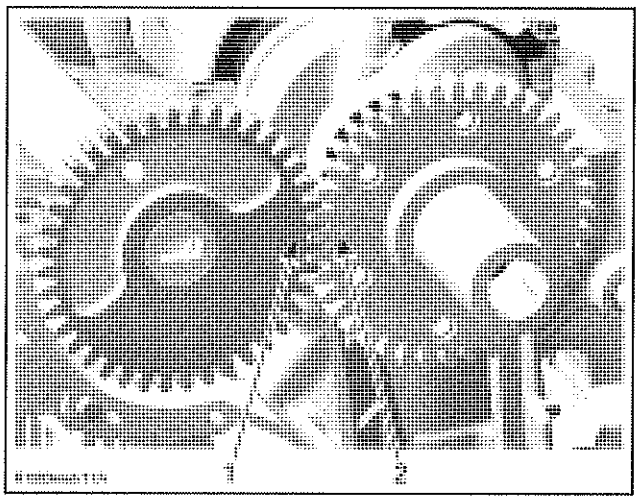
1. Dial gauge
2. Balancer shaft

BALANCER SHAFT AXIAL CLEARANCE mm (in)	
NEW	0.02 - 0.25 (.001 - .010)
SERVICE LIMIT	0.35 (.014)

Balancer Shaft Installation

For installation, reverse the removal procedure. Pay attention to following detail.

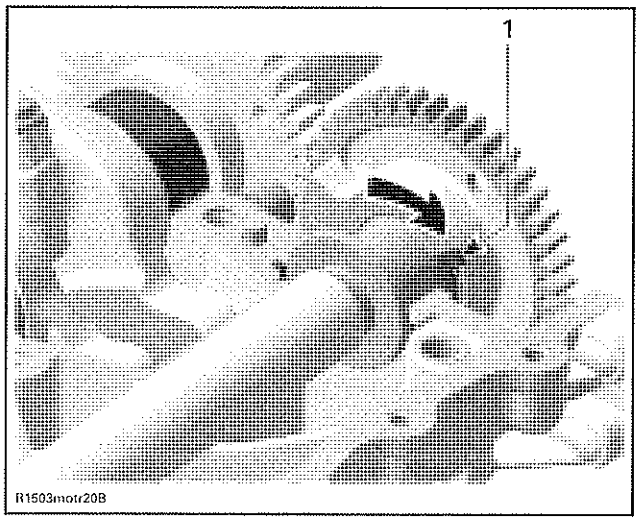
CAUTION: Balancer shaft and crankshaft marks have to be aligned.



1. Mark on balancer shaft
2. Mark on crankshaft

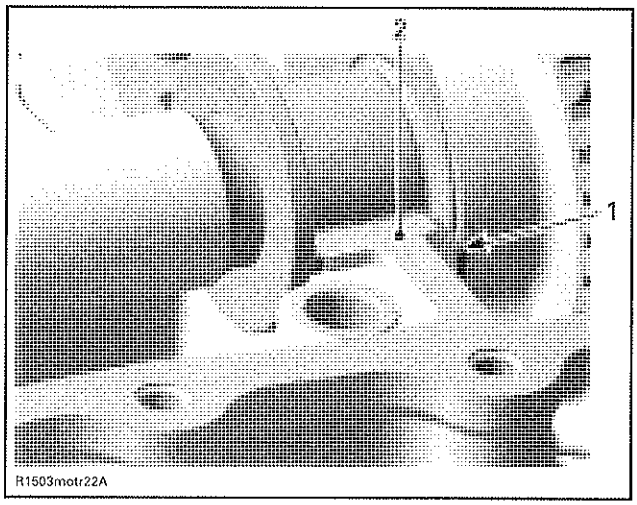
CAUTION: Never forget thrust washers no. **6** on PTO side to control axial adjustment on balancer.

Insert thrust washers as soon as balancer shaft is in place as per following illustration.



THRUST WASHER INSERT DIRECTION
1. Thrust washer

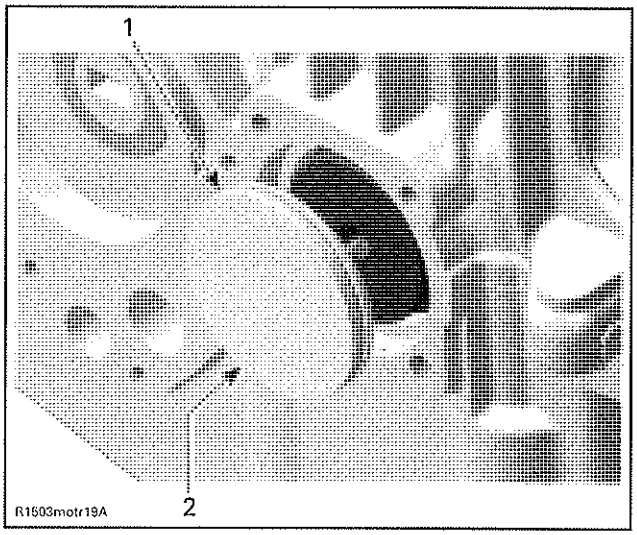
CAUTION: Thrust washers have to be flush with the cylinder block sealing surface.



1. Thrust washer
2. Sealing surface

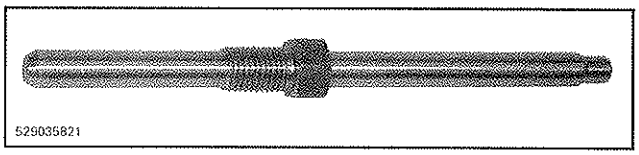
Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this section.

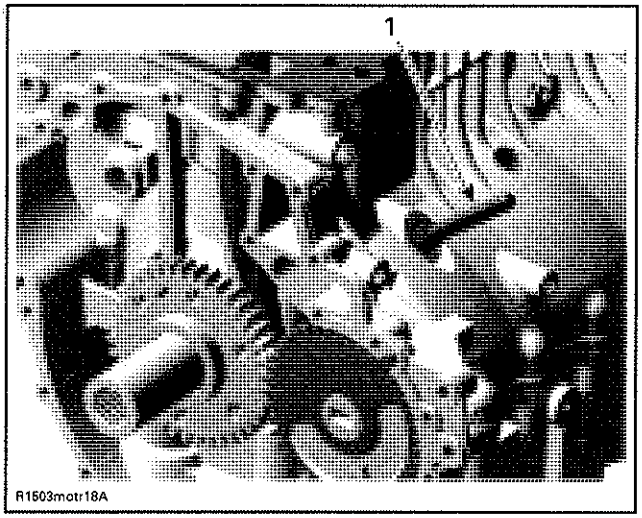
Install the crankshaft cover before mounting the engine bracket. Apply engine oil on O-ring and press cover in. Crankshaft cover has to be flush with cylinder block surface.



1. O-ring
2. Crankshaft cover

Install the crankshaft locking tool (P/N 529 035 821) right away to position crankshaft at TDC before installing the camshaft and the rocker arms (refer to *CYLINDER HEAD* section).





1. Crankshaft locking tool

CYLINDER BLOCK

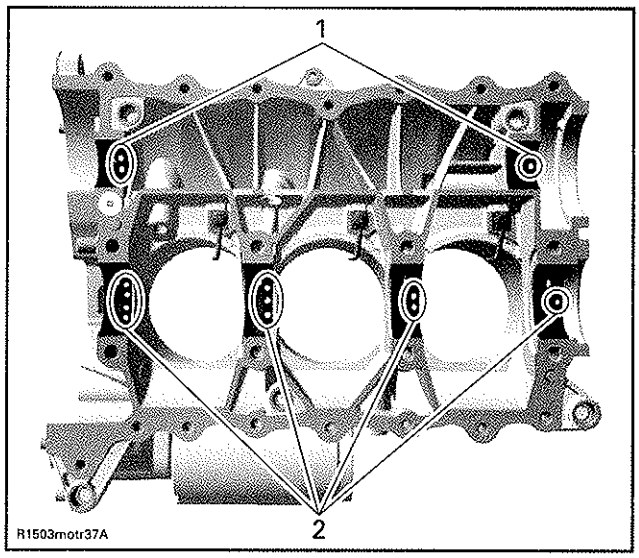
Cylinder Block Disassembly

Remove:

- Engine oil (refer to *LUBRICATION SYSTEM* section)
- Engine from vehicle (refer to *ENGINE REMOVAL/INSTALLATION* section)
- Cylinder head (refer to *CYLINDER HEAD* section)
- PTO housing (refer to *PTO HOUSING AND MAGNETO* section)
- Starter gear (refer to *PTO HOUSING AND MAGNETO* section)
- Starter drive
- Oil suction pump (refer to *LUBRICATION SYSTEM* section)
- Balancer shaft (refer to *BALANCER SHAFT* elsewhere in this section)
- Crankshaft (refer to *CRANKSHAFT* elsewhere in this section)
- Piston with connecting rod (refer to *PISTONS/CONNECTING RODS* elsewhere in this section).

Bearings

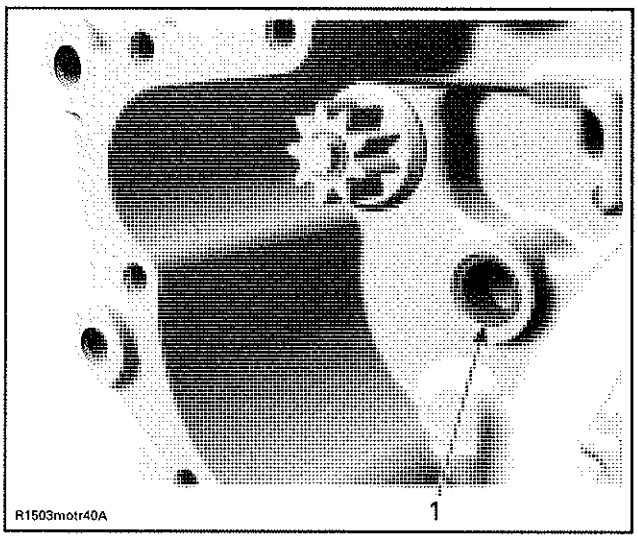
When bearings need to be removed from the cylinder block, mark them to identify the correct position at installation. See the following illustration for an example:



1. Mark on balancer shaft bearings
2. Mark on crankshaft bearings

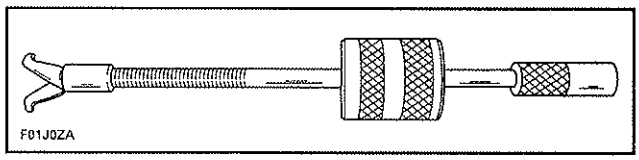
Starter Drive Bearing

Check bearing no. 21 of starter drive assembly no. 22 in cylinder block and replace it if damaged.



TYPICAL
1. Bearing of starter drive assembly

Starter drive bearing can be easily removed from crankcase lower half using the a small slide hammer such as the Snap-on small slide hammer (P/N CJ93B).



Close puller claws so that they can be inserted in end bearing. Holding claws, turn puller shaft clockwise so that claws open and become firmly tight against bearing.

Slide puller hammer outwards and tap puller end. Retighten claws as necessary to always maintain them tight against bearing. Continue this way until bearing completely comes out.

Cylinder Block Inspection

Cylinder

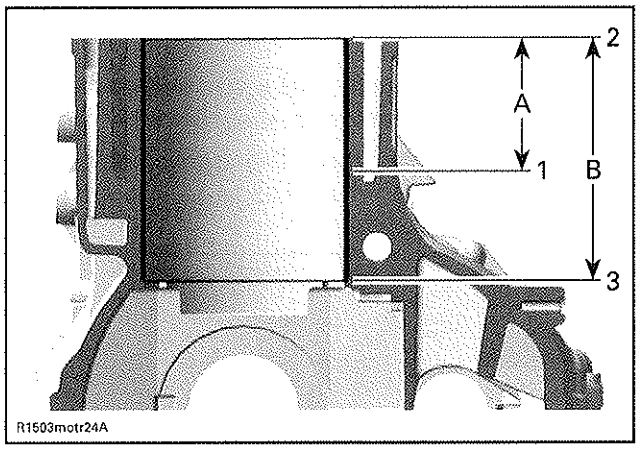
Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore and if it is out of specifications, re-hone cylinder sleeve and replace piston with first oversize.

NOTE: It is not necessary to have all cylinders re-honed if they are not all out of specification. Mixed standard size and oversize cylinders are allowed.

Measure cylinder bore at 3 recommended positions. See the following illustration.



1. First measuring diameter
2. Second measuring diameter
3. Third measuring diameter
A. 60 mm (2.362 in)
B. 110 mm (4.331 in)

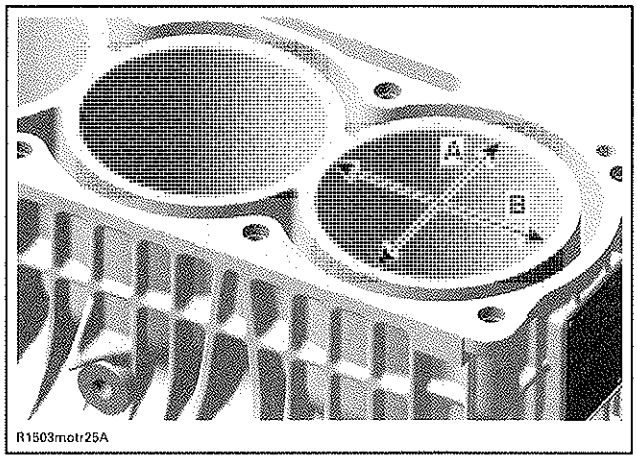
CYLINDER TAPER IN DIAMETER mm (in)	
NEW MAXIMUM	0.038 (.001)
SERVICE LIMIT	0.090 (.004)

Distance between measurements should not exceed the service limit mentioned above.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take an other measurement 90° from first one and compare.

NOTE: Take the same measuring points as described in *CYLINDER TAPER* above.



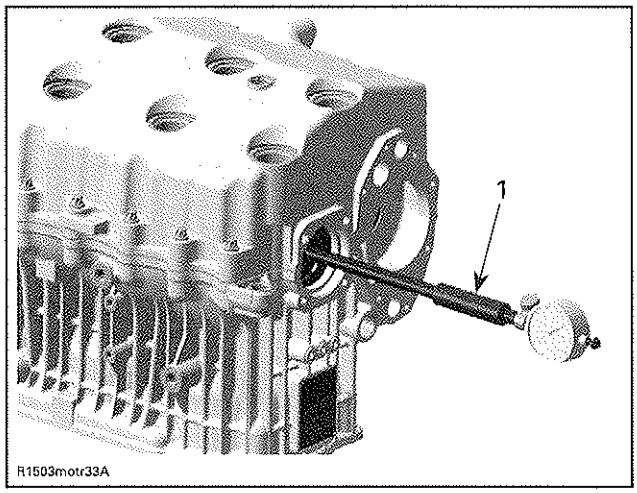
A. Perpendicular to crankshaft axis
B. Parallel to crankshaft axis

CYLINDER OUT OF ROUND mm (in)	
NEW MAXIMUM	0.008 (.0003)
SERVICE LIMIT	0.015 (.0006)

Bearings

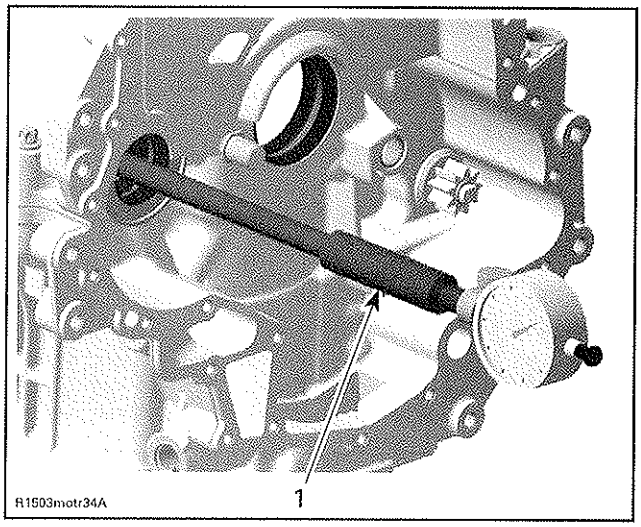
To measure the wear of the crankshaft bearings **no. 13** and **no. 14** and balancer shaft bearings **no. 15**, both cylinder block halves with **OLD** bearings have to be screwed together as per tightening procedure described below.

Measure the inside diameter of the bearings with a bore gauge.



ENGINE UPSIDE DOWN
1. Bore gauge

CRANKSHAFT BEARING INSIDE DIAMETER mm (in)	
SERVICE LIMIT	50.1 (1.9724)



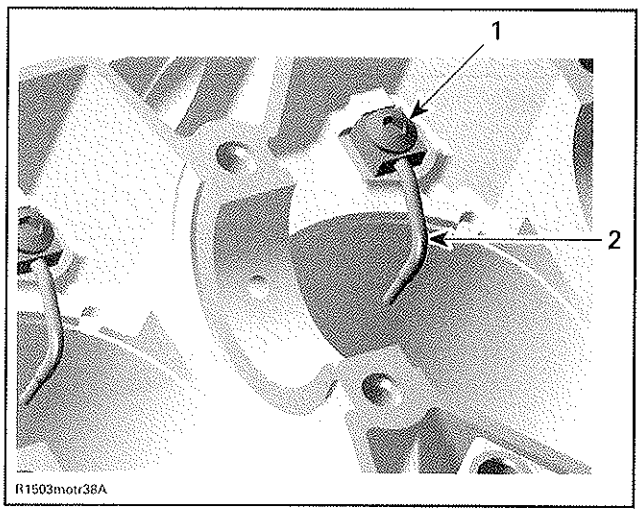
ENGINE UPSIDE DOWN
1. Bore gauge

BALANCER SHAFT BEARING INSIDE DIAMETER mm (in)	
SERVICE LIMIT	32.11 (1.2642)

Replace bearings if they are out of specifications.

Oil Spray Nozzles

Remove oil spray nozzle no. **16** and Banjo screw no. 17 from cylinder block.



1. Banjo screw
2. Oil spray nozzle

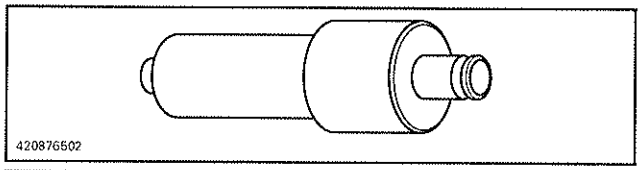
Check if ball inside moves freely in the Banjo screw. Clean oil spray nozzle and Banjo screw from dirt and debris.

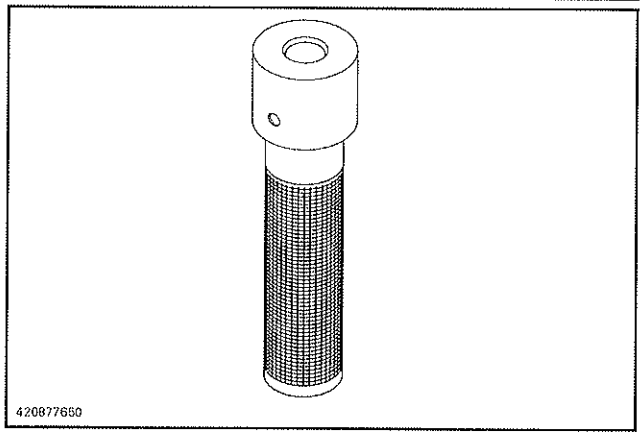
Cylinder Block Assembly

For assembly, reverse the disassembly procedure. Pay attention to the following details.

Torque Banjo screw to 18 N•m (159 lbf•**in**).

To install starter drive bearing **no. 21** of starter drive assembly, use the pusher (P/N 420 876 502) and the handle (P/N 420 877 650).

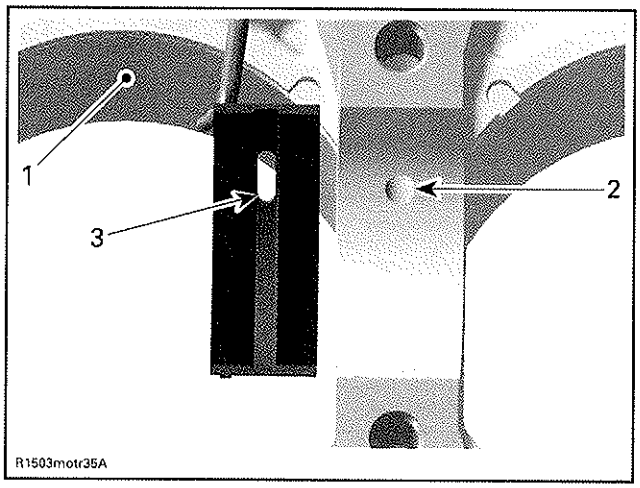




Use **NEW** bearings when diameters are out of specification.

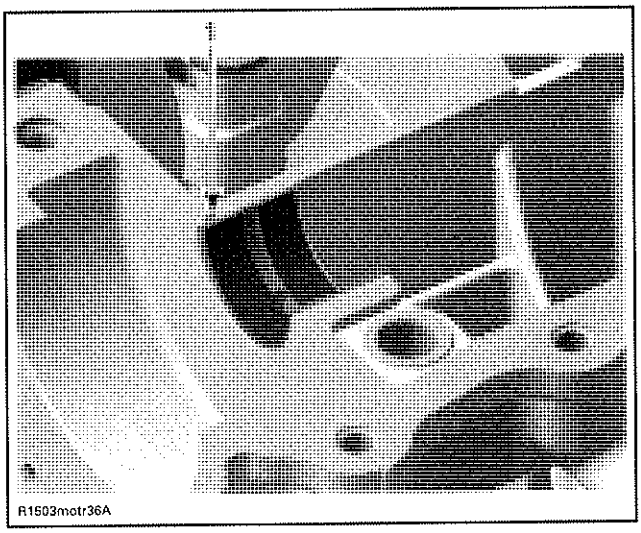
If **OLD** bearings can be used again, make sure they are at the same position as they were before.

Correctly install bearings. Top crankshaft bearing halves have a bore which has to be placed in the upper cylinder block.



1. Cylinder block upper half
2. Oil bore in cylinder block
3. Oil bore in bearing

Bearings have to be flush with the cylinder block split surface and their protrusions have to fit in the notched areas in the cylinder block seat.



1. Bearing protrusion in cylinder block notch

Apply engine oil on all bearings, in the bottom area of the cylinder bore and also on the band of the piston ring compressor tool.

For proper installation of pistons, refer to *PISTONS/CONNECTING RODS* in this section.

NOTE: Before installing the crankshaft, make sure that the timing chain is on the crankshaft and the chain guide has been installed first. Those parts cannot be installed after as the crankshaft is in place.

Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

Cylinder block mating surfaces are best cleaned using a combination of the Loctite chisel (gasket remover) (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass (cross hatch).

CAUTION: Do not wipe with rags. Use a new clean hand towel only.

IMPORTANT: When beginning the application of the crankcase sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

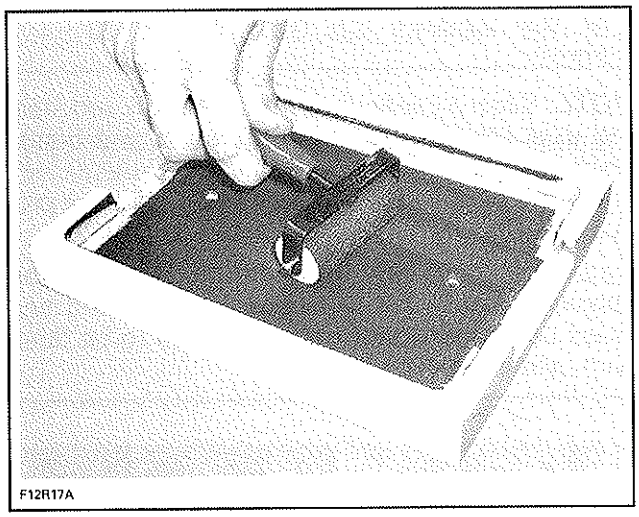
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute this sealant.

Apply Loctite 5910 (P/N 293 800 081) on mating surfaces.

CAUTION: Do not use other products to seal crankcase. Do not use an activator with the Loctite 5910. Using other products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase.

NOTE: Refer to the product label for the sealant curing time. Respect the manufacturer's recommendations prior to start engine.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.



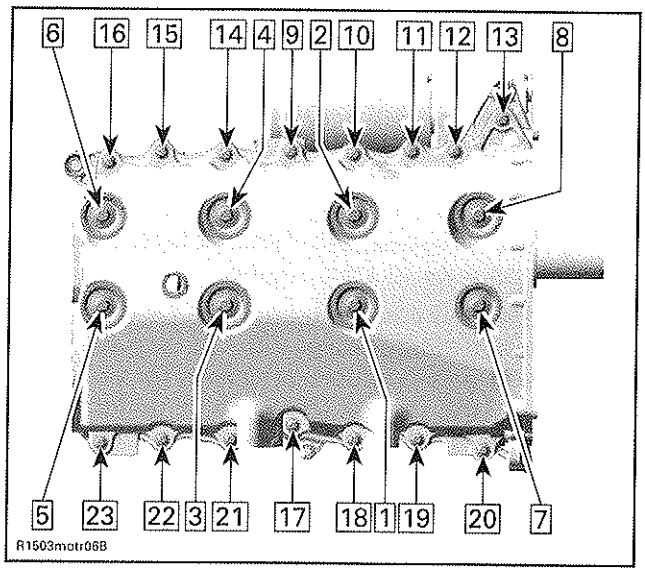
Do not apply in excess as it will spread out inside crankcase.

Tighten cylinder block screws as per following procedure:

Apply Loctite 243 (blue) (P/N 293 800 060) on screw threads.

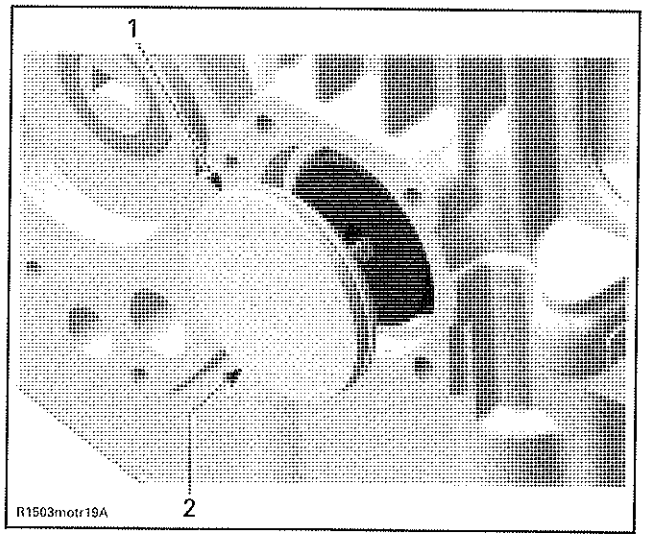
Torque cylinder block screws no. 3 to 40 N•m (30 lbf•ft) following sequence 1 to 8 and then to 55 N•m (41 lbf•ft) (repeat sequence).

Torque cylinder block screws no. 7 to 22 N•m (17 lbf•ft) following sequence 9 to 23.



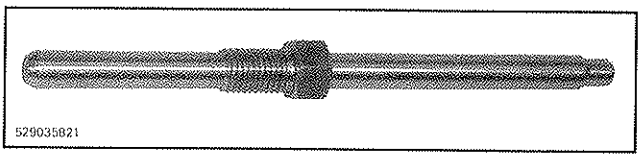
NOTE: Before continuing the assembly process, the axial clearance of balancer shaft and crankshaft has to be checked. Refer to *CRANKSHAFT* and *BALANCER SHAFT* in this section for the procedure.

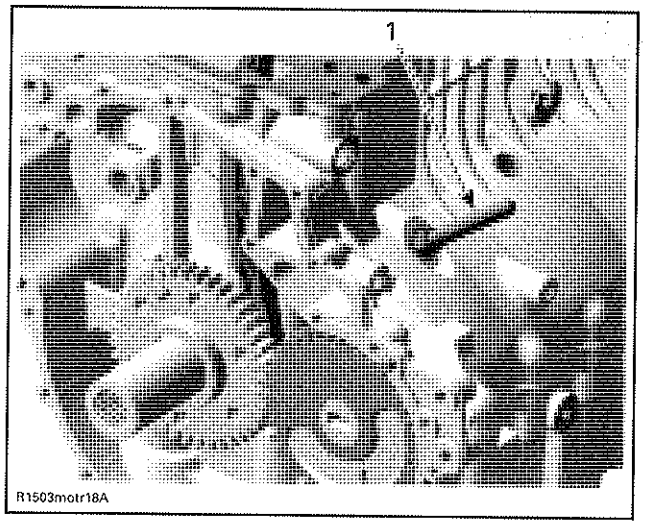
Install the crankshaft cover before mounting the engine bracket. Apply engine oil on O-ring and press cover in. Crankshaft cover has to be flush with cylinder block surface.



1. *O-ring*
2. *Crankshaft cover*

Install the crankshaft locking tool (P/N 529 035 821) right away to position crankshaft at TDC before installing the camshaft and the rocker arms (refer to *CYLINDER HEAD* section).

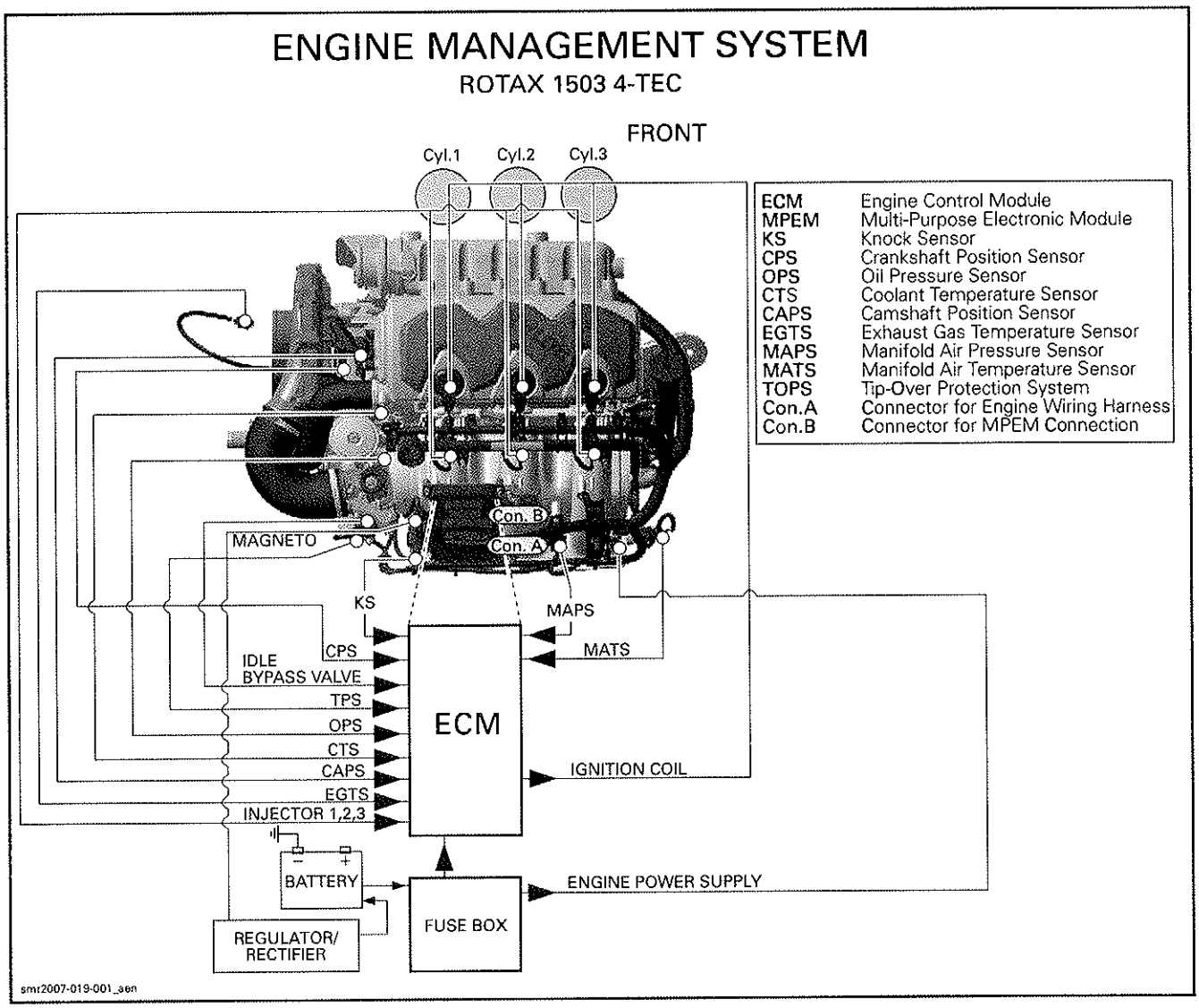




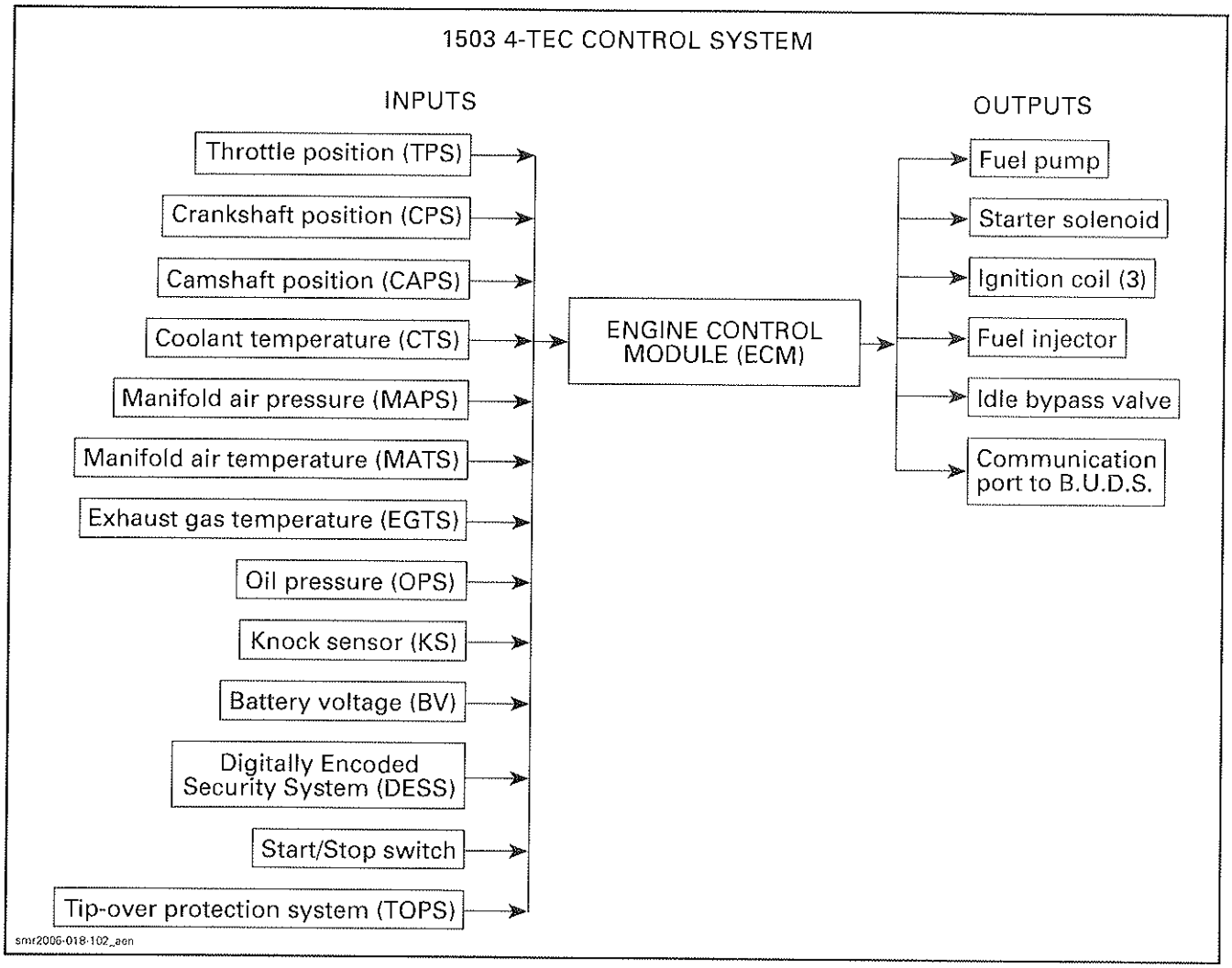
1. *Crankshaft locking tool*

Install cylinder head, PTO housing and the other parts in accordance with the proper assembly procedures.

OVERVIEW



ECM Inputs and Outputs



SYSTEM DESCRIPTION

There are 4 main systems in interaction with the engine management system:

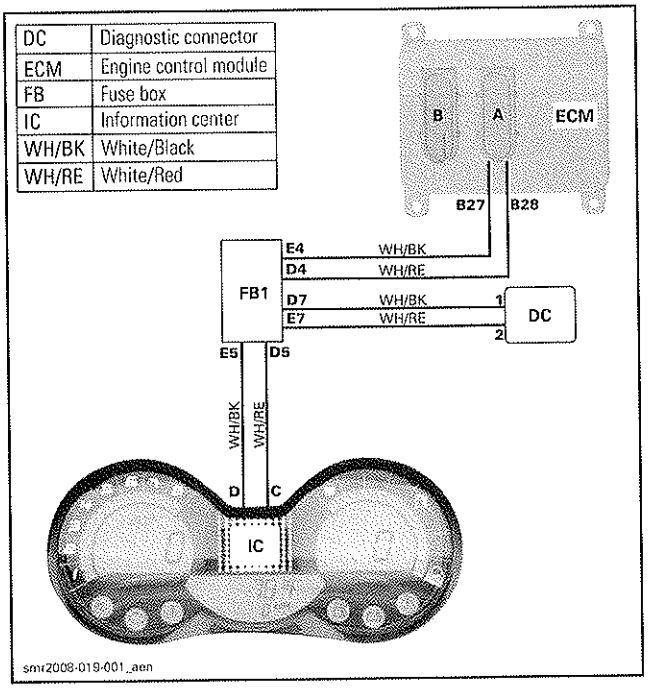
1. Electronic fuel injection
2. DESS system
3. Ignition system
4. Starting system

CONTROLLER AREA NETWORK (CAN)

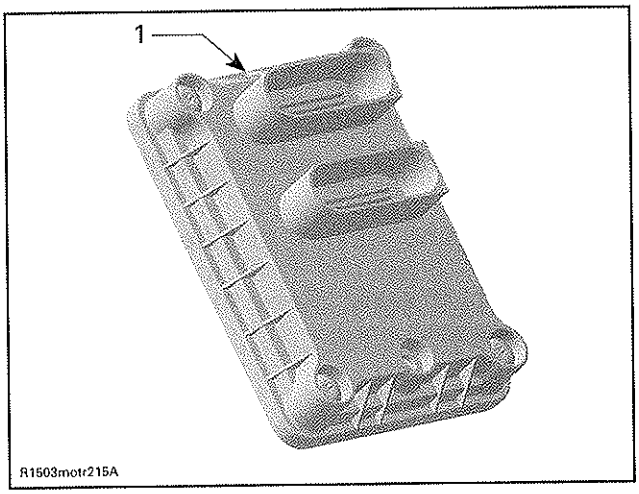
A communication link (CAN lines) is used to communicate between the ECM and the information center. CAN lines consist of a pair of wires (WHITE/RED and WHITE/BLACK).

For communication link troubleshooting, refer to *GAUGE/FUSES* in *ELECTRICAL SYSTEM* section.

The communication link is also used to communicate with the B.U.D.S. software. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE*.



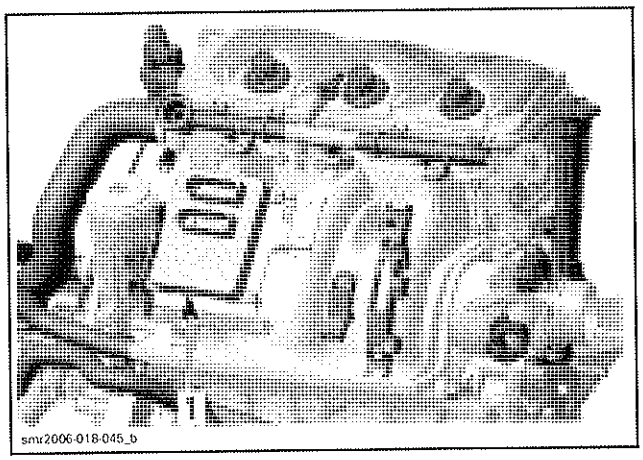
ENGINE CONTROL MODULE (ECM)



1. ECM

The ECM controls the electrical system and the engine management functions, by processing the information given by various sensors.

The ECM is mounted on the intake manifold. It controls all engine management functions, by processing the information given by various sensors.



TYPICAL
1. ECM on intake manifold

Engine RPM Limiter

The ECM will limit the maximum engine speed. The ECM monitors engine RPM through the CPS and it changes the fuel injection and ignition as necessary.

Drowned Mode

If engine is fuel-flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking.

NOTE: This mode can also be used if engine is water-flooded.

Proceed as follows to activate it.

With safety lanyard on its post while engine is stopped, press and HOLD throttle lever.

Press the start/stop button. The mode is now on.

Releasing throttle lever will bring back to its normal mode.

If engine does not start, it may be necessary to remove spark plugs and crank engine with rags over spark plug holes. Refer to *IGNITION SYSTEM* subsection.

Monitoring System

The ECM monitors the electronic components of the fuel injection system and also parts of the electrical system.

For more information, refer to *MONITORING SYSTEM/FAULT CODES*.

Limp Home Mode

The ECM may automatically uses default parameters for the engine management to ensure the adequate operation of the watercraft if a component of the fuel injection system is not operating properly.

The following components failure will trigger a limp home mode: CTS, EGTS and OPS.

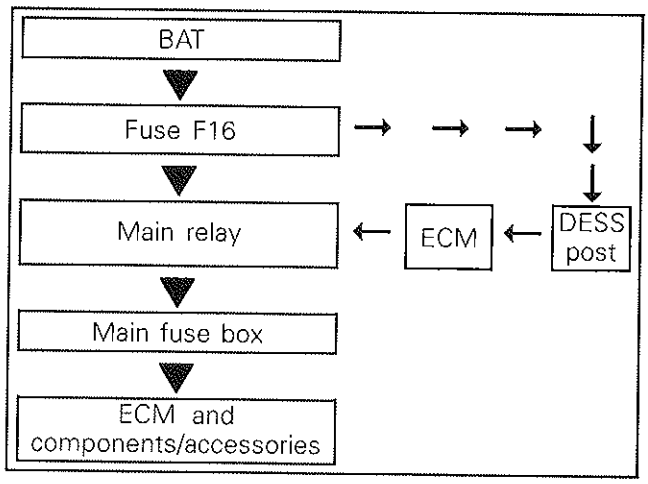
These performance-reduced modes allow the rider to go back home which would not be otherwise possible without this advanced system. Refer to the *MONITORING SYSTEM/FAULT CODES*.

Diagnostic Mode

The ECM features a self-diagnostic mode when safety lanyard is installed on DESS post. However, some components need the engine to be running so that they can be monitored. Some problems will turn on a warning lamp or will set the engine in limp home mode. Refer to *MONITORING SYSTEM/FAULT CODES* section for more information.

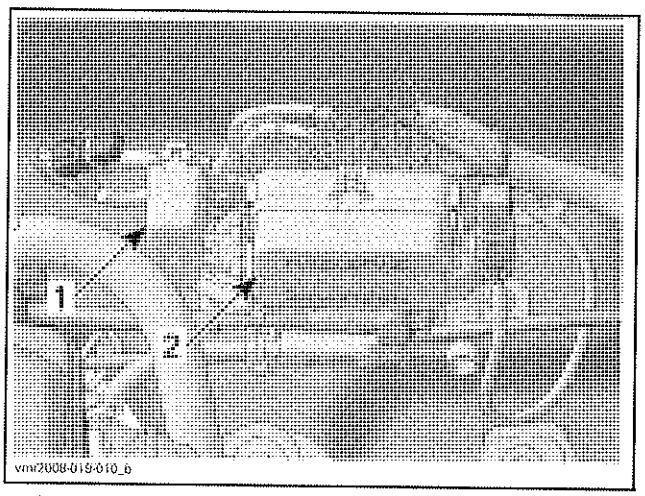
POWER DISTRIBUTION

Most of the electrical system is managed by the ECM.



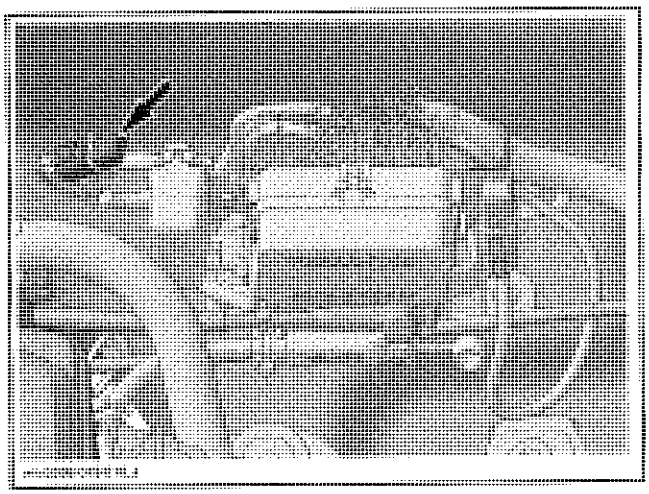
Power comes from battery and goes through a main relay to then be distributed to all components and accessories by the main fuse box.

The main relay isolates the battery from the electrical system to prevent battery drain. When safety lanyard is installed on DESS post, the ECM activates the relay that in turn, supplies current to the fuse box. When safety lanyard is removed, all power is cut-off.



1. Main relay (inside relay fuse box)
2. Main fuse box

A diode is used to protect the ECM against reverse connection of the battery. The diode is located besides the main relay.



Components and accessories are protected by fuses located in the fuse boxes. Fuse ratings is identified on fuse box cover. Refer to *GAUGE AND FUSES*.

IMPORTANT: When safety lanyard is installed, components are continuously powered from the fuse box. The ECM switches the ground to complete the electrical circuits it controls. Take this into account when troubleshooting the electrical system.

COMMUNICATION TOOLS/B.U.D.S. SOFTWARE

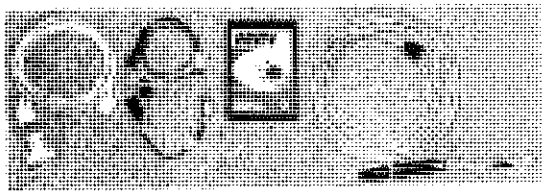
SERVICE TOOLS

Description	Part Number	Page
Optional extension cable	529 035 703	189
Communication kit	529 035 981	189
MPI-2	529 036 018	191
DESS post interface	529 036 019	192
Diagnostic cable	710 000 851	191
Optional extension cable	Not sold by BRP	191

COMMUNICATION TOOLS

Two different Multi-Purpose Interface can be used with B.U.D.S. software: MPI and MPI-2. Refer to the following for proper connections.

MPI

PART REQUIRED
PC computer
B.U.D.S. software Use latest version available on BOSSWeb
Communication kit (P/N 529 035 981) 
Optional extension cable (P/N 529 035 703) 

MPI Supply

The MPI can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

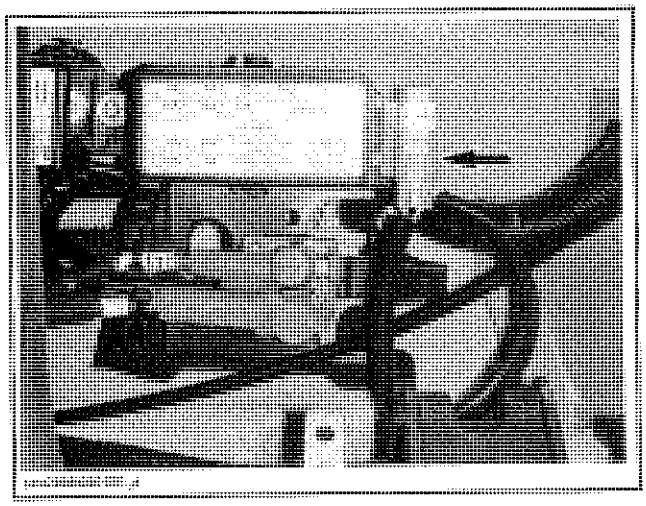
Connections with Vehicle

⚠ WARNING

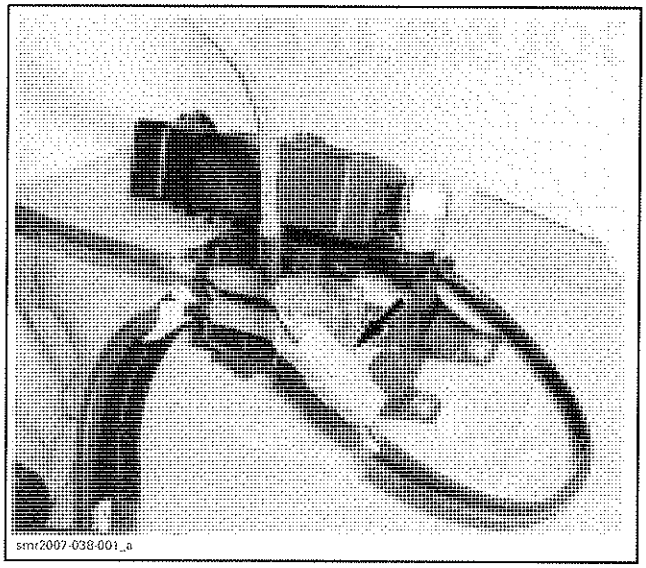
If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

Remove seat.

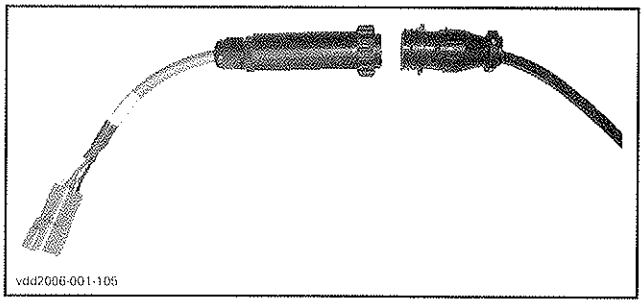
Pull out the 6-pin connector from the protective cap.



Connect the 6-pin adapter to the vehicle connector.

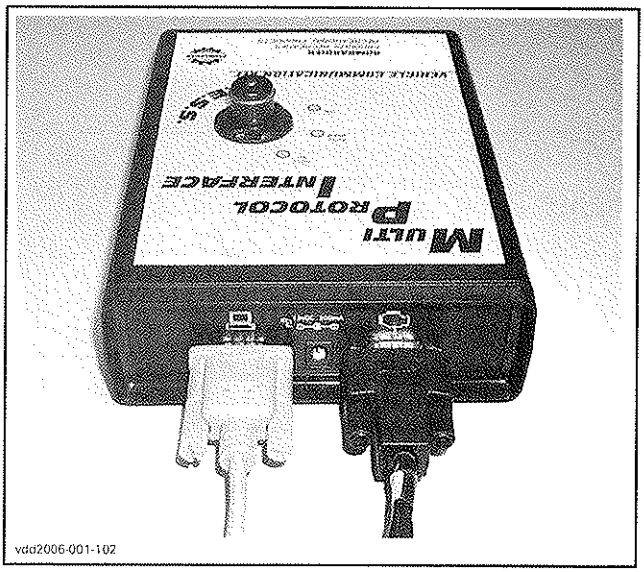


Connect the diagnostic cable to the 6-pin adapter.

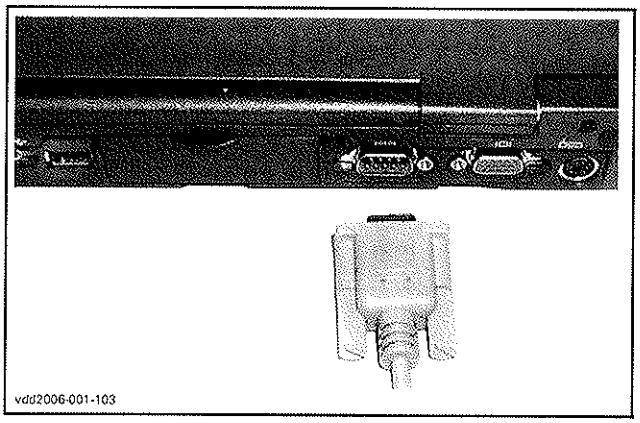


Connect the other diagnostic cable connector to MPI connector.

Connect serial cable to MPI connector.

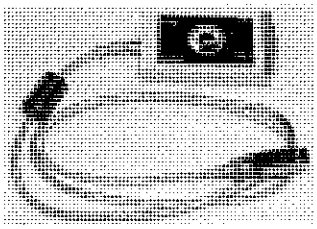
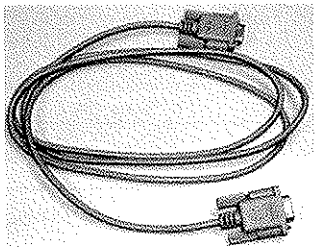
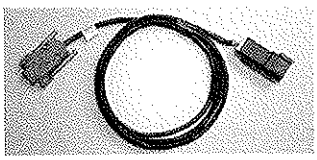


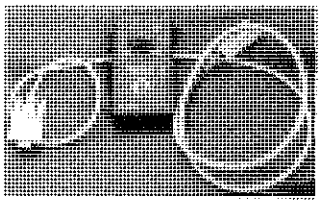
Connect remaining serial cable connector to the serial port of a PC (personal computer).



Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

MPI-2

PART REQUIRED	OPERATION	
	– PROGRAMMING KEY(S)	– ENTERING CUSTOMER INFORMATION – SETTING IGNITION TIMING/ CLOSED TPS – READING FAULT CODES – ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
PC computer	X	X
B.U.D.S. software Use latest version available on BOSSWeb	X	X
MPI-2 (P/N 529 036 018) 	X	X
Optional extension cable NOTE: Can be purchased from a PC dealer. IMPORTANT: Do not exceed 7.6 m (25 ft). 	X	X
Diagnostic cable (P/N 710 000 851) 	X	X

PART REQUIRED	OPERATION	
	– PROGRAMMING KEY(S)	– ENTERING CUSTOMER INFORMATION – SETTING IGNITION TIMING/ CLOSED TPS – READING FAULT CODES – ACTIVATION OF COMPONENTS (IGNITION COIL, FUEL PUMP ETC.)
DESS post interface (P/N 529 036 019) 	X	

MPI-2 Power Supply

The MPI uses the PC computer USB port for its power supply.

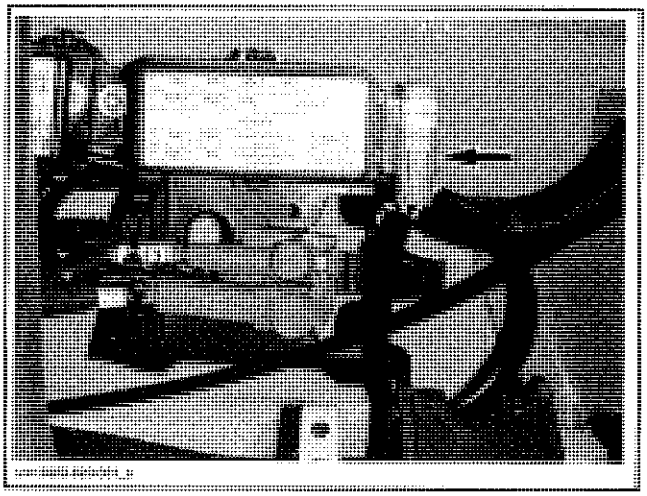
Connections with Vehicle

⚠ WARNING

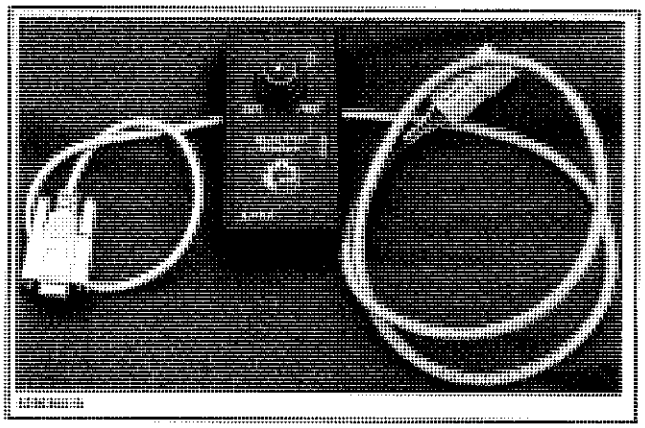
If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

Remove seat.

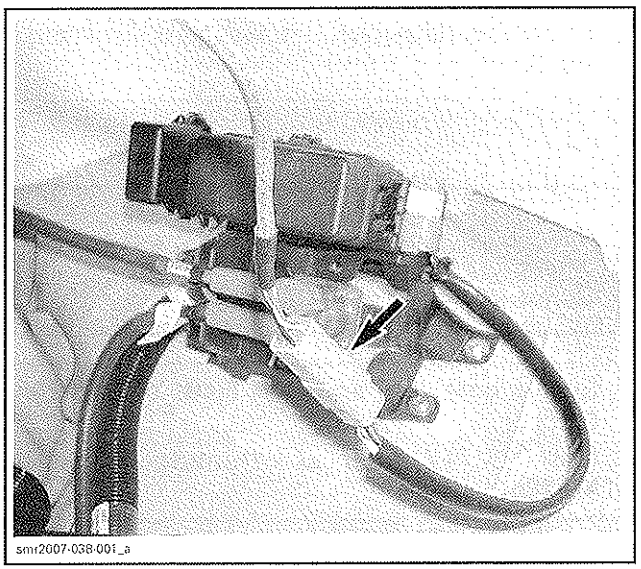
Pull out the 6-pin connector from the protective cap.



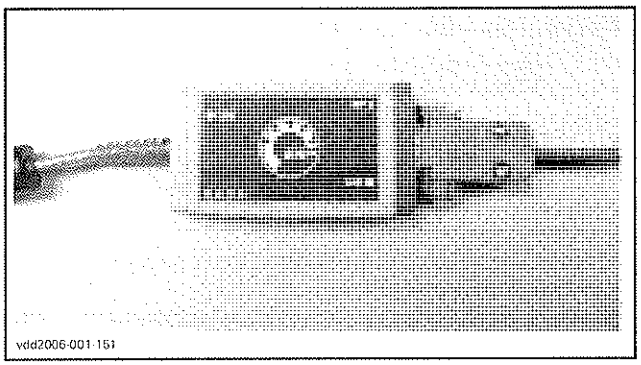
NOTE: To program key(s), install DESS post interface between vehicle 6-pin connector and MPI-2. You can leave post interface connected for all operations you do with B.U.D.S. Post interface must be connected before starting B.U.D.S.



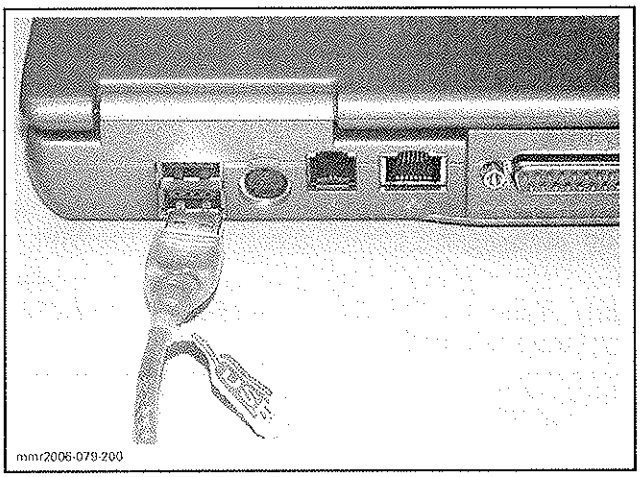
Connect diagnostic cable to vehicle connector.



Connect remaining connector to MPI-2 connector.



Connect remaining MPI-2 connector to the USB port of a PC (personal computer).

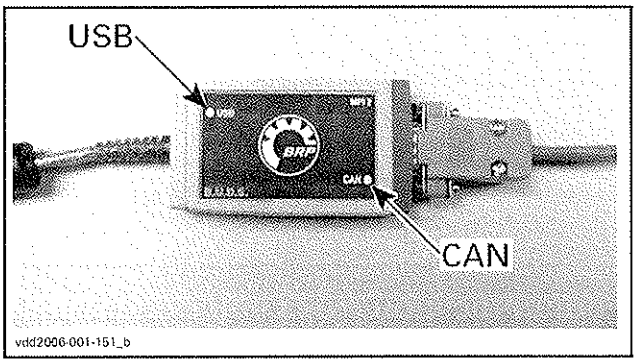


Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

Connection Troubleshooting

MPI-2 Status Lights

The MPI-2 includes 2 status lights to show the connection conditions: USB and CAN. **Both lights must be GREEN** so that MPI-2 works properly. Otherwise, refer to the following charts.



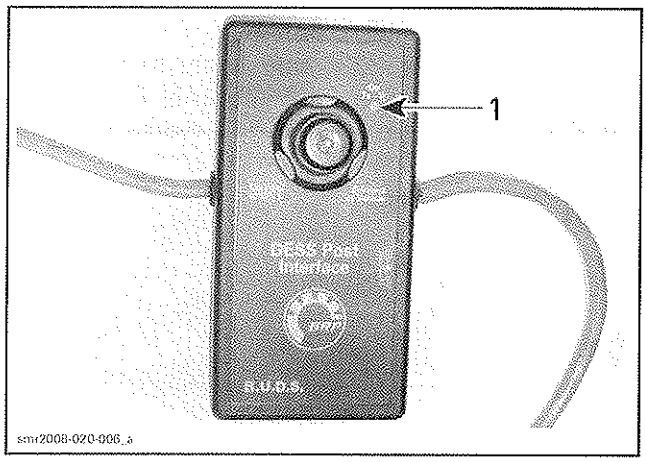
Prerequisite for USB communication:
- PC Computer turned on.
- MPI-2 connected to PC computer.

USB LIGHT	
STATUS	WHAT TO DO
Light is OFF	– Check USB connection between MPI-2 and PC computer. – Check USB operation on PC computer (hardware or Windows drivers).
Light is GREEN	Connections are GOOD. Communication can take place on USB side.

Prerequisite for CAN communication:
- MPI-2 connected to diagnostic connector of vehicle.
- DESS key installed on DESS post of vehicle.
- B.U.D.S. started and logged.

CAN LIGHT	
STATUS	MEANING
Light is OFF	– Check connection between MPI-2 and diagnostic connector of vehicle. – Check connection of DESS post interface (if used) with MPI-2 and diagnostic connector of vehicle.
Light is RED	Check CAN wires/connectors on vehicle.
Light is GREEN	Connections are GOOD. Communication can take place on CAN side.

DESS Post Interface Status Light



1. Status light

DESS POST INTERFACE LIGHT	
STATUS	WHAT TO DO
Light is OFF	– Check connection between MPI-2 and diagnostic connector of vehicle. – Install new batteries in interface.
Light is RED	Connections are GOOD. Communication can take place.

B.U.D.S. SOFTWARE

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to program key(s), to allow electrical component inspection, to diagnose and monitor components and to carry out settings such as the closed throttle and idle actuator.

For more information pertaining to the use of the B.U.D.S. software, use its help which contains detailed information on its functions.

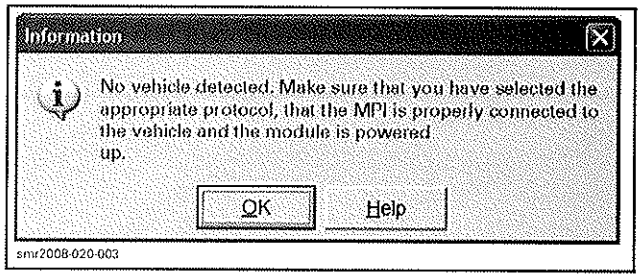
Ensure to use the latest B.U.D.S. version available on BossWeb.

IMPORTANT: Ensure all connections have been made before starting B.U.D.S. to allow proper operation.

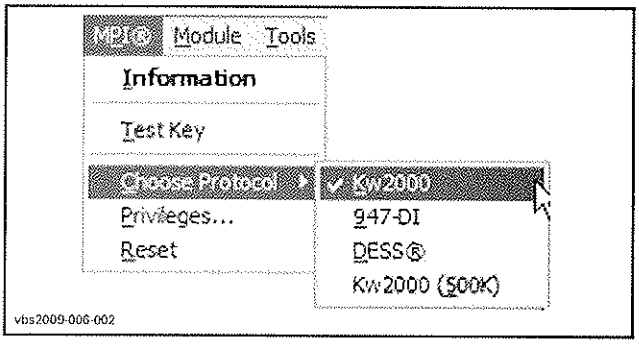
Connect key to vehicle DESS post to activate the communication.

Start B.U.D.S. and logon.

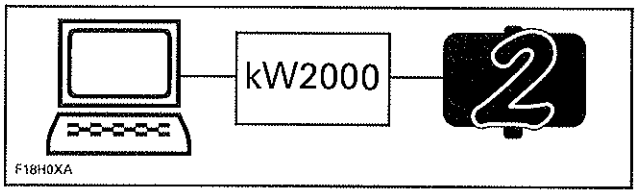
If No vehicle detected... message is displayed in B.U.D.S.:



– Ensure both USB and CAN lights of MPI-2 are GREEN.
– Check MPI-2 protocol. It must be set to Kw2000.



Ensure the status bar shows the Kw2000 and the number 2 to its right.

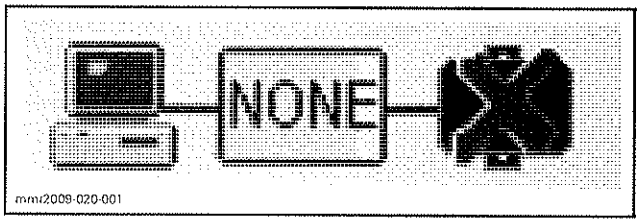


CONNECTION SUCCESSFUL

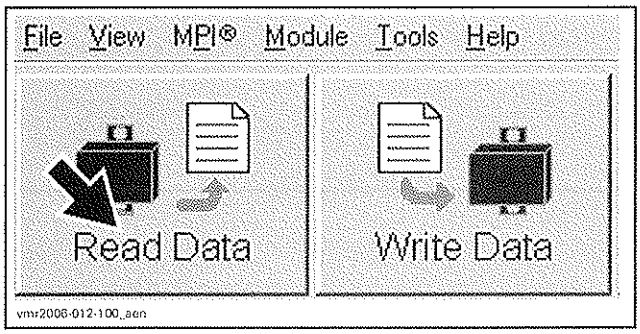
Number 2 means that 2 "ECUs" are connected (Information center and ECM).

If a "1" is shown, either the ECM or the information center is not communicating with the MPI.

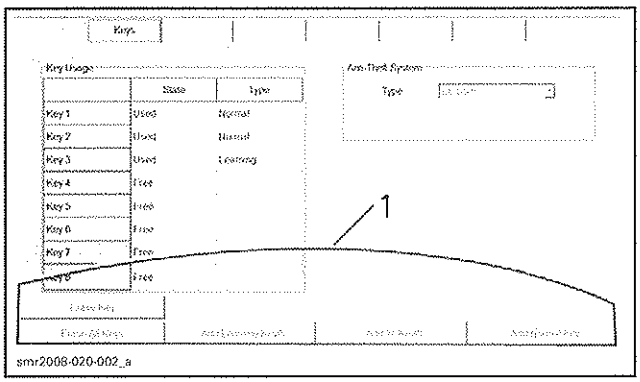
If an "X" is shown, the communication has been lost. Refer to *CONNECTION TROUBLESHOOTING* then restart B.U.D.S.



Read ECM by clicking the **Read Data** button.



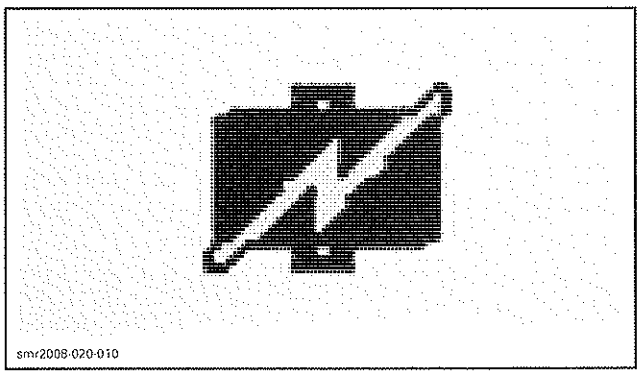
If all buttons are greyed out in Keys tab in B.U.D.S.



1. *All buttons greyed out*

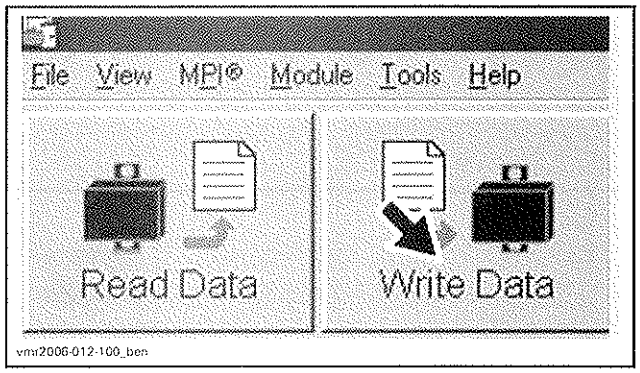
- The batteries in the DESS post interface are leak or are not installed. Install new batteries.
- The DESS post interface was connected after B.U.D.S. has been started.
- In all cases, exit B.U.D.S., ensure the DESS post interface is properly connected then restart B.U.D.S.

If an update icon is present in B.U.D.S. status bar, refer to *ECM OR INFORMATION CENTER UPDATE*

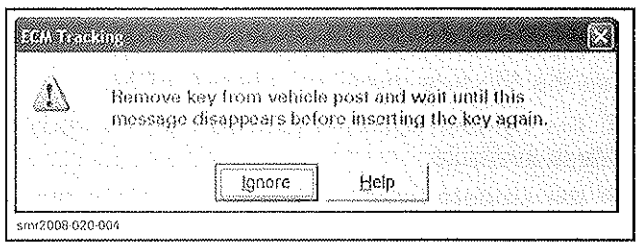


Changes in ECM

When finished, save new data in ECM by clicking the Write Data button.

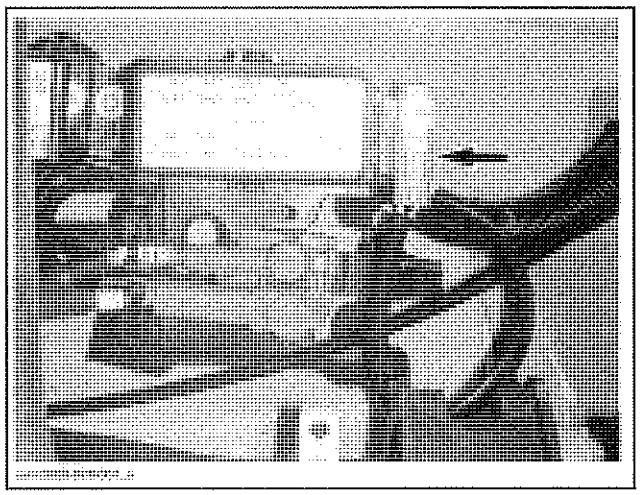


Anytime a change is brought in ECM through B.U.D.S., there will be an ECM Tracking box that will say "Remove key from the vehicle...".



When this occurs, remove the DESS key from its post and wait until the message disappears (it lasts approximately 15 seconds after key removal).

Disconnect MPI connections and reconnect vehicle harness in protective cap.

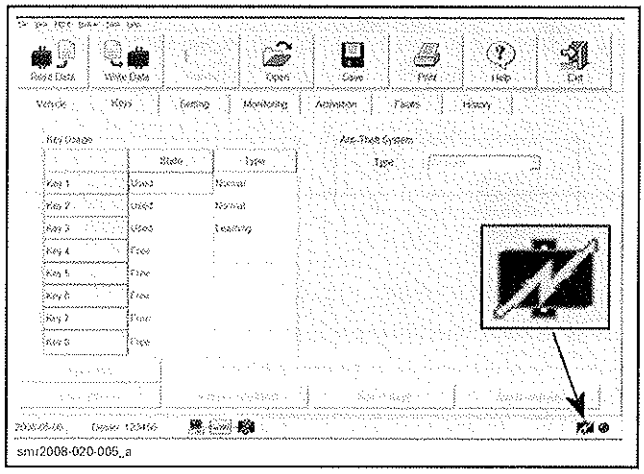


CAUTION: Failure to secure the 6-pin connector in its protective cap would allow corrosion and damage to the terminals.

NOTE: There is a 120 Ω resistor in protective cap to minimize the possibility of communication error.

ECM or Information Center Update

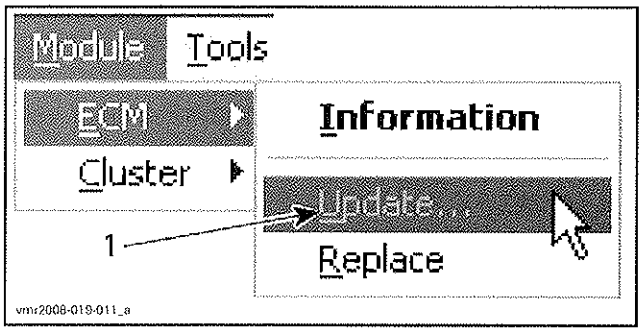
Whenever B.U.D.S. is started, check if there is an update icon.



The icon indicates that a file is available in B.U.D.S. to update the ECM and/or the information center.

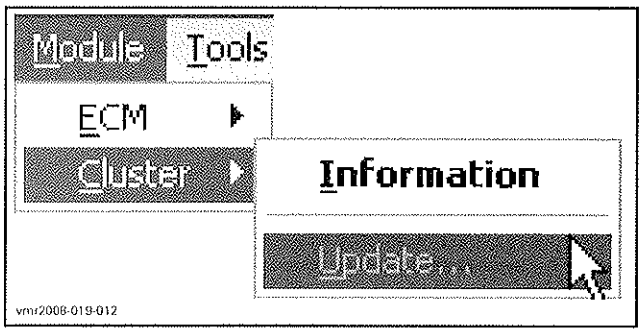
Use the **Module** menu and choose **ECM**.

- If the **Update** option is **greyed** out, no update file is available.
- If the **Update** option is **black**, an update file is available. Select the update option and load the proper file.



1. Greyed out: No update to perform
Black: Update file available

IMPORTANT: For the **Cluster**, the **Update** option will always be **black** misleading you to believe there is an update. Do not update the cluster unless you replaced the information center or if a bulletin has been published requesting to do so.



MONITORING SYSTEM/FAULT CODES

MONITORING SYSTEM

The EMS features a monitoring system that self-diagnose its electronic components (control modules, sensors and actuators) to ascertain they are not faulty or defective. This mode comes active when safety lanyard is on DESS post.

NOTE: Some components need the engine to be running so that they can be monitored (fuel injectors for example).

When a malfunction is currently detected, the ECM:

- Sets an active fault code.
- Adapts the proper protection strategy according to the failure.
- Sends out warning signals to the information center/beeper to inform the rider of a particular condition.

When a minor fault occurs:

- A message/beeper will warn the rider and the check engine light will turn on. Warning signal(s) will disappear automatically when the condition does not exist anymore. Releasing throttle and letting the engine returning at idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the DESS key on its post.

When an important fault occurs:

- SENSOR or another message will be displayed in the information center and the check engine light will turn on. It may be necessary to depress the throttle quite slowly to allow engine RPM to increase and operate the watercraft.

In the following situations, engine RPM will be limited.

CONDITION	MAX ALLOWED RPM
High engine temperature (from 110°C (230°F))	2500
High exhaust temperature (from 115°C (239°F))	
Low oil pressure (below 180 - 220 kPa (26 - 32 PSI))	

The following components or functions are monitored.

COMPONENT
EMS (TPS, CPS, CAPS, MAPS, MATS, CTS, OPS, IACV, EGTS, knock sensor, ignition coils and fuel injectors)
Battery voltage
Engine RPM
CAN
ECM
DESS system
Starter solenoid
Fuel pump and level sensor
Lake and exterior temperature sensors
Beeper, compass, VTS and switches, bilge pump and depth sounder

Beeper Signals

When one of the below conditions occurs, the monitoring system emits the following beep signals.

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (while installing DESS key on post).	– Confirms key signal operation. – Key is recognized by the ECM. – Good contact between key and DESS post.	– Engine can be started.
1 long beep (while installing key on post).	– Bad DESS system connection. – Wrong key. – Defective key. – Dried salt water or dirt in key. – Defective DESS post. – Improper operation of ECM or defective wiring harness.	– Reinstall key correctly over post. – Use a key that has been programmed for the watercraft. If it does not work, check key with B.U.D.S. Replace key if defective. – Use another programmed key. – Clean key to remove salt water. – Refer to *DESS* section. – Refer to *ELECTRONIC FUEL INJECTION* section.
4 very short beeps will sound every 5 minutes for 2 cycles. Then, 4 very short beeps will sound every 3 second interval.	– DESS key has been installed on its post without starting engine within 10 seconds or left connected 10 seconds after engine was stopped.	– To prevent battery discharge, remove the key from its post.
2 seconds beep every 15 minutes interval.	– VTS, compass, bilge pump, lake temperature sensor, exterior temperature sensor or circuit malfunction. – Watercraft is upside down or TOPS switch or circuit malfunction. – Wrong ECM or information center installed. – Battery voltage too high or too low. – CAN communication, ECM, MAPS, MATS, CTS, OPS, EGTS, CPS, CAPS, TPS, knock sensor, IACV or circuit malfunction. – Fuel injector or circuit malfunction. – Ignition coil or circuit malfunction. – Fuel pump/fuel level or circuit malfunction. – Starter solenoid or circuit malfunction.	– Refer to *GAUGE/FUSES.* – Turn watercraft upright. If it does not work, check the TOPS switch. Refer to *ELECTRONIC FUEL INJECTION* section. – Refer to *ELECTRONIC FUEL INJECTION* or *GAUGE/FUSES.* – Refer to *CHARGING SYSTEM* section. – Refer to *ELECTRONIC FUEL INJECTION* section. – Refer to *ELECTRONIC FUEL INJECTION* section. – Refer to *IGNITION SYSTEM* section. – Refer to *FUEL SYSTEM* section. – Refer to *STARTING SYSTEM* section.
A 2 seconds beep every 5 minutes interval.	– Low fuel level. – Fuel tank level sensor or circuit malfunction.	– Refer to *GAUGE/FUSES* section. – Refer to *GAUGE/FUSES* section.
A 2 seconds beep every minute interval.	– High air intake temperature detected.	– Refer to *INTAKE MANIFOLD* or *INTERCOOLER (255 ENGINE)* section.

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
Continuously beeps.	– High engine coolant temperature.	– Refer to *COOLING SYSTEM* section.
	– High exhaust temperature.	– Refer to *EXHAUST SYSTEM* section.
	– Low engine oil pressure.	– Refer to *LUBRICATION SYSTEM* section.

FAULT CODES

When there is a problem, the EMS (engine management system) can provide fault codes to ease the troubleshooting.

Verify if the check engine light is ON. If so, look for fault codes to diagnose the trouble. The fault codes recorded in the ECM can be checked on the information center or by using the software B.U.D.S.

NOTE: Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the fault codes (state, count, first, etc.) and report, refer to B.U.D.S. online help.

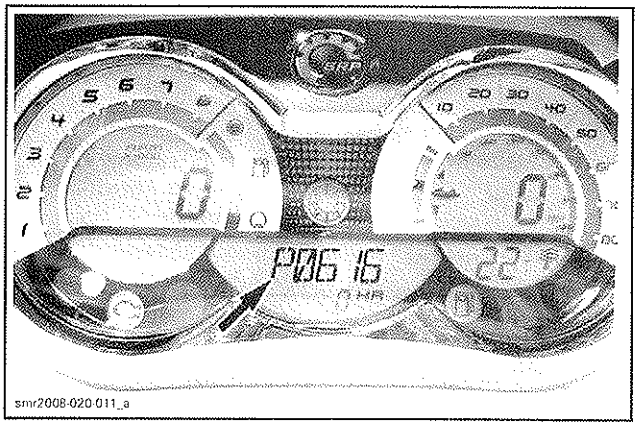
When the fault is not active anymore, its status is changed from active to occurred and it is stored in the ECM. Stored fault codes are kept in the ECM even if the battery is disconnected.

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred as A-23 for instance. It means ECM connector "A" and the circuit wire no. 23 as found in the wiring diagram.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the B.U.D.S. software. This will properly reset the appropriate counter(s) and will also record that the problem has been fixed in the ECM memory.

Fault Code Reading on the Information Center

Fault codes starting with the letter "P" followed by 4 digits (P-1234) will be automatically displayed in the information center for troubleshooting.



If more than one fault is active the following fault(s) will be displayed after a short delay up to the end to then come back to the first one and the cycle continues.

NOTE: The multifunction gauge display only fault codes that are active. Occurred non-active faults can only be seen using B.U.D.S.

Fault Code Reading Using B.U.D.S. Software

Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

SPECIFIC FAULT CODES

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups: TPS faults and adaptation faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTATION FAILURE.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Fix.
Check if sensor is loose	Tighten and reset Closed Throttle and Idle Actuator.
Inspect sensor for damage or corrosion	Replace and reset Closed Throttle and Idle Actuator.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset Closed Throttle and Idle Actuator.
Test sensor operation (wear test)	Replace and reset Closed Throttle and Idle Actuator.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaptation Failure":

- Idle speed is out of range.
- Engine stops when throttle is released quickly.
- Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset Closed Throttle and Idle Actuator.
Throttle body has been replaced and TPS closed position not reset	Reset Closed Throttle and Idle Actuator.
ECM has been replaced and TPS closed position not reset	Reset Closed Throttle and Idle Actuator.
Throttle cable too tight	Tighten and reset Closed Throttle and Idle Actuator.
Sensor is loose	Tighten and reset Closed Throttle and Idle Actuator.
Throttle bracket is loose	Tighten and reset Closed Throttle and Idle Actuator.
Idle speed screw (tamper proof) worn or loose	Change throttle body.
Idle bypass valve replaced but not reset	Reset Closed Throttle and Idle Actuator using B.U.D.S.

Communication Link Fault Code P1681

Sometimes the information center does not synchronize fast enough for the ECM. That brings this fault code. Simply clear the fault and try again.

ECM Fault Codes P0601, P0602, P0604 and P0605

These codes may occur in the following situations:

- Electrical noise is picked up by the ECM. Ensure that all connections are in good condition, also grounds (battery, ECM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine particularly in the ignition system. Installing resistive caps, non-resistive spark plugs or improper knock sensor wiring/routing may lead to generate this fault code.
- Electrical noise might also lead engine to occasional cutout without generating a fault code when engine is restarted. When looking at the fault code, pay attention to the "count" value in the software B.U.D.S. A value between 1 and 9 confirms an electrical noise problem. A value of 10 and above will generate a fault code.
- When installing a new ECM. It is not properly programmed from the factory. The ECM must be returned to be properly "activated".
- If everything is in good condition, try a new ECM.

Fault Code P1513

Wrong ECM or information center. Installed part is not appropriate for the vehicle. Engine will crank but will not start. Refer to parts catalogs for proper part according to vehicle.

Fault Code P0562

Battery voltage too low. It occurs when both battery voltage and engine RPM conditions are met. See chart.

BATTERY VOLTAGE	ENGINE SPEED
Lower than 6.5 Vdc	Lower than 1280 RPM
Lower than 11.8 Vdc	Greater than 1280 RPM

Fault Code P0563

Battery voltage too high. It occurs when battery voltage is above 16 Vdc when engine is running.

FAULT CODE TABLE

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0106	Intake pressure sensor out of range.	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of housing or leaking inlet. Fault detected when the engine is running.	Check system circuits A-12, A-28 and A-40. Make sure that the sensor housing is correctly inserted into the manifold. Check sensor connector for: a) 5 volts on pin 1. b) 0 volt on pin 2. c) 0 volt on pin 3.	2 second beep every 15 minutes	On
P0107	Manifold atmospheric pressure shorted to ground.	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of housing or leaking inlet. Fault detected when the engine is running.	Make sure that the sensor housing is correctly inserted into the manifold. Check sensor connector for: a) 5 volts on pin 1. b) 0 volt on pin 2. c) 0 volt on pin 3.	2 second beep every 15 minutes	On
P0107	Manifold barometric pressure shorted to ground.	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of housing or leaking inlet. Fault detected when the engine is stopped.	Make sure that the sensor housing is correctly inserted into the manifold. Check sensor connector for: a) 5 volts on pin 1. b) 0 volt on pin 2. c) 0 volt on pin 3.	2 second beep every 15 minutes	On
P0108	Manifold atmospheric pressure open circuit or shorted to battery.	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of housing or leaking inlet. Fault detected when the engine is running.	Make sure that the sensor housing is correctly inserted into the manifold. Check sensor connector for: a) 5 volts on pin 1. b) 0 volt on pin 2. c) 0 volt on pin 3.	2 second beep every 15 minutes	On
P0108	Manifold barometric pressure open circuit or shorted to battery.	Sensing port dirty or blocked. Sensor failure or unexpected reading at idle. Sensor fallen out of housing or leaking inlet. Fault detected when the engine is running.	Make sure that the sensor housing is correctly inserted into the manifold. Check sensor connector for: a) 5 volts on pin 1. b) 0 volt on pin 2. c) 0 volt on pin 3.	2 second beep every 15 minutes	On
P0111	Intake manifold temperature sensor functional problem.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running.	Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-7 and A-21.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0112	Intake manifold temperature sensor shorted to ground.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running.	Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-7 and A-21.	2 second beep every 15 minutes	On
P0113	Intake manifold temperature sensor open circuit or shorted to battery.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running.	Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-7 and A-21.	2 second beep every 15 minutes	On
P0116	Engine temperature sensor functional problem.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running.	Check for debris or blockage in cooling system. Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-11 and A-27.	2 second beep every 15 minutes	On
P0117	Engine temperature sensor voltage too low.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running.	Check for debris or blockage in cooling system. Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-11 and A-27.	2 second beep every 15 minutes	On
P0118	Engine temperature sensor voltage too high.	Engine overheated or damaged sensor. Fault detected when the engine is running.	Check for debris or blockage in cooling system. Check the sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Check for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F) between ECM connector pins A-11 and A-27.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0122	Throttle position sensor out of range – voltage too low.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Damaged or out of alignment throttle bodies or sensor. Fault detected when the engine is running or stopped.	Check for 0 volt on sensor connector pin 1. Check for 5 volts on sensor connector pin 2. Check for 4.5 to 5 volts on sensor connector pin 3. With throttle closed, check ECM connector for: a) 1000 to 1100 ohms between pins A-24 and A-39. b) 2600 to 2700 ohms between pins A-24 and A-25 c) 1600 to 2400 ohms between pins A-25 and A-39.	2 second beep every 15 minutes	On
P0123	Throttle position sensor out of range – voltage too high.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Damaged or out of alignment throttle bodies or sensor. Fault detected when the engine is running.	Check for 5 volts on sensor connector pin 2. Check for 4.5 to 5 volts on sensor connector pin 3. With throttle closed, check ECM connector for: a) 1000 to 1100 ohms between pins A-24 and A-39. b) 2600 to 2700 ohms between pins A-24 and A-25 c) 1600 to 2400 ohms between pins A-25 and A-39.	2 second beep every 15 minutes	On
P0127	Intercooler system fault.	High air intake temperature detected. Fault detected when the engine is running and stopped. Blocked intercooler water circuit.	Clean intercooler water system.	2 second beep every minute	On
P0231	Fuel pump open circuit or shorted to ground.	Damaged pump, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Check for approximately 1 ohm between pins A and D of the fuel pump connector. Check fuse #6 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires. Check for damaged connector, damaged ECM output pins or ECM failure.	2 second beep every 15 minutes	On
P0232	Fuel pump shorted to battery.	Damaged pump, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for approximately 1 ohm between pins A and D of the fuel pump connector. Check fuse #6 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires. Check for damaged connector, damaged ECM output pins or ECM failure.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0261	Injector 1 open circuit or shorted to ground.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 1 and ECM connector pin A-15. Check for 12 volts on pin 2 of injector connector. Check fuse #7 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On
P0262	Injector 1 shorted to battery.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 1 and ECM connector pin A-15. Check for 12 volts on pin 2 of injector connector. Check fuse #7 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On
P0264	Injector 2 open circuit or shorted to ground.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 2 and ECM connector pin A-33. Check for 12 volts on pin 2 of injector connector. Check fuse #8 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On
P0265	Injector 2 shorted to battery.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 2 and ECM connector pin A-33. Check for 12 volts on pin 2 of injector connector. fuse #8 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On
P0267	Injector 3 open circuit or shorted to ground.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 3 and ECM connector pin A-14. Check for 12 volts on pin 2 of injector connector. Check fuse #9 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On
P0268	Injector 3 shorted to battery.	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 11.4 to 12.6 ohms between engine connector pin 3 and ECM connector pin A-14. Check for 12 volts on pin 2 of injector connector. Check fuse #9 (refer to *WIRING DIAGRAM*). Check for damaged circuit wires.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0326	Knock sensor out of range.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Bring engine to 5000 RPM. If fault code appears then check for approximately 5 Mohms between system circuits A-9 and A-23.	2 second beep every 15 minutes	On
P0336	Crank position sensor – Wrong engine RPM detected.	Damaged sensor, damaged circuit wires, damaged connector, damaged ECM pins or damaged tooth wheel.	For the CPS, check for 190 to 290 ohms between terminals A-5 and A-19 of ECM connector. For the CAPS, refer to camshaft position sensor. Check continuity for circuits A-20, A-34 and terminal 4 on engine connector.	None	On
P0337	No CPS signal but CAPS signal detected.	Damaged sensor, damaged circuit wires, damaged connector, damaged ECM pins or damaged tooth wheel.	Check for 190 to 290 ohms between terminals A-5 and A-19 of ECM connector. Check for 2 volts AC while cranking the engine.	2 second beep every 15 minutes	On
P0337	No CPS signal but CAPS signal detected.	Damaged sensor, damaged circuit wires, damaged connector, damaged ECM pins or damaged tooth wheel.	Check for 190 to 290 ohms between terminals A-5 and A-19 of ECM connector.	2 second beep every 15 minutes	On
P0339	Crank signal not possible with cam signal.	Damaged sensor, damaged circuit wires, damaged connector, damaged ECM pins or damaged tooth wheel.	For the CPS, check for 190 to 290 ohms between terminals A-5 and A-19 of ECM connector. For the CAPS, check for 12 volts on sensor connector pin 3. Check continuity for circuits A-20, A-34 and terminal 4 on engine connector. Check fuse #4 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0344	Cam phase sensor signal missing.	Damaged sensor, damaged circuit wires, damaged connector, damaged ECM pins or damaged tooth wheel. Fault detected when the engine is running.	For the CPS, check for 190 to 290 ohms between terminals A-5 and A-19 of ECM connector. For the CAPS, check for 12 volts on sensor connector pin 3. Check continuity for circuits A-20, A-34 and terminal 4 on engine connector. Check fuse #4 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0351	Ignition coil 1 open circuit or shorted to ground or to battery.	Damaged coil, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 0.85 to 1.15 ohms between engine connector pin 1 and ECM connector pin A-41. Check for 12 volts on pin 2 of coil connector. Check fuse #7 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0352	Ignition coil 2 open circuit or shorted to ground or to battery.	Damaged coil, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 0.85 to 1.15 ohms between engine connector pin 1 and ECM connector pin A-1. Check for 12 volts on pin 2 of coil connector. Check fuse #8 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0353	Ignition coil 3 open circuit or shorted to ground or to battery.	Damaged coil, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for 0.85 to 1.15 ohms between engine connector pin 3 and ECM connector pin A-29. Check for 12 volts on pin 2 of coil connector. Check fuse #9 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0461	Fuel level circuit out of range.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 2.6 (full tank) to 93.6 ohms (empty tank) between pin B and pin C at the fuel pump connector. Verify the 500 ohms resistor (refer to *WIRING DIAGRAM*). Check fuse #4 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0462	Fuel level circuit voltage low.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 2.6 (full tank) to 93.6 ohms (empty tank) between pin B and pin C at the fuel pump connector. Verify the 500 ohms resistor (refer to *WIRING DIAGRAM*). Check fuse #4 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	Off
P0463	Fuel level circuit voltage high.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 2.6 (full tank) to 93.6 ohms (empty tank) between pin B and pin C at the fuel pump connector. Verify the 500 ohms resistor (refer to *WIRING DIAGRAM*). Check fuse #4 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On
P0505	Idle bypass valve output stage cutoff memory difference.	Damaged actuator, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for approximately 50 ohms between pins A and D and also between pins B and C of the idle bypass valve. Check for damaged circuit wires. Check for approximately 50 ohms between pins A-36 and A-35 and also between pins A-37 and A-38. Check for damaged connector, damaged ECM output pins or ECM failure.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P505	Idle bypass valve output stage fault.	Damaged actuator, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Check for approximately 50 ohms between pins A and D and also between pins B and C of the idle bypass valve. Check for damaged circuit wires. Check for approximately 50 ohms between pins A-36 and A-35 and also between pins A-37 and A-38. Check for damaged connector, damaged ECM output pins or ECM failure.	2 second beep every 15 minutes	On
P0520	Oil pressure switch functional problem.	Engine leak, oil pump failure, damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins. Fault detected when the engine is running or stopped.	Check resistance at 0 RPM and above 3500 RPM. When blow-by pressure exceeds 40 kPa (6 PSI), the resistance is infinitely high.	2 second beep every 15 minutes	On
P0544	Exhaust gas temperature functional problem.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for approximately 2280 to 2736 ohms at temperature of 19 to 21°C (66 to 70°F) between system circuits A-10 and A-26.	2 second beep every 15 minutes	On
P0545	Exhaust gas temperature shorted to ground.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for approximately 2280 to 2736 ohms at temperature of 19 to 21°C (66 to 70°F) between system circuits A-10 and A-26.	2 second beep every 15 minutes	On
P0546	Exhaust gas temperature open circuit or shorted to battery.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Check for approximately 2280 to 2736 ohms at temperature of 19 to 21°C (66 to 70°F) between system circuits A-10 and A-26.	2 second beep every 15 minutes	On
P0562	Battery voltage too low.	Battery failure, rectifier failure, damaged circuit wires, battery terminal connection, damaged AC generator or damaged connectors. Fault detected when the engine is running.	Check fuses #15 (refer to *WIRING DIAGRAM*). Check ground continuity to the engine block.	2 second beep every 15 minutes	On
P0563	Battery voltage too high.	Battery failure, rectifier failure or battery terminal connection. Fault detected when the engine is running.	Check for regulator-rectifier failure.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0600	Communication problem detected by ECM.	Damaged circuit wires, damaged connector, damaged ECM output pins. Diagnostic connector cap not connected. Fault detected when the engine is stopped.	Connect diagnostic connector cap.	2 second beep every 15 minutes	On
P0600	Communication problem – ECM message missing.	Damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Check system circuits B-10 and B-11.	2 second beep every 15 minutes	On
P0601	TPS learns unlikely or checksum fault.	ECM not coded, damaged ECM or TPS not initialized.	Check cable adjustment. Check idle stop for wear. Check throttle angle at idle. Reset closed TPS.	2 second beep every 15 minutes	On
P0601	Module call monitoring.	Damaged ECM.	Key on and off. Reset closed TPS. Check battery voltage. Replace TPS.	2 second beep every 15 minutes	On
P0602	ECM not coded.	ECM not coded or damaged ECM.	No service action available for fault P0602, symptom 142.	2 second beep every 15 minutes	On
P0604	RAM fault.	Damaged ECM.	No service action available for fault P0604, symptom 136.	2 second beep every 15 minutes	On
P0605	EEPROM fault.	Damaged ECM.	No service action available for fault P0605, symptom 137.	2 second beep every 15 minutes	On
P0605	EEPROM checksum fault.	Damaged ECM.	No service action available for fault P0605, symptom 143.	2 second beep every 15 minutes	On
P0605	Coding ID checksum fault.	Damaged ECM.	No service action available for fault P0605, symptom 144.	2 second beep every 15 minutes	On
P0605	Coding checksum fault.	Damaged ECM.	No service action available for fault P0605, symptom 145.	2 second beep every 15 minutes	On
P0605	Programming checksum fault.	Damaged ECM.	No service action available for fault P0605, symptom 146.	2 second beep every 15 minutes	On
P0608	Sensor's power supply voltage too low.	Intake pressure sensor or TPS failure. Sensors power line shorted to ground. Fault detected when the engine is stopped.	Check for MAPS or TPS failure. Check for MAPS or TPS circuit failure.	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P0608	Sensor's power supply voltage too high.	Intake pressure sensor or TPS failure. Sensors power line shorted to battery. Fault detected when the engine is stopped.	Check for MAPS or TPS failure. Check for MAPS or TPS circuit failure.	2 second beep every 15 minutes	On
P0616	Starter relay open circuit or shorted to ground.	Damaged solenoid, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Verify fuse #12 (refer to *WIRING DIAGRAM*). Check for 12 volts on pin A of the starter relay connector.	2 second beep every 15 minutes	On
P0617	Starter relay shorted to battery.	Damaged solenoid, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is running.	Verify if system circuit B-31 is shorted to 12 V.	2 second beep every 15 minutes	On
P1102	Throttle position sensor adaptation failure.	No initialization after throttle body or ECM replacement or throttle idle stop drifted.	Check cable adjustment. Check idle stop for wear. Make sure that the throttle plate is against the throttle stop. Check throttle angle at idle. Reset closed TPS.	2 second beep every 15 minutes	On
P1104	Throttle position sensor adaptation cancelled.	No initialization after throttle body or ECM replacement or throttle idle stop drifted.	Check cable adjustment. Check idle stop for wear. Make sure that the throttle plate is against the throttle stop. Check throttle angle at idle. Reset closed TPS.	2 second beep every 15 minutes	On
P1116	High engine temperature.	Engine overheat or damaged sensor.	Check cooling system for blockage. Check sensor impedance (should be at 2280-2736 ohms @19-21°C (66-70°F) between circuits 4-9 and 4-11 of system.	Continuous	On
P1148	Fuel injector 1, 2 or 3 – safety fuel cut-off detected.	Idle bypass valve wrong reference, TPS adaptation failure, TPS failure or battery voltage out of range.	Key on and off. Reset closed TPS. Check battery voltage. Replace TPS. Replace idle bypass valve.	None	Off
P1502	T.O.P.S. functional problem.	Boat or sensor upside down, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Check fuse #10 (refer to *WIRING DIAGRAM*).	2 second beep every 15 minutes	On

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P1509	Lake water temperature sensor circuit out of range.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 6528.3 to 25403.3 ohms between system circuits B-8 and B-20.	2 second beep every 15 minutes	On
P1510	Lake water temperature sensor circuit voltage low.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for no continuity between system circuit and battery ground. Connect or disable lake water temperature sensor in setting page.	2 second beep every 15 minutes	Off
P1511	Lake water temperature sensor circuit voltage high.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 6528.3 to 25403.3 ohms between system circuits B-8 and B-20. Connect or disable lake water temperature sensor in setting page.	2 second beep every 15 minutes	Off
P1513	Wrong ECM.	ECM or Cluster is not compatible with the engine.	Use proper ECM or code the Instrument cluster.	2 second beep every 15 minutes	On
P1514	Exterior air temperature sensor circuit voltage high.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 200 to 24000 ohms between pins 1 and 9 of the instrument cluster harness connector. Connect or disable exterior air temperature sensor in setting page.	None	Off
P1517	Compass circuit out of range.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check compass connection. Connect or disable compass in setting page.	2 second beep every 15 minutes	On
P1520	Low oil pressure.	Low oil level, engine leak, oil pump fault.	Check oil level. Check impedance of sensor.	Continuous	On
P1544	High exhaust temperature.	Exhaust overheat, damaged sensor or damaged circuit wires.	Check cooling system for blockage. Check if the exhaust injection valve is properly calibrated.	Continuous	On
P1590	VTS position sensor circuit out of range.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 24 to 167.5 ohms between system circuits B-34 and B-35. Connect or disable VTS in setting page.	2 second beep every 15 minutes	Off
P1591	VTS position sensor circuit voltage low.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 24 to 167.5 ohms between system circuits 2-8 and 2-9. Connect or disable VTS in setting page.	2 second beep every 15 minutes	Off

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P1592	VTS position sensor circuit voltage high.	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 24 to 167.5 ohms between system circuits 2-8 and 2-9. Connect or disable VTS in setting page.	2 second beep every 15 minutes	Off
P1593	VTS malfunction.	Mechanical failure on VTS or VTS mechanically immobilized.	Check VTS rod.	2 second beep every 15 minutes	Off
P1607	ECM fault.	Damaged ECM.	No service action available for fault P1607.	2 second beep every 15 minutes	On
P1611	P+ test of ISC output signal failed.	Intake pressure sensor or TPS failure. Sensors power line shorted to ground or to battery. Damaged ECM. Fault detected when the engine is stopped.	Key on and off. Reset closed TPS. Check battery voltage. Replace TPS. Replace idle bypass valve.	None	Off
P1655	DESS line shorted to battery.	Damaged safety switch, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Remove DESS key and check for an open circuit on system circuit B-38.	None	On
P1656	DESS line shorted to ground.	Damaged safety switch, damaged circuit wires, damaged connector or damaged ECM output pins. Fault detected when the engine is stopped.	Remove DESS key and check for an open circuit on system circuit B-38.	None	On
P1660	Bilge pump open circuit or shorted to ground.	Damaged bilge pump, damaged circuit wires, damaged connector or damaged ECM output pins.	Check system circuits 2-20 and 2-3. Connect or disable bilge pump in setting page.	2 second beep every 15 minutes	On
P1661	Bilge pump shorted to battery.	Damaged bilge pump, damaged circuit wires, damaged connector or damaged ECM output pins.	Check system circuits 2-20 and 2-3.	2 second beep every 15 minutes	On
P1670	Buzzer shorted to battery.	Damaged connector or damaged ECM output pins.	Check system circuit 1-20.	None	Off
P1675	Depth sounder open circuit or shorted to ground.	Damaged component, damaged circuit wires, damaged connector or damaged ECM output pins.	Connect component or disable depth sounder in setting page.	None	Off

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P1676	Depth sounder shorted to battery.	Damaged component, damaged circuit wires, damaged connector or damaged ECM output pins.	Connect component or disable depth sounder in setting page.	None	Off
P1678	Spare output 2 open circuit or shorted to ground.	Damaged component, damaged circuit wires, damaged connector or damaged ECM output pins.	Connect component or disable spare output 2 in setting page.	None	Off
P1679	Spare output 2 shorted to battery.	Damaged component, damaged circuit wires, damaged connector or damaged ECM output pins.	Connect component or disable spare output 2 in setting page.	2 second beep every 15 minutes	On
P1680	Communication problem detected by ECM.	Damaged circuit wires, damaged connector, damaged ECM output pins. Diagnostic connector cap not connected.	Connect diagnostic connector cap.	None	Off
P1681	Communication problem – instrument cluster message missing.	Damaged circuit wires, damaged connector, damaged ECM output pins. Instrument cluster not connected.	Check system circuits 1-10 and 1-11. Check for 12 volts between pins 7 and 8 on the instrument cluster harness connector. Check 1A fuse. Connect instrument cluster.	None	Off
P1682	Communication problem – ECM message missing.	Damaged circuit wires, damaged connector, damaged ECM output pins. ECM not connected.	Check system circuits 2-10 and 2-11. Check for 12 volts between system circuit A-11 and ground. Check 5A fuses. Check connection.	2 second beep every 15 minutes	On
P1683	Communication RAM fault.	Damaged ECM.	No service action available for fault P1683, symptom 88.	None	Off
P1690	VTS control up circuit open circuit or shorted to ground.	Damaged VTS, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 12 volts between system circuits 2-7 and 2-1 when VTS UP is activated.	None	Off
P1691	VTS control up circuit shorted to battery.	Damaged VTS, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 12 volts between system circuits 2-7 and 2-1 when VTS UP is activated.	2 second beep every 15 minutes	Off

FAULT CODE	DESCRIPTION	POSSIBLE FAULT	ACTION	BEEPER PATTERN	CHECK ENGINE LIGHT
P1692	VTS control down circuit open circuit or shorted to ground.	Damaged VTS, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 12 volts between system circuits 2-6 and 2-1 when VTS DOWN is activated.	2 second beep every 15 minutes	Off
P1693	VTS control down circuit shorted to battery.	Damaged VTS, damaged circuit wires, damaged connector or damaged ECM output pins.	Check for 12 volts between system circuits 2-6 and 2-1 when VTS DOWN is activated.	2 second beep every 15 minutes	Off

ELECTRONIC FUEL INJECTION (EFI)

SERVICE TOOLS

Description	Part Number	Page
ECM	420 277 010	221, 230, 233–234, 238–239, 241, 244–249, 252
tachometer	529 014 500	228
Fluke 115 multimeter	529 035 868	225, 230, 233–234, 243
crimper die	529 035 906	223
crimping tool	529 035 909	223
fuel hose disconnect tool	529 036 037	235

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Fluke rigid back probe	TP88	243
Snap-on terminal remover tool	TT600-1	222

SERVICE PRODUCTS

Description	Part Number	Page
Deoxit	293 550 034	221
XP-S Lube	293 600 016	236
Loctite 243	293 800 060	241

GENERAL

SYSTEM DESCRIPTION

The ECM (Engine Control Module) is the central point of the engine management system. It reads the signals from different sensors which indicate engine operating conditions at micro-second intervals.

EFI Sensors

The ECM reads the inputs from the sensors, makes computations, uses pre-determined parameters and activates the outputs (injectors, ignition coils etc.).

Signals from sensors are used by the ECM to determine the injection and ignition parameters (such as fuel maps required for optimum air-fuel ratio).

Air Induction

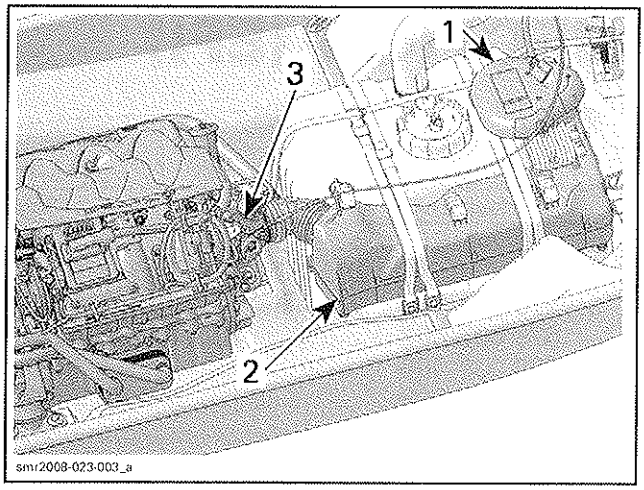
Air Intake Silencer

Air is drawn through the air intake silencer located at front of vehicle.

The air entry is raised above the air intake silencer to prevent the ingestion of water. If water was drawn, baffles inside the air intake silencer would separate the water from the air. Water would then flow out through drain valves at bottom of the air intake silencer.

130/155 Naturally Aspirated Engine

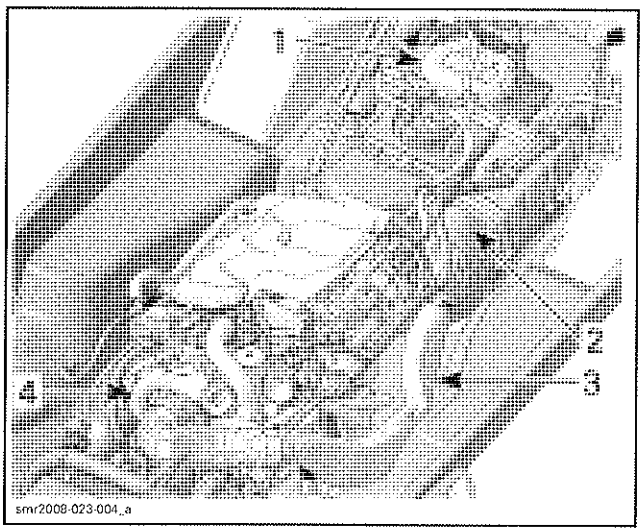
The air is then brought to the throttle body.



1. *Air entry*
2. *Air intake silencer*
3. *Throttle body*

215/255 Supercharged Intercooled Engine

An air duct is used to bring the air to the supercharger.



TYPICAL
1. *Air entry*
2. *Air intake silencer*
3. *Air duct*
4. *Supercharger*

An intercooler cools down the air from the supercharger.

Intercooler

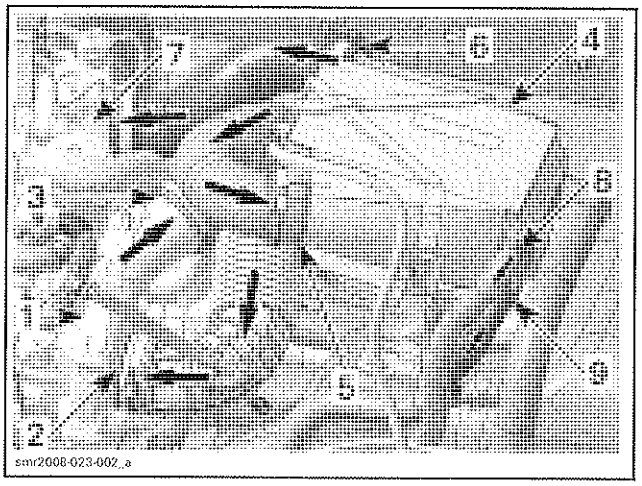
215 Supercharged Intercooled Engine

The intercooler is located inside the intake manifold. The intercooler is a cylindrical tuibe that comprises smaller tubes. Water taken from the outside of the watercraft is pumped through the small tubes and cools down the intake air flowing inside the intercooler. This increases the air density and you get more air into the engine.

255 Supercharged Intercooled Engine

The intercooler is mounted externally of intake manifold and is located above drive shaft.

Air that exits the supercharger has been warmed up by the air compression. The air that enters the intercooler is cooled down by circulating across small tubes in which cooling water flows. The cooling water is supplied by the jet pump. The end result is that the air density is higher and you get more air into the engine.



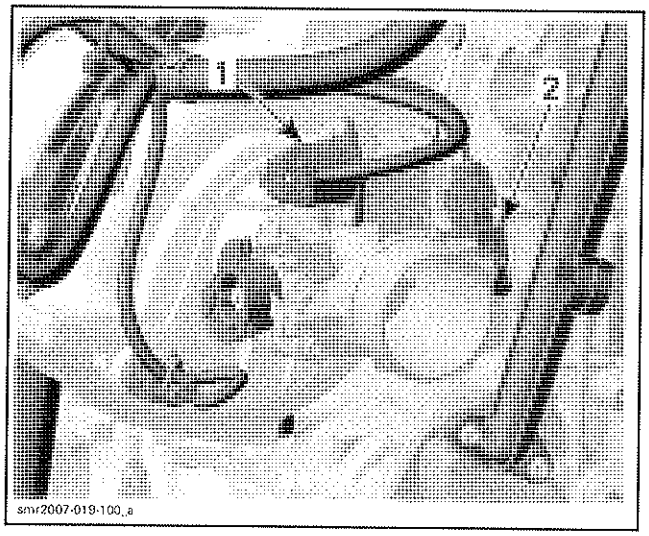
1. *Supercharger*
2. *Supercharger inlet*
3. *Supercharger outlet*
4. *Intercooler*
5. *Intercooler air inlet — warm air from supercharger*
6. *Intercooler air outlet — cooled air*
7. *Throttle body*
8. *Cooling water outlet — warmed water*
9. *Intercooler cooling water inlet — cold water*

Throttle Body

A 52 mm throttle body is mounted on the intake manifold. Fitted on the throttle body, the TPS and the idle air control valve allow the ECM to control the RPM while the throttle plate is closed.

130/155 Naturally-Aspirated Engine

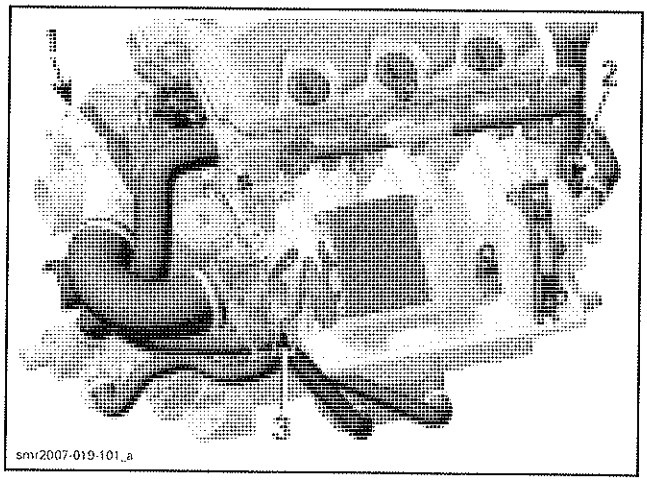
Air for combustion is drawn directly at the front of the engine through the throttle body. The air flow is controlled by a throttle plate. The air continues through the intake manifold, which contains the flame arrester and goes into the cylinder head.



THROTTLE BODY (52 MM)
1. *Idle air control valve*
2. *Throttle position sensor (TPS)*

215 Supercharged Intercooled Engine

Air for combustion is drawn at the back of the engine by a mechanically-driven supercharger. The compressed air flows through the throttle body and is controlled by a throttle plate. The air continues through the intake manifold, which contains the water/air intercooler and goes into the cylinder head.



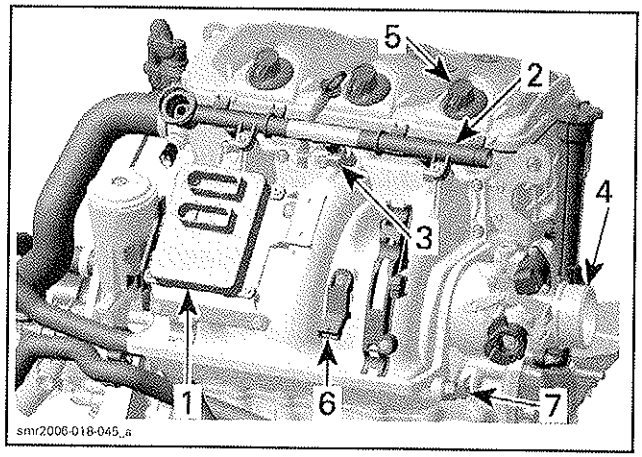
1. *Supercharger*
2. *Intercooler*
3. *Throttle body*

255 Supercharged Intercooled Engine

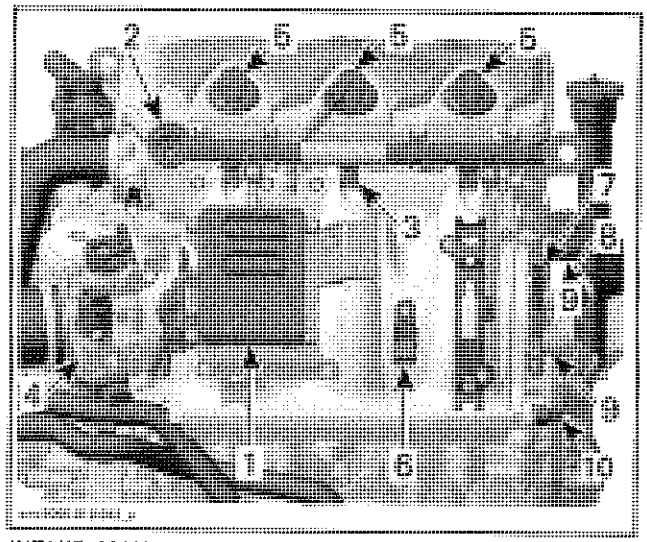
Air for combustion is drawn at the back of the engine by a mechanically-driven supercharger. The compressed air flows through the throttle body and is controlled by a throttle plate. The air continues through the intake manifold and goes into the cylinder head.

Intake Manifold

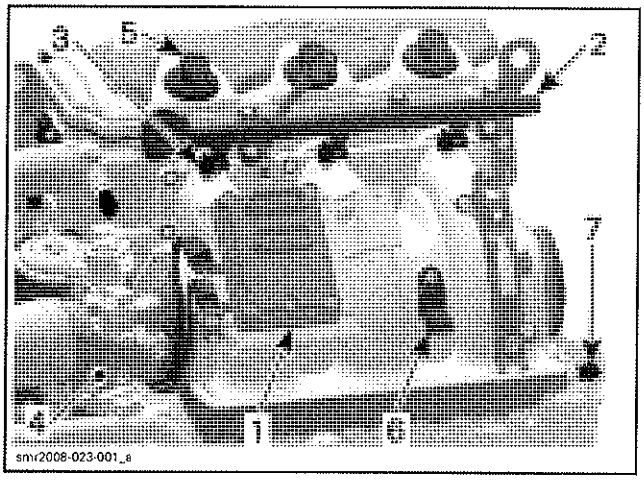
The intake manifold is mounted on the side of the cylinder block. It provides support for the fuel injectors, the fuel rail, the ECM, the flame arrester and the throttle body. The intake manifold is a resonator between the throttle body and the cylinder head.



INTAKE MANIFOLD
(130/155 NATURALLY ASPIRATED ENGINES)
1. *Engine Control Module (ECM)*
2. *Fuel rail*
3. *Injector*
4. *Throttle body*
5. *Ignition coil*
6. *Manifold air pressure sensor (MAPS)*
7. *Manifold air temperature sensor (MATS)*



INTAKE MANIFOLD
(215 SUPERCHARGED INTERCOOLED ENGINE)
1. *Engine Control Module (ECM)*
2. *Fuel rail*
3. *Injector*
4. *Throttle body*
5. *Ignition coil*
6. *Manifold air pressure sensor (MAPS)*
7. *Intercooler*
8. *Intercooler outlet*
9. *Intercooler inlet*
10. *Manifold air temperature sensor (MATS)*



INTAKE MANIFOLD
(255 SUPERCHARGED INTERCOOLED ENGINE)
1. *Engine Control Module (ECM)*
2. *Fuel rail*
3. *Injector*
4. *Throttle body*
5. *Ignition coil*
6. *Manifold air pressure sensor (MAPS)*
7. *Manifold air temperature sensor (MATS)*

Flame Arrester

The flame arrester is a tube inside the intake manifold. It prevents flames leaving through the intake system if the engine backfires.

Fuel Rail

One fuel rail is mounted on the intake manifold. The fuel rail ensures all the time, that enough fuel can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump with the properly regulated fuel pressure.

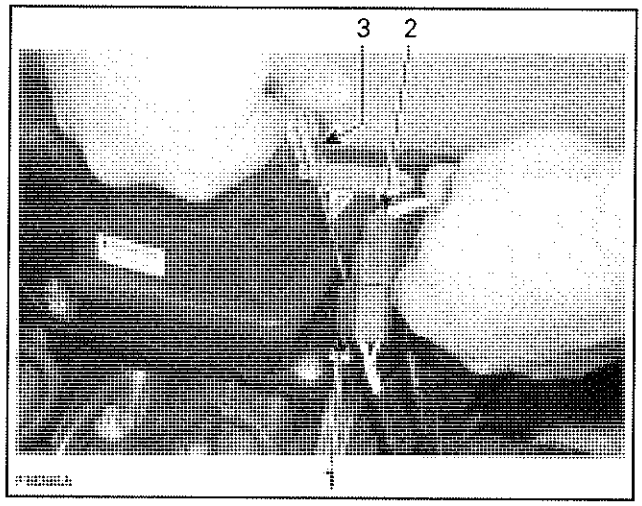
Fuel Injectors

Three fuel injectors are used to inject fuel into the intake ports of the cylinder head. One injector is used per cylinder.

DEUTSCH CONNECTOR INFORMATION

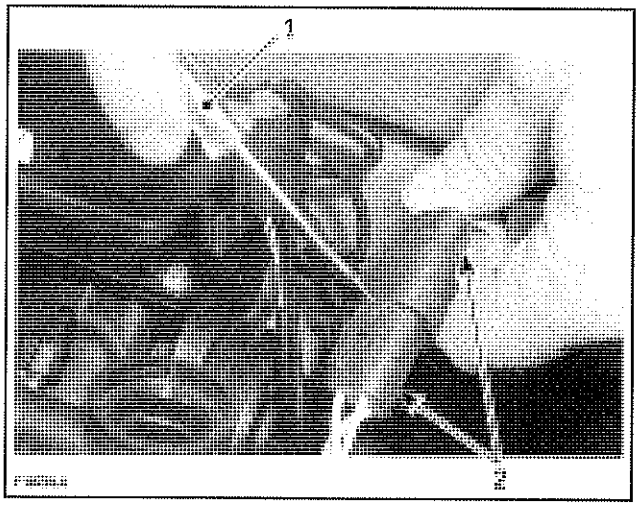
Connector Removal from its Support

Slide a flat screwdriver between the support and the Deutsch connectors and remove connectors.

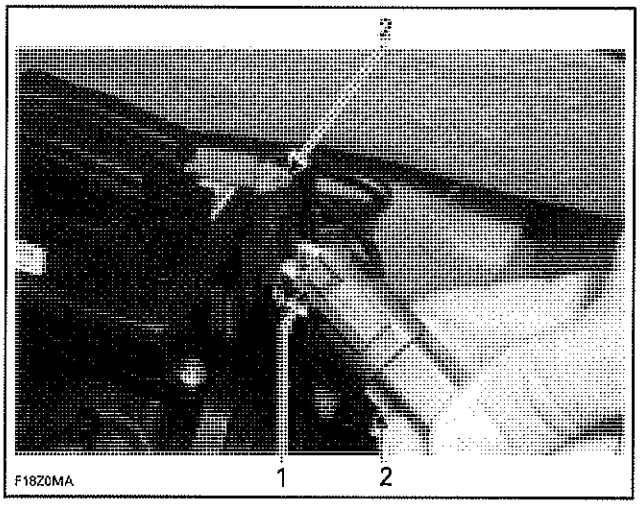


1. *Support*
2. *Deutsch connectors*
3. *Flat screwdriver*

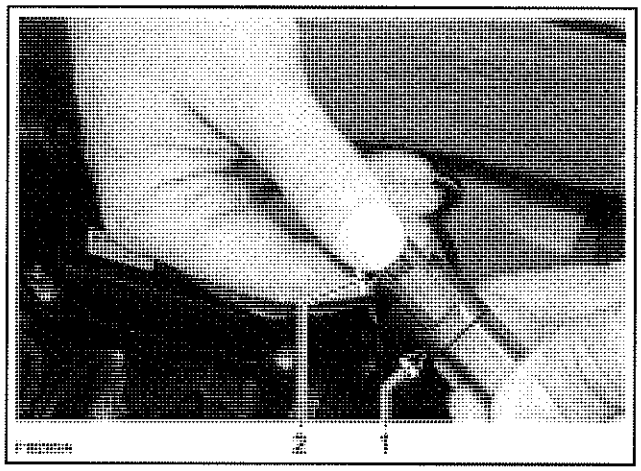
To disconnect the Deutsch connectors, slide a flat screwdriver between each housing to disengage, press the release button and disconnect them.



1. *Flat screwdriver*
2. *Deutsch connectors*

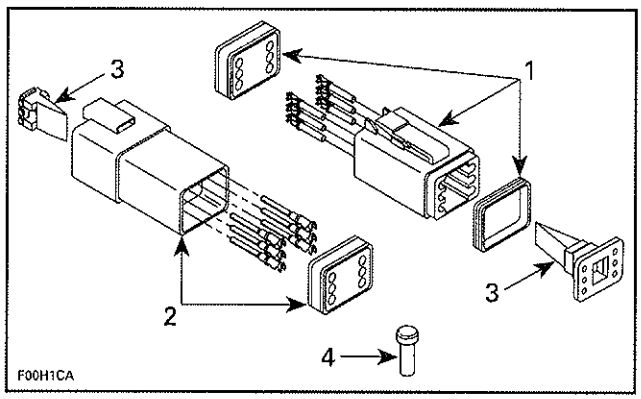


1. Release button
2. Deutsch connectors



1. Deutsch connectors
2. Press release button

Connector Disassembly

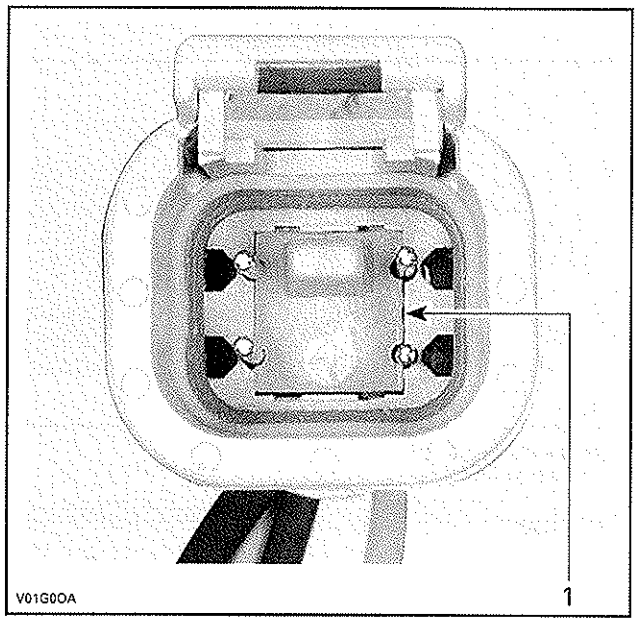


1. Male connector
2. Female connector
3. Secondary lock
4. Sealing cap

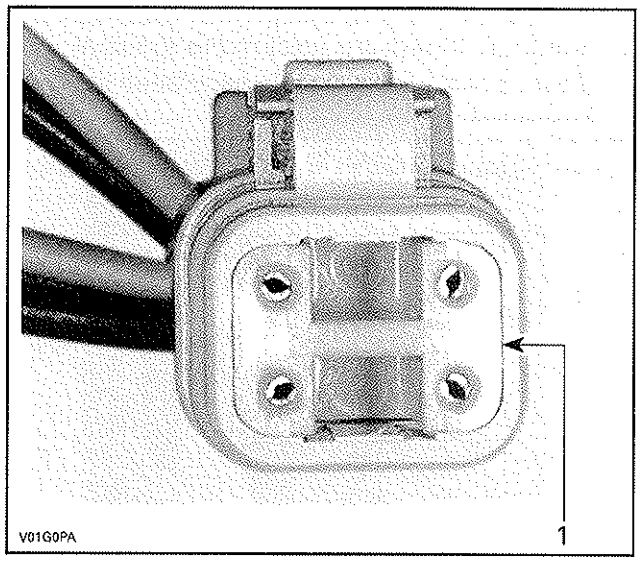
CAUTION: Do not apply dielectric grease on terminal inside connector.

To remove terminals from connector, proceed as follows:

– Using a long nose pliers, pull out the lock.



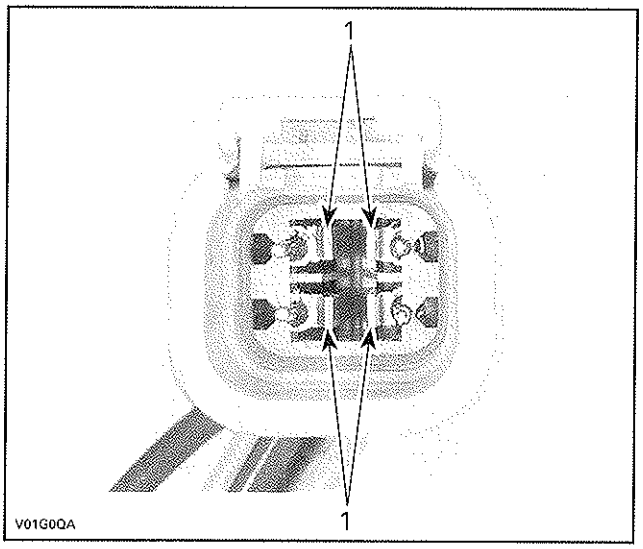
FEMALE CONNECTOR
1. Female lock



MALE CONNECTOR
1. Male lock

NOTE: Before extraction, push wire forward to relieve pressure on retaining tab.

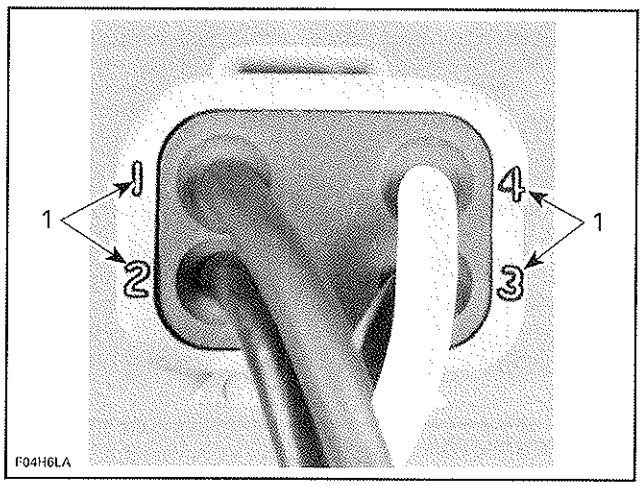
– Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
– Pry back the retaining tab while gently pulling wire back until terminal is removed.



FEMALE CONNECTOR
1. Retaining tabs

To install:

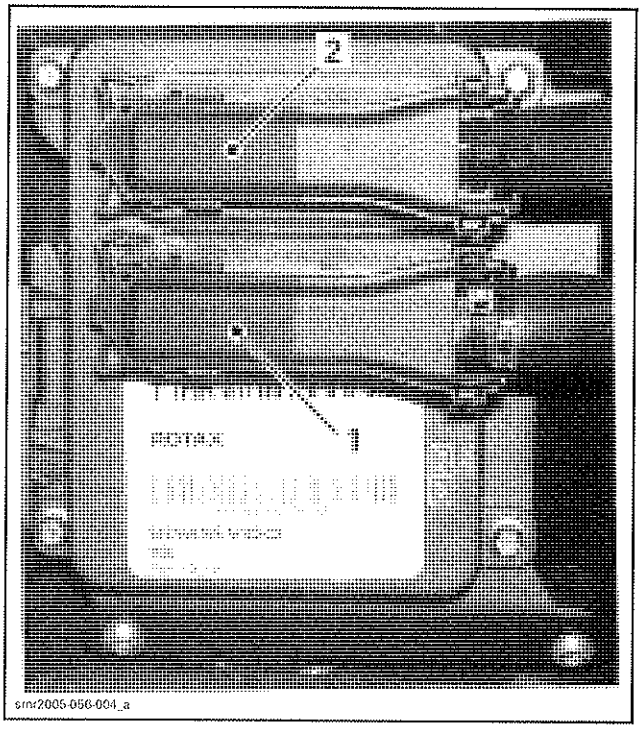
- For insertion of a terminal, make sure the lock is removed.
- Insert terminal into appropriate cavity and push as far as it will go.
- Pull back on the terminal wire to be sure the retention fingers are holding the terminal.
- After all required terminals have been inserted, the lock must be installed.



1. Wire identification numbers

KOSTAL CONNECTOR (ECM) INFORMATION

There are two Kostal connectors used on the 4-TEC models and they are connected on the ECM. The engine harness female connector is connected on the module male connector A and the watercraft system control harness female connector is connected to the module male connector B. The ECM connectors have 41 pins.



ECM
1. Connector A (engine harness)
2. Connector B (watercraft harness)

CAUTION: Do not disconnect the ECM connectors needlessly. They are not designed to be disconnected/reconnected frequently.

Connector Inspection and Testing

Connector Inspection

Before replacing a ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and re-plugging the ECM. Or if a newly replaced ECM is working, try the old one and recheck if it works. The voltage and current might be too weak to go through dirty wire terminals. Check carefully if terminals show signs of moisture, corrosion or if they look dull.

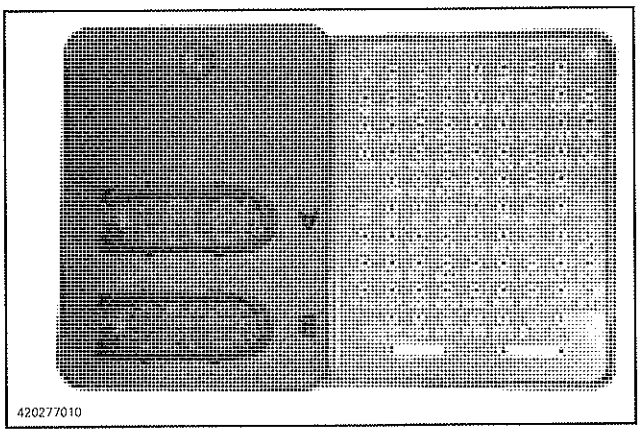
To clean oxidized ECM terminals, use a contact cleaner such as Deoxit (P/N 293 550 034).

CAUTION: Remove connector seal prior to applying the product. Otherwise, the seal will swell and will let water enter inside connector. Dry out connector with compressed air prior to reinstalling the seal.

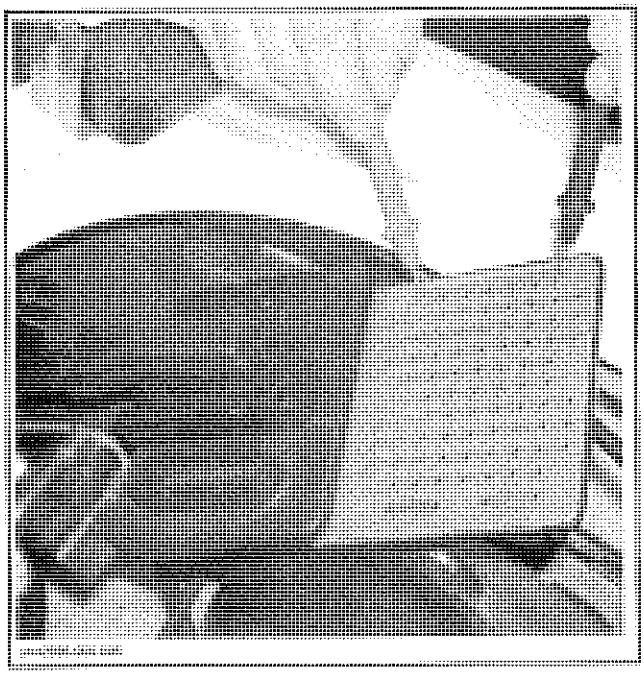
Do not apply any lubricant product to the pins of the connector on the ECM.

Testing Method

The most recommended and safest method to probe ECM connector terminals is to use the ECM (P/N 420 277 010). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.

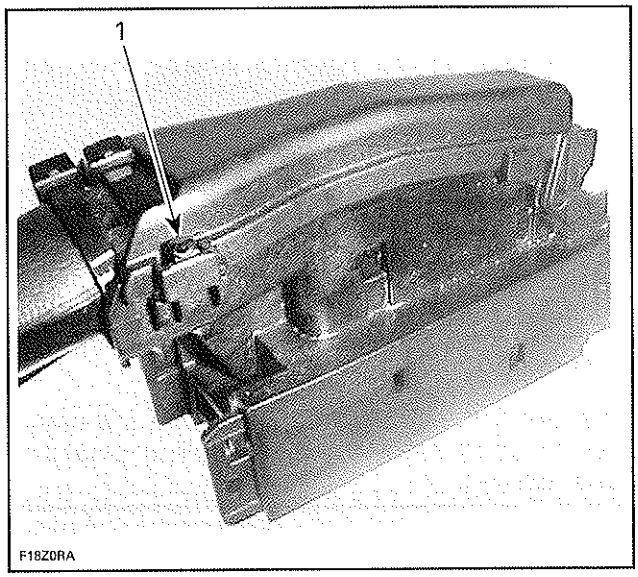


Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool pins.



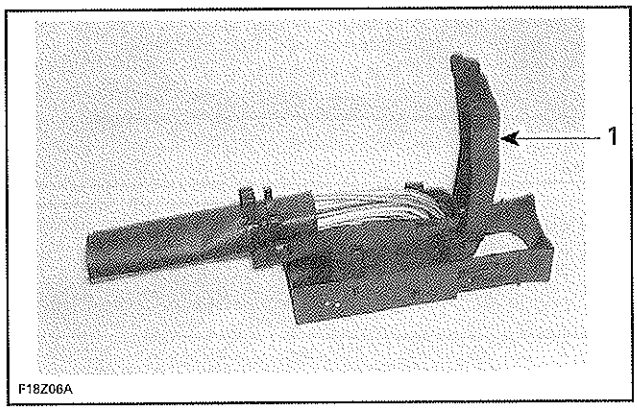
Terminal Removal

Unlock the connector cover by pushing in the tabs on top of the connector with a flat screwdriver to be able to flip the top cover up.



1. Push in tab

Lift the cover by pushing it forward.

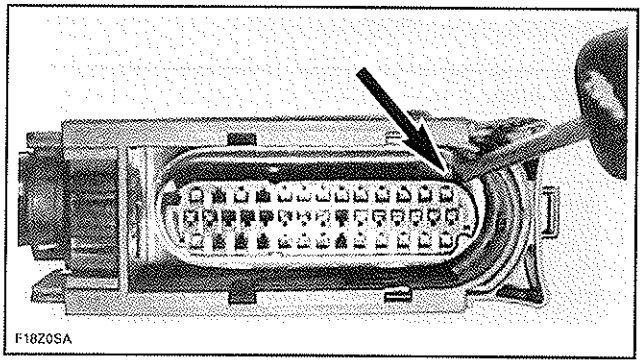


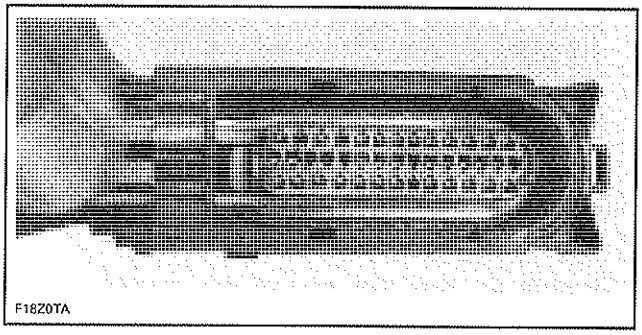
1. Cover

Cut both tie raps that secure the harness to the connector.

1. Tie raps

Turn the connector over and remove the orange locking tab by pushing and then pulling toward the wire harness.

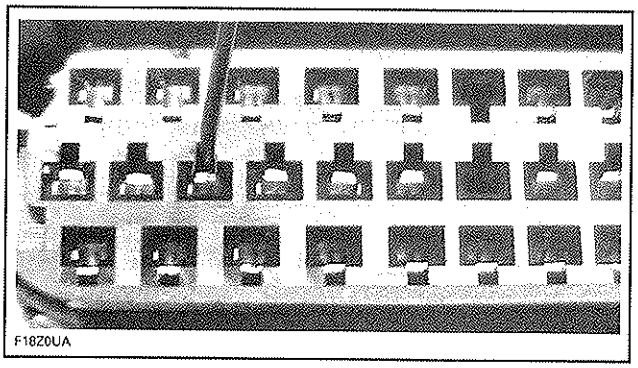


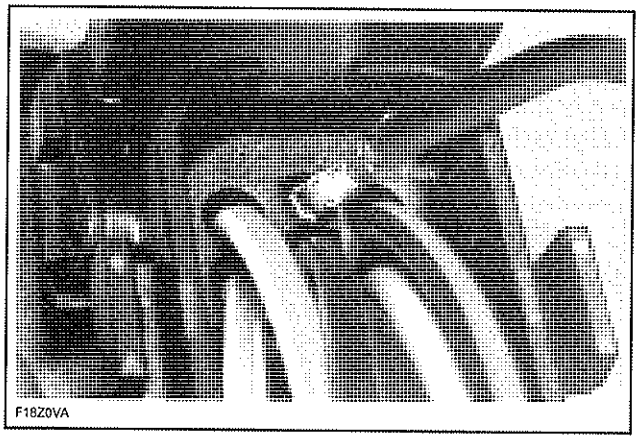


Use Snap-on terminal remover tool (P/N TT600-1) or equivalent (or a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit) must be inserted into the terminal cavity to release the locking tab from the connector.

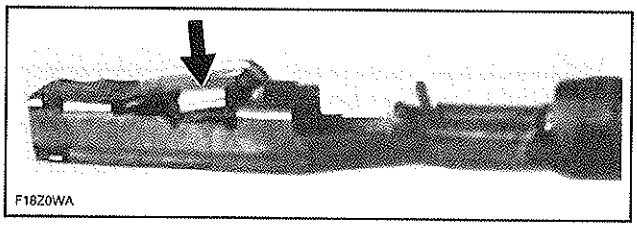
CAUTION: Using a tool tip larger than 0.76 mm (.030 in) may damage the terminal.

Insert the tool tip into the terminal cavity as shown, and locate its wire in the back of the connector. You may have to pry the tool tip against the locking tab to release it, then remove the terminal from the connector.





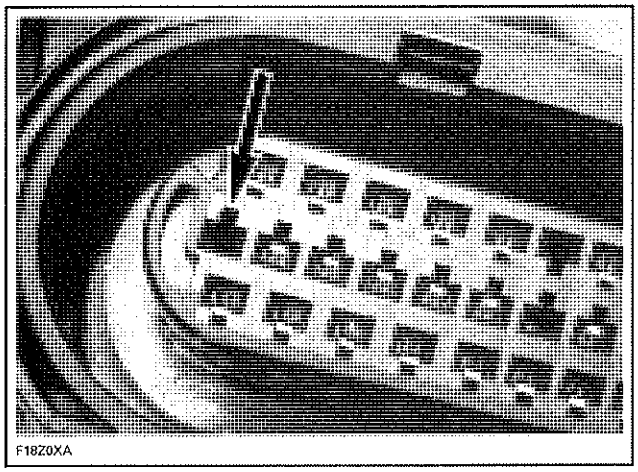
Check the locking tab on the terminal, it may have to be bent out a little so it will lock in its cavity when it is re-inserted.



If the wire is in good condition but the terminal is rusted or corroded, remove defective terminal and crimp a new one. If wire and terminal are defective, replace with a new genuine wire and new terminal and crimp them together as explained below.

IMPORTANT: Use genuine wires only. Otherwise wires will not fit properly.

When re-inserting the terminal, the locking tab must be installed facing the smaller cutout of the terminal cavity.

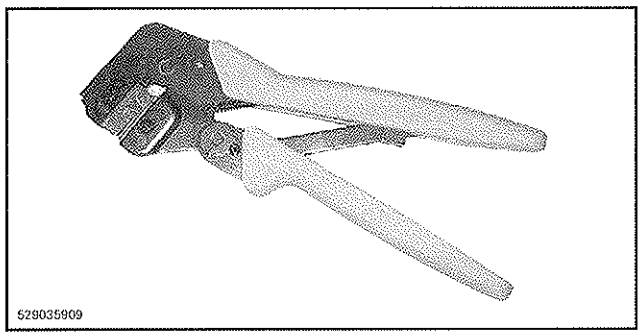

F18Z0XA

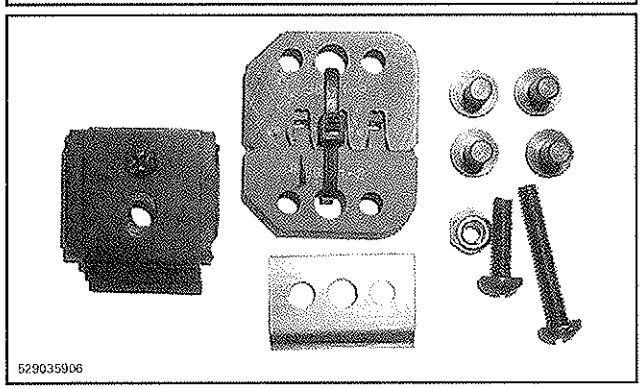
Insert the terminal, ensuring the locking tab snaps into its cavity.

Re-install the orange locking tab, attach the 2 tie raps, and close the connector cover.

Terminal Crimping

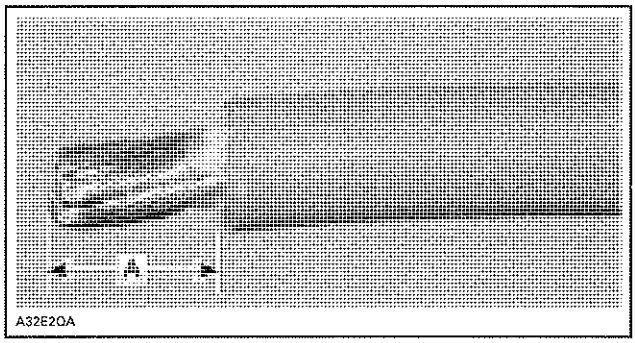
To crimp a new connector terminal, use the crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).


529035909


529035906

To properly crimp the wires, strictly follow this procedure.

Strip the wire to a maximum of 3 mm (1/8 in).

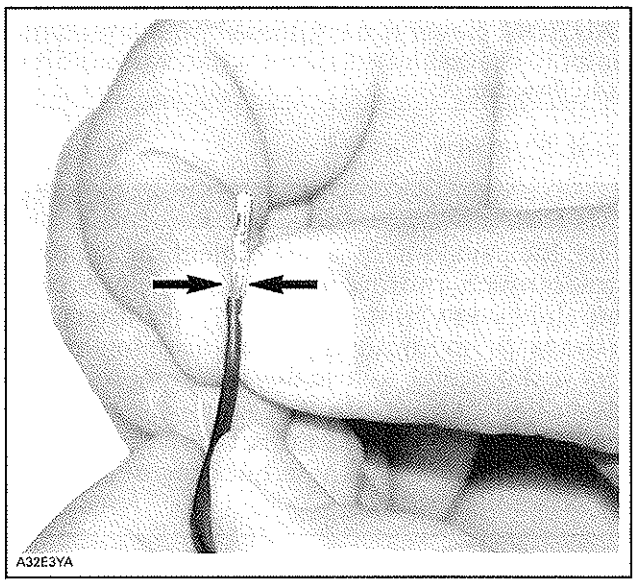


A32E2OA

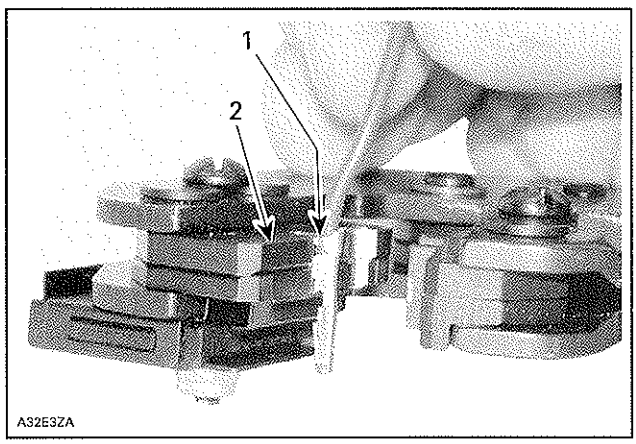
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.


A32E3YA

Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



A32E3ZA

1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

GENERAL RECOMMENDATIONS

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

When replacing a component, always check its operation after installation.

Whenever watercraft is out of water and engine is running, ensure to supply water through the connector on jet pump support to cool down exhaust system.

CAUTION: Never run engine without supplying water to the exhaust system when watercraft is out of water.

Fuel System

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than on a carbureted watercraft. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Note that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

Use the B.U.D.S. software to release the fuel pressure in the system. Refer to *FUEL SYSTEM.*

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the B.U.D.S. software to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always disconnect battery prior to working on the fuel system. After performing a pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

Always disconnect battery properly prior to working on the fuel system. Refer to *CHARGING SYSTEM* section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Refer to *FUEL SYSTEM* section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the key on the DESS post. Always perform the high pressure test if any component has been removed. A pressure test must be done before connecting the DESS key. The fuel pump is started each time the DESS key is installed and it builds pressure very quickly.

To check fuel rail for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

Thoroughly rinse an dry fuel hoses from the soapy solution after the leak test. The soap might deteriorate fuel lines.

⚠ WARNING

If any gasoline leak and/or odor are present, do not start the engine. Repair the leak.

⚠ WARNING

Never use a hose pincher on high pressure hoses.

When finished, wipe out soap and thoroughly rinse with fresh water.

⚠ WARNING

Failure to clean fuel lines from soap might lead to fuel line deterioration over time.

Electrical System

It is important to check that the following electrical system components are functioning properly:

- Battery
- Fuses
- Ground connections
- Wiring connectors.

Pay particular attention to ensure that terminals are not out of their connectors or out of shape.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

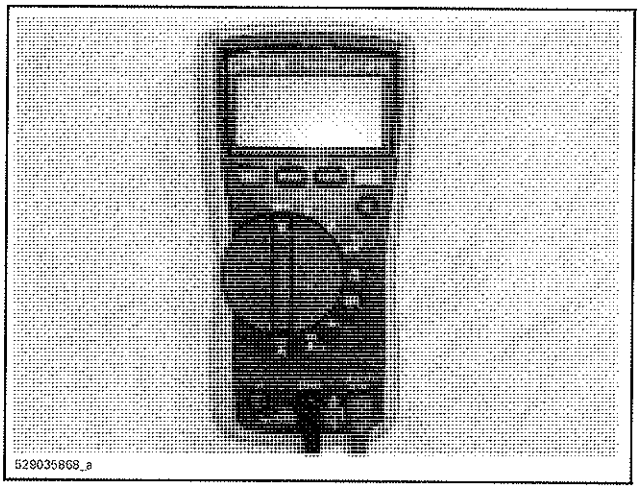
Ensure that all electronic components are genuine. Any modification on the wiring harness may lead to generate fault codes or bad operation.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (idle air control valve, injectors, fuel pump, ignition coils and starter solenoid) are permanently supplied by the battery when the DESS key is installed. Always disconnect the battery prior to disconnecting any electrical or electronic parts.

To perform the electrical tests, the Fluke 115 multimeter (P/N 529 035 868) should be used.



Pay particular attention to ensure that pins are not out of their connectors or out of shape.

When probing terminals, pay attention not to bend the terminal as this could bring a loose connection that would be difficult to troubleshoot.

For diagnostics purposes, use B.U.D.S. software. See *EMS DIAGNOSTIC* subsection.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the B.U.D.S. software.

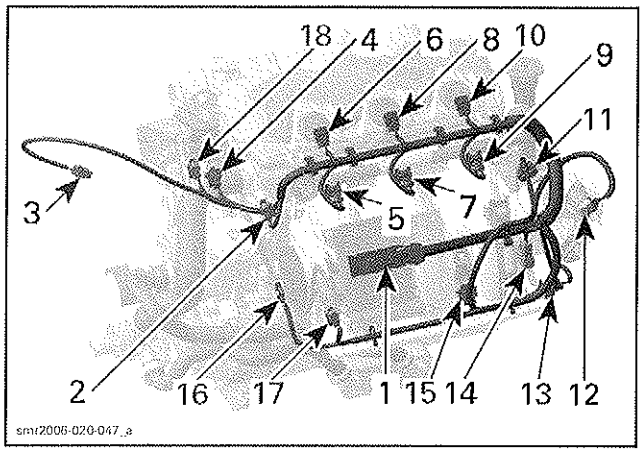
Sensor Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (69°F). The value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) increases as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value decreases as the temperature increases. Take it into account when measuring at temperatures different from 20°C (69°F). Use this table for resistance variation relative to temperature for temperature sensors.

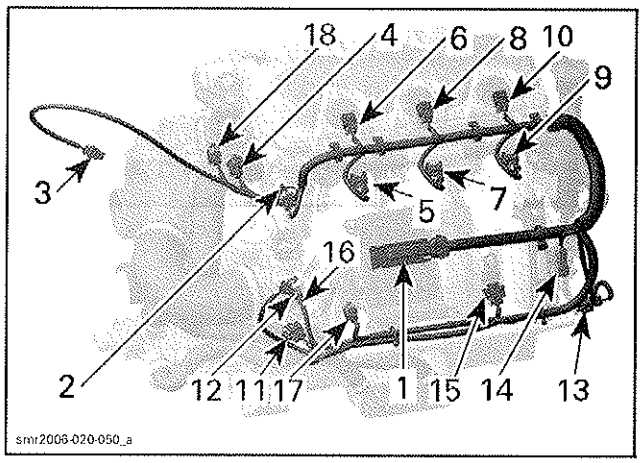
The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at ambient temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/muffler and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

Engine Wiring Harness



1503 ENGINE
1. *ECM connector*
2. *CTS connector*
3. *EGTS connector*
4. *CAPS connector*
5. *Fuel injector connector (cylinder 1)*
6. *Ignition coil connector (cylinder 1)*
7. *Fuel injector connector (cylinder 2)*
8. *Ignition coil connector (cylinder 2)*
9. *Fuel injector connector (cylinder 3)*
10. *Ignition coil connector (cylinder 3)*
11. *TPS connector*
12. *Idle air control valve connector*
13. *MATS connector*
14. *Engine connector*
15. *MAPS connector*
16. *OPS connector*
17. *KS connector*
18. *CPS connector*



1503 SUPERCHARGED INTERCOOLED ENGINE
1. *ECM connector*
2. *CTS connector*
3. *EGTS connector*
4. *CAPS connector*
5. *Fuel injector connector (cylinder 1)*
6. *Ignition coil connector (cylinder 1)*
7. *Fuel injector connector (cylinder 2)*
8. *Ignition coil connector (cylinder 2)*
9. *Fuel injector connector (cylinder 3)*
10. *Ignition coil connector (cylinder 3)*
11. *TPS connector*
12. *Idle air control valve connector*
13. *MATS connector*
14. *Engine connector*
15. *MAPS connector*
16. *OPS connector*
17. *KS connector*
18. *CPS connector*

Resistance Test

Check continuity of the circuits according to the wiring diagram in the *ELECTRICAL CONNECTORS AND WIRING DIAGRAM* section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

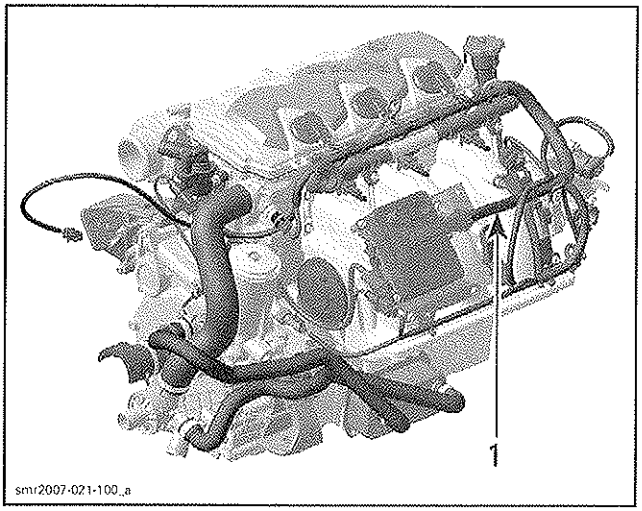
Harness Removal

Remove fuel rail cover.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the ECM connector from the ECM.

Cut all tie raps which are holding the wiring harness in position.

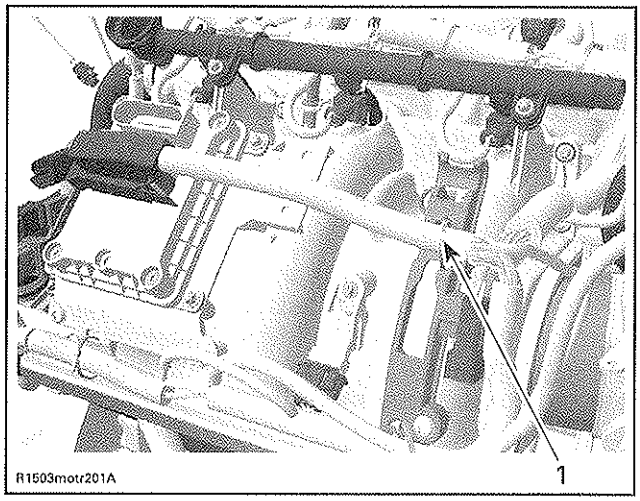


TYPICAL
1. Wiring harness

Remove complete wiring harness.

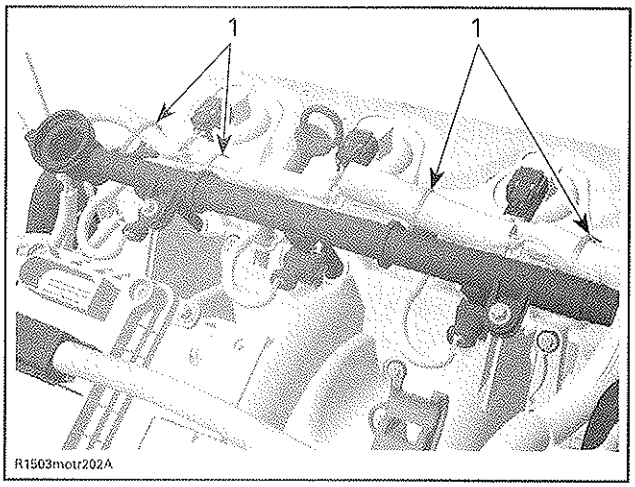
Harness Installation

First connect the ECM connector A and fix the harness on the wiring support with a locking tie.



1. Locking tie

Lead the cable bundle with the injector and ignition coil connectors to the fuel rail and fix it also by using 4 locking ties.



1. Locking ties

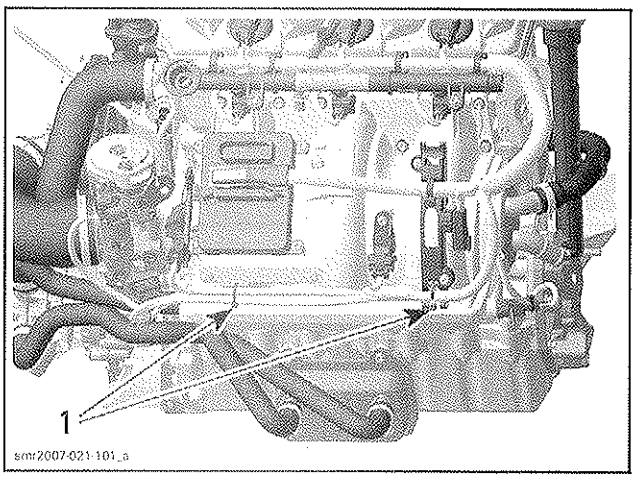
Connect the fuel injectors, ignition coils, CAPS, CTS and EGTS to the wiring harness.

⚠ WARNING

Pay attention not to mix injectors or ignition coils wires between cylinders. The location of the splice connectors indicate which cylinder wires belong to.

Install the engine connector on the appropriate bracket on the wiring support.

Then fix the other bundle on the appropriate supports on the wiring support and the ECM bracket with locking ties.

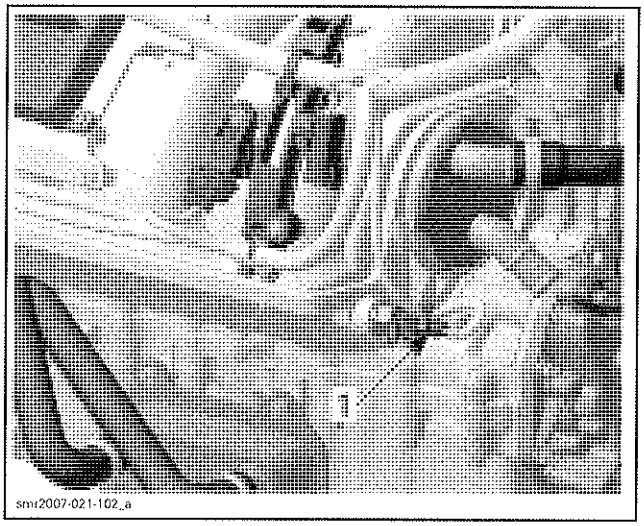


1. Locking ties

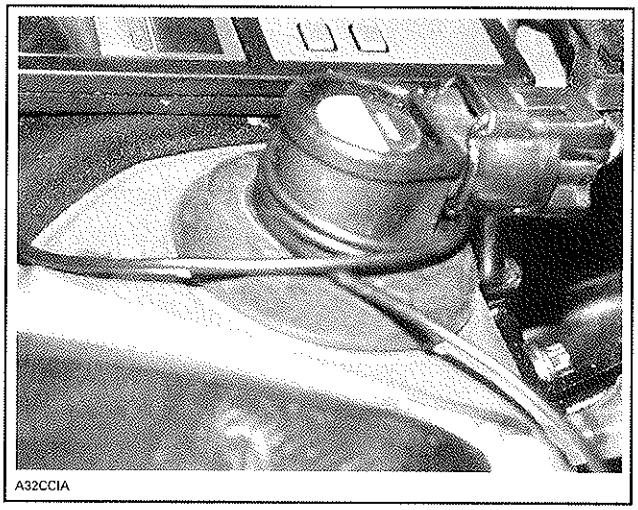
Connect the CPS, KS, OPS, and the MAPS to the wiring harness.

Also connect now the MATS, TPS, and idle air control valve to the wiring harness.

Fix the wiring for the MATS with a locking tie to support the cables.



1. Locking tie



TYPICAL

Install all remaining parts, which has been removed.

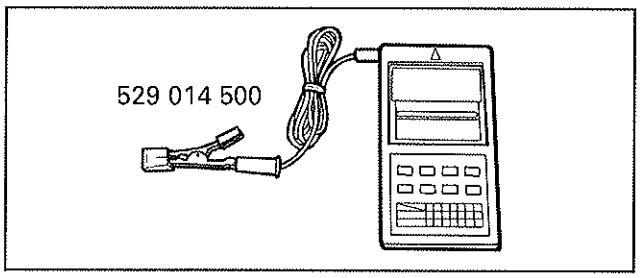
BASIC ADJUSTMENTS

IDLE SPEED

The idle speed is not adjustable. The ECM controls the idle speed of the engine.

If desired, the engine RPM can be measured following this procedure:

Use a tachometer (P/N 529 014 500).



Wrap the tachometer's wire a few times around the protruding part of ignition coil.

Start engine to verify engine RPM.

NOTE: If idle speed is not within specifications, check if there is any occurred or active fault code(s). If not, check throttle cable adjustment and proceed with the Closed Throttle and Idle Actuator reset. If idle speed is still not adequate, there is probably a mechanical problem.

CLOSED THROTTLE AND IDLE ACTUATOR RESET

NOTE: This operation performs a reset of the values in the ECM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations and the setting of the idle air control valve will determine the basic parameters for the idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) or the idle air control valve is loosened or removed or throttle body is replaced or ECM is replaced.

CAUTION: An improperly set TPS or idle air control valve may lead to poor engine performance and emission compliance could possibly be affected. In addition, improper idle air control valve reset may lead to poor engine starting, improper idle (too low or too high) and engine stop on deceleration.

Use the B.U.D.S. software to perform this adjustment.

Ensure the throttle body plate stop lever rest against its stopper. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. If stopper does not rest against its stop lever, perform throttle cable adjustment.

To properly reset idle air control valve, first install DESS key then remove it and then wait 5 seconds. Repeat this cycle 2 - 3 times.

Push the **Reset** button in the **Setting** tab of B.U.D.S.

NOTE: If TPS is not within the allowed range while resetting the **Closed Throttle and Idle Actuator**, the ECM will generate a fault code and will not accept the setting. In this case, the fault must be cleared to allow the reset operation.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to *MONITORING SYSTEM AND FAULT CODES* section for more information.

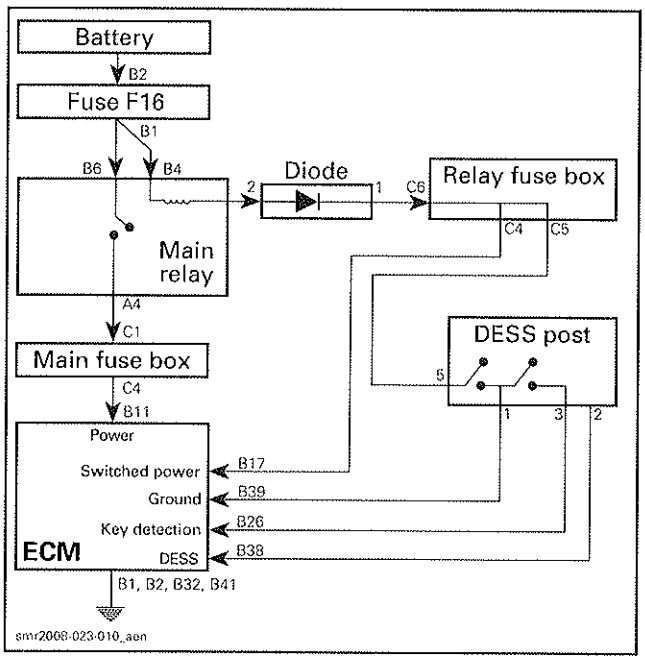
IGNITION TIMING

The ECM is able to determine the exact position of camshaft and crankshaft. That means that no ignition timing setting has to be performed.

REPAIR PROCEDURES

ENGINE CONTROL MODULE (ECM)

Power Supply to ECM



NOTES
When DESS key has been removed for a while, no power goes to the ECM.
When DESS key is installed on its post: – The magnet in the DESS key closes the reed switches in the DESS post. – ECM pin B39 provides a ground through the reed switch. This closes the main relay contacts. – ECM pin B11 receives its main power from battery. ECM operation is started. – ECM pin B17 receives power from battery. – ECM pin B26 monitors if a key is present. – ECM pin B38 reads the DESS key and determines if it is valid.
When DESS key is just removed from its post: – ECM pin B26 senses the key has been removed. – Reed switches open but ECM pin B17 keeps main relay contacts temporarily closed. – ECM stops the engine. – ECM completes its tasks. – ECM pin B17 releases the main relay contacts. – Main relay contacts open and power to the ECM is cut.

Troubleshooting ECM

Install key on DESS post.

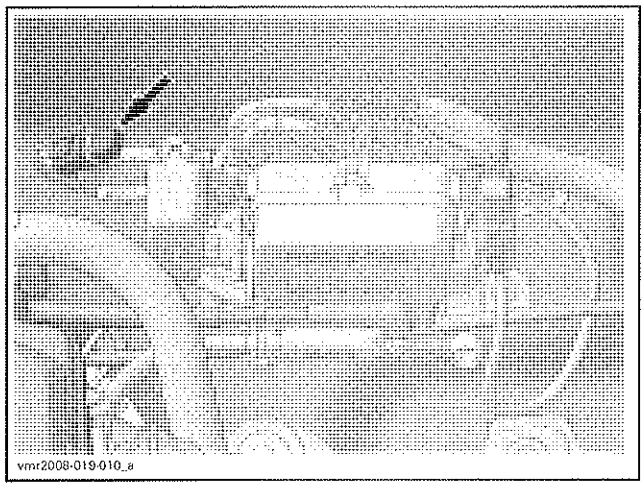
This should wake up the ECM and continuously activate the main relay.

QUICK INDICATION THAT ECM IS NOT POWERED (assuming the observed component is working)
Beeper does not sound.
Information center does not turn on.
Fuel pump does not turn on for approx. 5 seconds.
Engine cranking does not occur when pressing START button.

If ECM does not turn on, check the following:
- Fuse F16
- Battery voltage, refer to *CHARGING SYSTEM*
- Diode 1
- DESS key and post, refer to *DESS SYSTEM*
- Main relay, refer to *GAUGE AND FUSES*

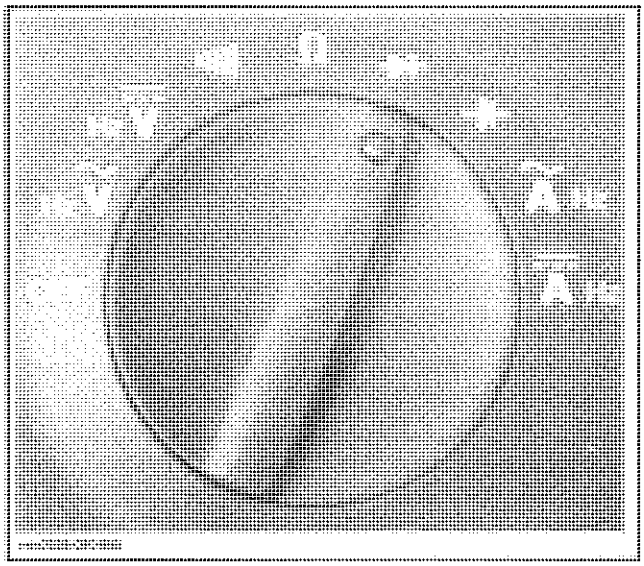
– ECM power supply wires and ground wires, see below.

Diode 1 Test

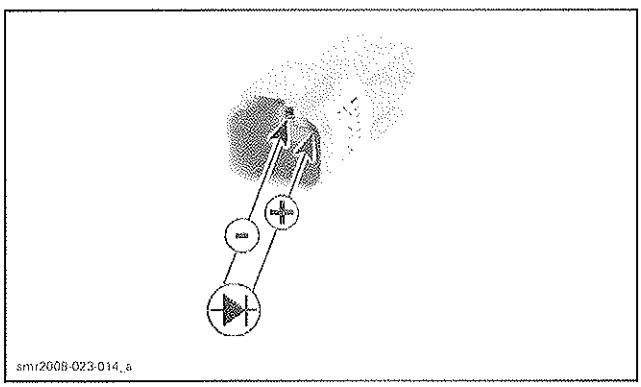


Pull out diode from the connector.

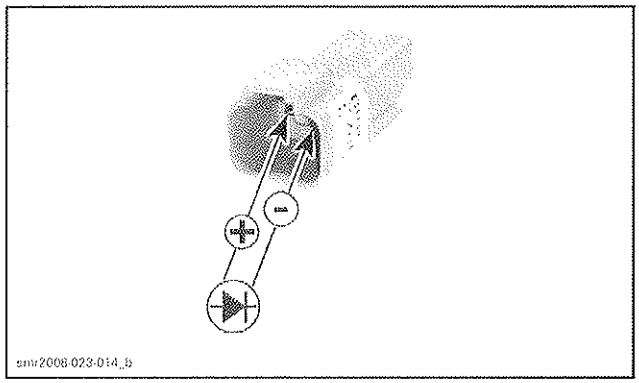
Use the Fluke 115 multimeter (P/N 529 035 868) and set it to the diode symbol as shown.



Probe terminals while paying attention to the diode orientation to respect the polarity.



FORWARD POLARITY, MUST BE AROUND 0.5 V



REVERSE POLARITY, MUST BE OPEN CIRCUIT

If any test failed, replace diode.

ECM Power Supply Test

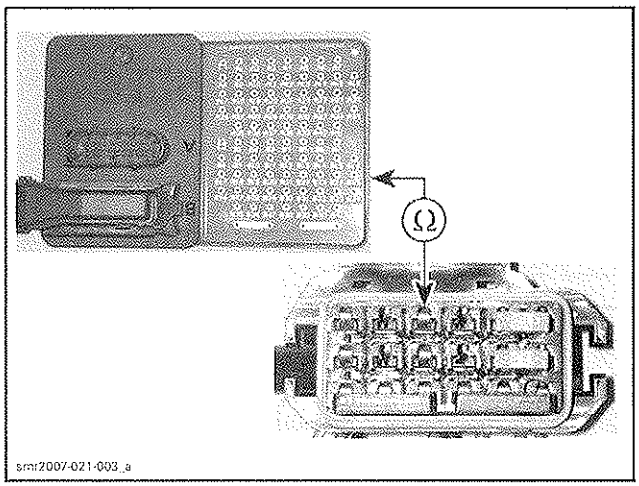
Remove relay fuse box cover.

Remove main relay.

Disconnect connector B from ECM.

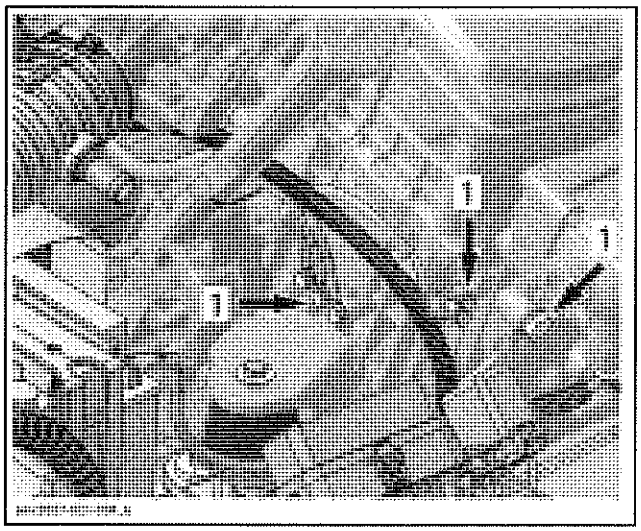
Use ECM adapter (P/N 420 277 010) and a multimeter. Probe circuit as per following table.

RELAY FUSE BOX	ECM ADAPTER	RESISTANCE
Terminal A4	Pin B-11	Close to 0 Ω (continuity)



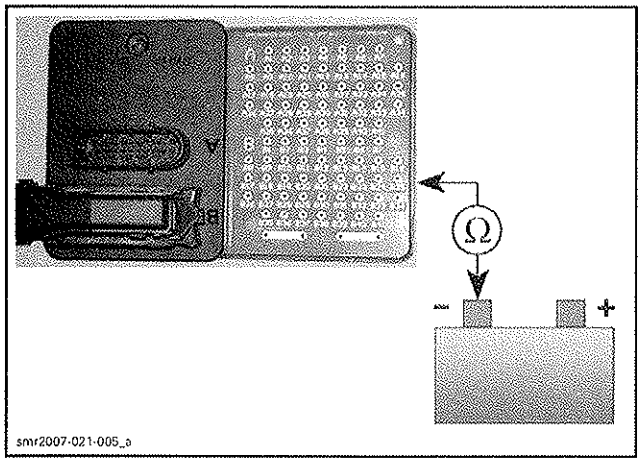
If measurement is out of specification, check wiring from relay fuse box to ECM.

If measurement is as per specification, check ECM grounds as follows.



1. Engine grounds

ECM ADAPTER	BATTERY POST	RESISTANCE
Pins B1, B2, B32 and B41	Ground	Close to 0 Ω (continuity)



If measurement is out of specification, check battery ground and engine grounds.

If everything tests good, refer to *ECM REPLACEMENT*.

Reinstall relay.

ECM Replacement

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

If the defective ECM can be read with B.U.D.S., it is possible to transfer the recorded information of this module to the new ECM. Use Replace ECM in the Module menu of B.U.D.S. Follows instructions in its help system.

If the defective ECM can not be read, do the following.

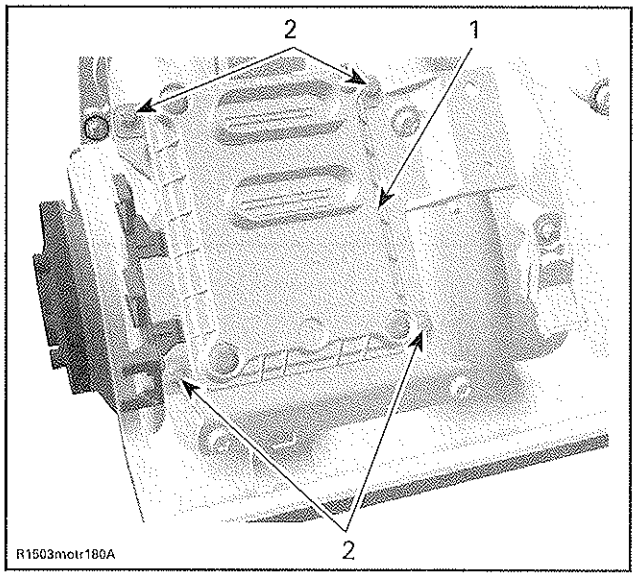
Disconnect battery cables.

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

Disconnect both ECM connectors from ECM.

Unscrew all retaining screws and remove the engine ECM from intake manifold.



TYPICAL
1. ECM
2. Retaining screws

Install the new ECM to the engine.

CAUTION: Always replace ECM by the same part or by an approved equivalent.

Reconnect ECM connectors to ECM then battery cables.

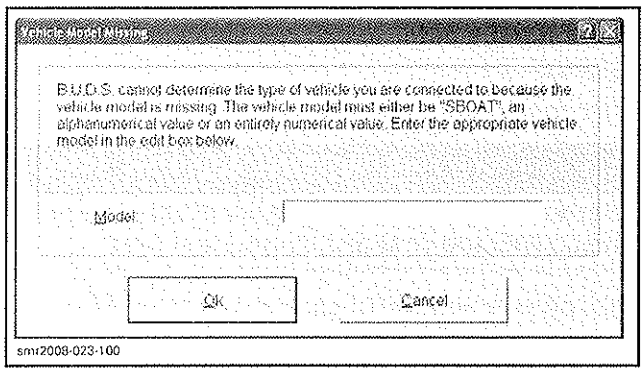
If the Previous ECM was Read with B.U.D.S.

Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets.

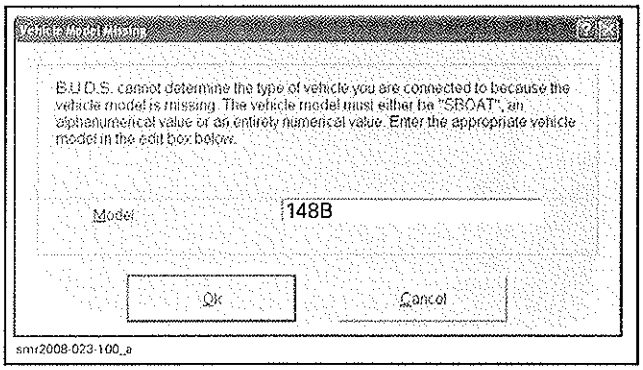
Continue procedure as per *FINALIZING ECM REPLACEMENT* below.

If the Previous ECM was NOT Read with B.U.D.S.

When a new ECM is first started with B.U.D.S. connected, the following window will pop up.



Enter the actual vehicle **model** number (example: 148B without leading and trailing 0 (zero)).



CAUTION: DO NOT enter "sboat". Otherwise, the speedometer will be deactivated in the ECM and will not work. This cannot be changed thereafter unless the ECM is shipped to BRP for a reset.

Enter the vehicle and engine **serial** numbers and the customer's name.

Click to **Write Data** to transfer the information into ECM.

When done, **Read Data** again from ECM and continue entering the information as follows:

- Reprogram DESS key(s).
- Enter the **old** ECM serial number in the **Part Replacement** under **History** tab. Click on **Add Part** in **History**.

NOTE: The ECM serial number can be found on the ECM sticker that also shows the part number.

- Manually activate the options installed on vehicle under the **Setting** tab.

NOTE: If an option is installed but not checked in B.U.D.S., the information center will not display that option. If an option is checked in B.U.D.S. but not installed in vehicle, a fault code will be generated.

Continue procedure as per *FINALIZING ECM REPLACEMENT* below.

Finalizing ECM Replacement

IMPORTANT: When the ECM is replaced, the **Closed Throttle and Idle Actuator** must be reset. Refer to *BASIC ADJUSTMENTS* for the procedure.

After performing the required reset, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 5000 RPM to be sure no fault appears.

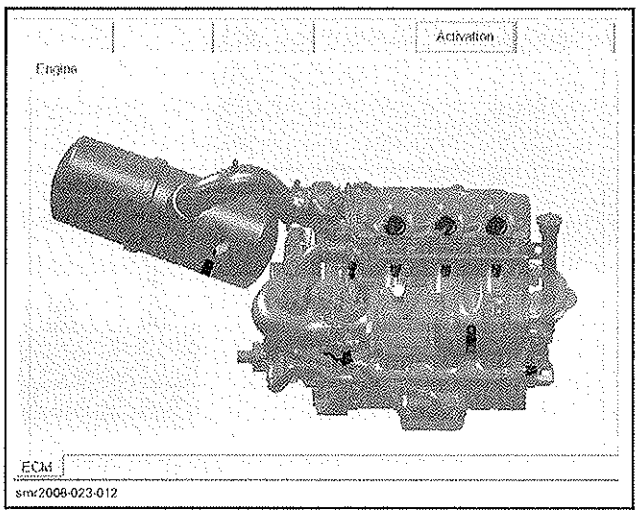
FUEL INJECTOR

IMPORTANT: Never mix up fuel injectors of a 1503 and 1503 supercharged intercooled engines. Doing so will automatically lead to a misfunction of the EMS and will cause a bad engine calibration.

Injector Test with B.U.D.S.

Install DESS key on its post.

Using the B.U.D.S. software, energize the desired fuel injector from the **Activation** section.



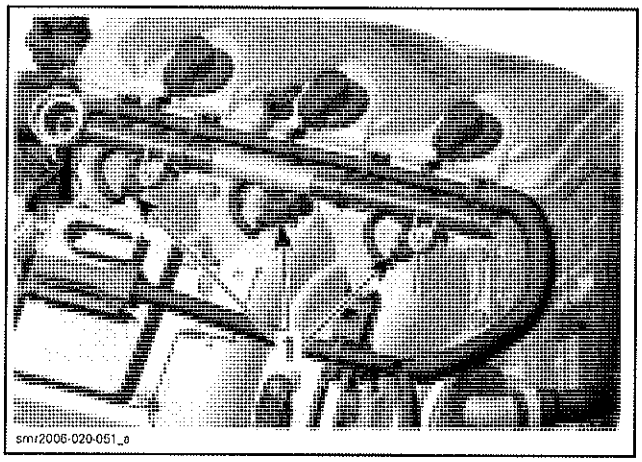
You should hear the injector working.

This validates the injector mechanical and electrical operation.

If the injector does not work, check injector input voltage.

Injector Input Voltage Test

Disconnect injector connectors.



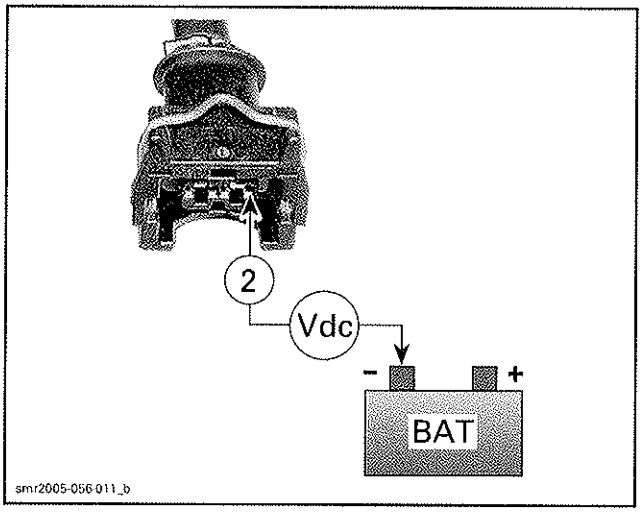
1. Injector connectors

Install DESS key on its post.

Use the Fluke 115 multimeter (P/N 529 035 868) and select Vdc.

Read voltage of the desired injector.

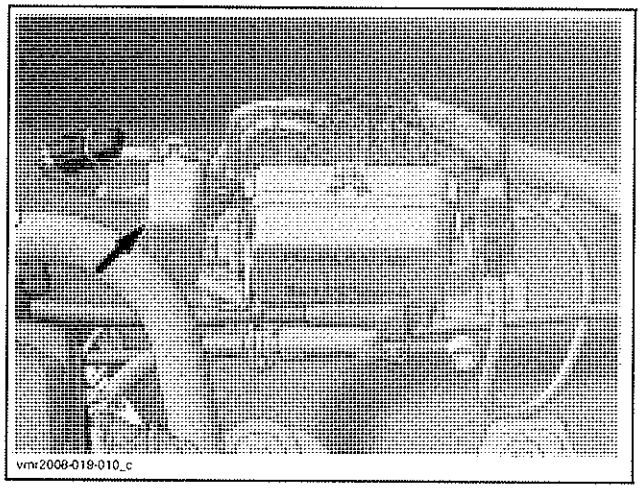
INJECTOR CONNECTOR	MEASUREMENT
Terminal 2 and battery ground	Battery voltage



If input voltage is good, carry out the *INJECTOR CONTROL CIRCUIT TEST*.

If input voltage is not good, check continuity between main relay and injector as follows.

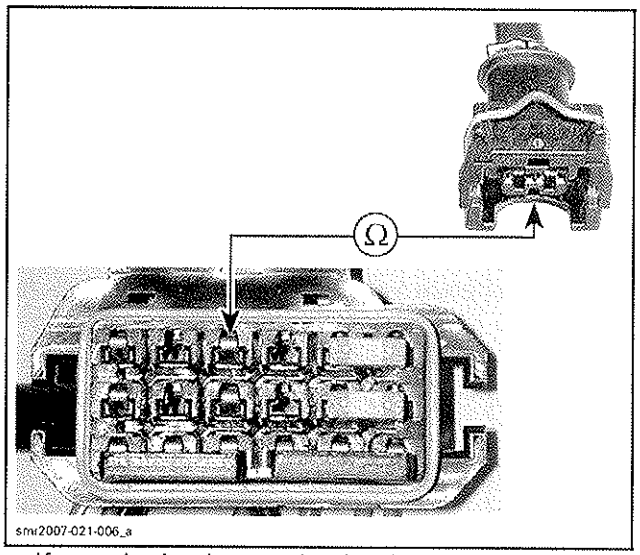
Remove main relay from its socket.



Use the Fluke 115 multimeter (P/N 529 035 868) and select Ω.

Read resistance of the desired injector circuit.

INJECTOR CONNECTOR	RELAY FUSE BOX	MEASUREMENT
Terminal 2	Pin A4	Close to 0 Ω



- If continuity is good, check relay and wiring from battery.
- If continuity is faulty, repair/replace wiring from relay socket to injector.

Reinstall main relay.

Injector Control Circuit Test

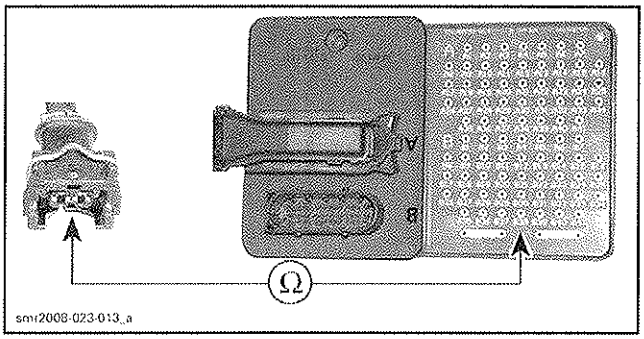
Disconnect ECM A connector.

Install ECM (P/N 420 277 010) on ECM connector.

Use the Fluke 115 multimeter (P/N 529 035 868) and select Ω.

Probe terminals as follows.

INJECTOR	ECM PIN	INJECTOR PIN	MEASUREMENT
1	A-15	1	Close to 0 Ω
2	A-33		
3	A-14		



If control circuit is faulty, repair/replace wiring/connectors.

If control circuit and all tests applicable to the injector are good, try a new ECM. Refer to *ECM*.

Injector Resistance Test (at ECM Connector)

Reconnect the injector connector.

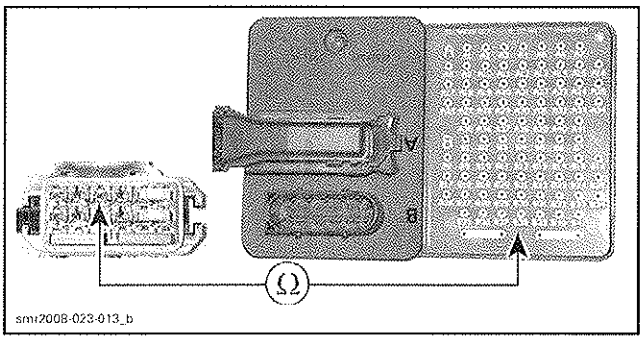
Disconnect the ECM A connector.

Install ECM (P/N 420 277 010) on ECM connector.

Remove main relay from its socket.

Using the Fluke 115 multimeter (P/N 529 035 868), check resistance value between terminals as follows.

INJECTOR	RELAY SOCKET TERMINAL	ECM CONNECTOR	RESISTANCE @ 20°C (68°F)
1	A4	A-15	1503: 11.4 - 12.6 Ω 1503 SC intercooled: 14 - 15 Ω
2		A-33	
3		A-14	



If resistance value is correct, injector coil is in good condition.

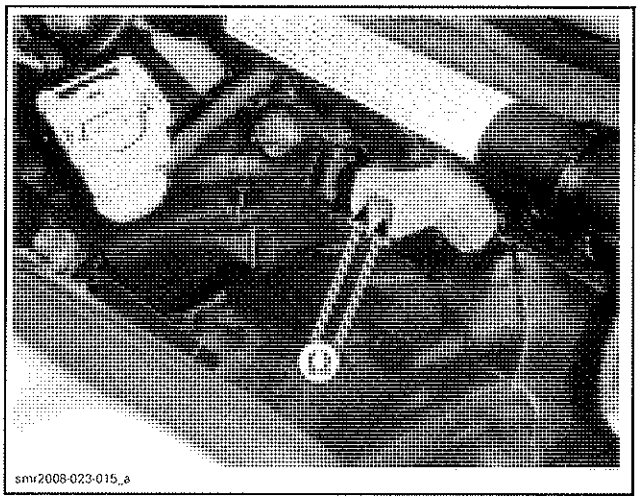
If resistance value is incorrect, repeat test at injector connector.

Reinstall main relay.

Injector Resistance Test (at Component)

Remove injector connector and check resistance value between injector pins as follows.

INJECTOR PIN		RESISTANCE @ 20°C (68°F)
1	2	See above.



If readings are out of specifications, replace injector.

If readings are good, repair/replace wiring/connectors from ECM to injector.

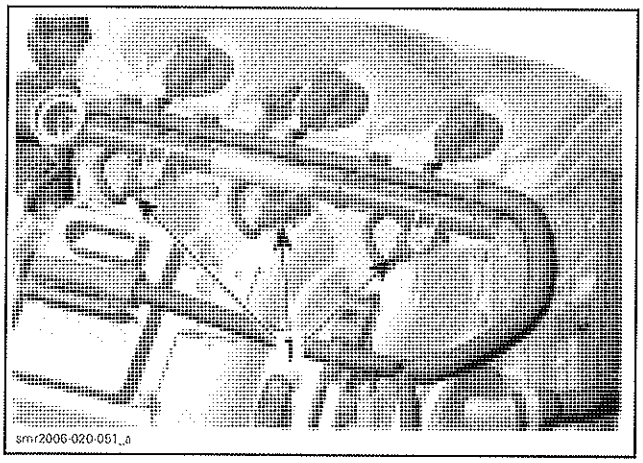
Reinstall fuel rail cover.

Fuel Injector Removal

Remove fuel rail cover from the engine.

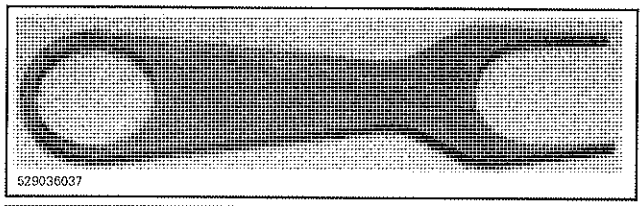
Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

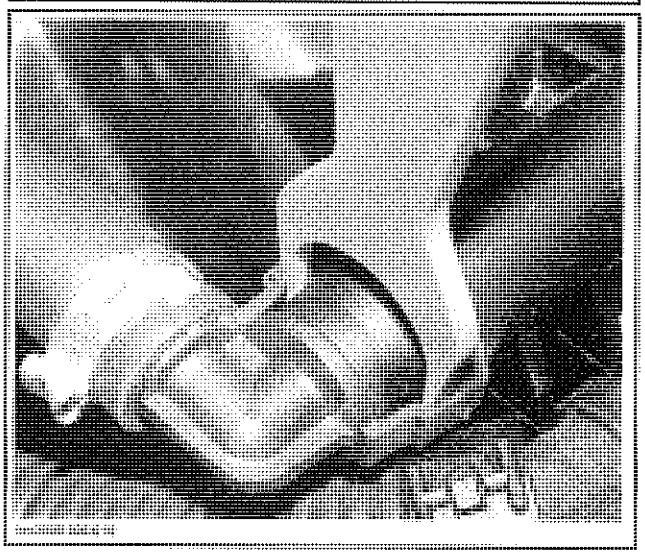
Disconnect wiring harness from the three fuel injectors.



1. Fuel injector connectors

Disconnect fuel hose using the fuel hose disconnect tool (P/N 529 036 037).





Wrap a rag around the hose end to prevent rail draining.

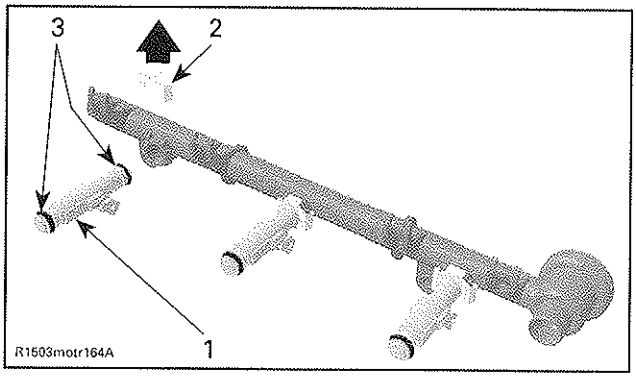
Cut tie raps and remove the wiring harness from the fuel rail.

Unscrew rail retaining screws.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

Then remove the injector clip. Now the fuel injector can be easily pulled out of the fuel rail.



FUEL RAIL ASSEMBLY
1. *Fuel injector*
2. *Injector clip*
3. *O-ring*

Fuel Injector Installation

For the installation, reverse the removal procedure. Paying attention to the following details.

If you reinstall a used injector, carefully inspect O-ring condition before reinstalling fuel injector. Replace O-ring with a new one if damaged. Insert the fuel injector in place with your hand.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in fuel rail and intake manifold.

Apply Loctite 243 on rail retaining screws then torque to 10 N•m (89 lbf•**in**).

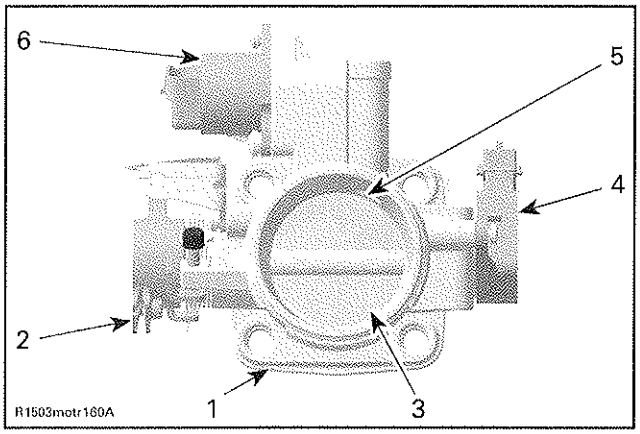
When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to *FUEL SYSTEM* section.

THROTTLE BODY

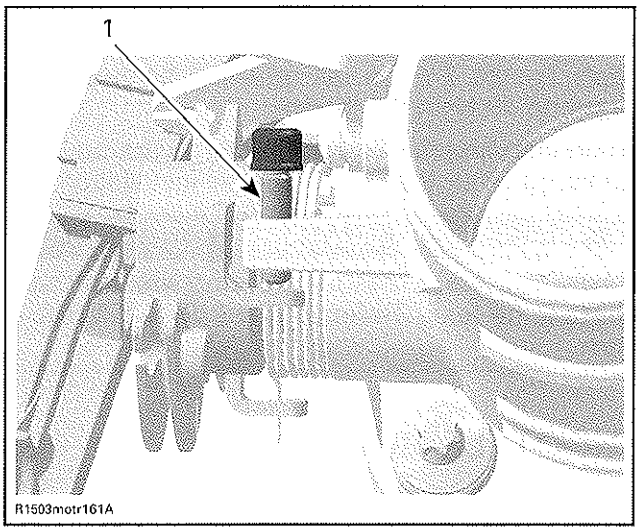
IMPORTANT: Never mix up throttle bodies of a 1503 naturally aspirated engine and a 1503 Supercharged intercooled engine. Doing so will automatically lead to a misfunction of the EMS and will cause a bad engine calibration.



TYPICAL
1. *Throttle body*
2. *Throttle cable attachment*
3. *Throttle plate*
4. *TPS*
5. *Idle air control channel*
6. *Idle air control valve*

The adjustment of the idle stop screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the idle speed through this screw. See *IDLE SPEED* in *BASIC ADJUSTMENTS.*



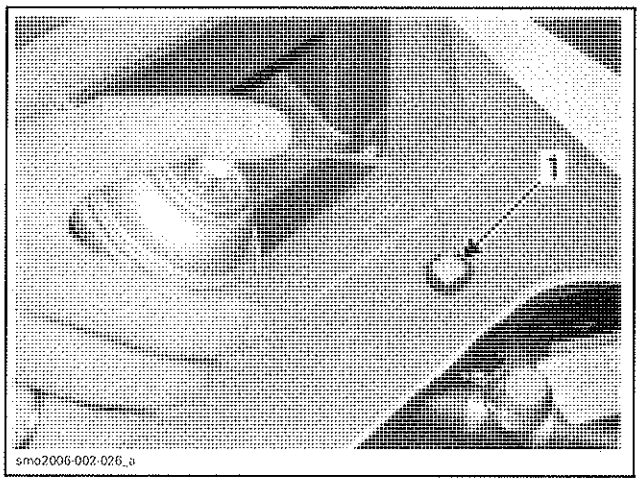
THROTTLE BODY
1. *Idle stop screw (do not tamper adjustment)*

Throttle Body Lubrication

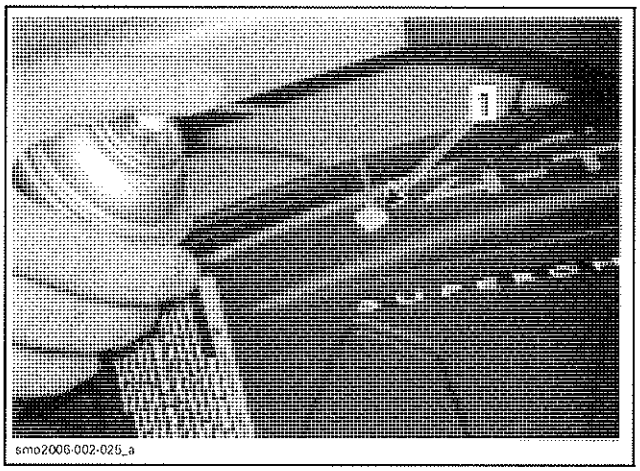
It is recommended to lubricate the throttle body to prevent corrosion on external and internal parts especially if the watercraft is used in salt water.

Use fitting for that purpose provided in the engine compartment.

Make sure to spray XP-S Lube (P/N 293 600 016) at least 3 to 5 seconds for proper lubrication.



GTI MODELS — TYPICAL
1. *Fitting*



GTX, RXP AND RXT MODELS — ENGINE COVER
1. *Fitting*

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever. Throttle plate must return freely, quickly and completely. If not, check for salt accumulation on throttle plate shaft. Try lubricating throttle plate shaft, moving plate several times and recheck. Replace throttle body if necessary.

⚠ WARNING

Replace throttle body when throttle plate does not return properly.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

- Throttle cable adjustment too tight. Not returning fully to idle stop.
- Throttle body idle set screw is loose or worn (in this case, throttle body must be replaced).

- TPS is loose.
- Idle air control valve is loose.
- Corroded or damaged wiring or connectors.
- Throttle body has been replaced and the Closed Throttle and Idle Actuator reset has not been performed.
- ECM has been replaced and the Closed Throttle and Idle Actuator reset has not been performed.

Electrical Inspection

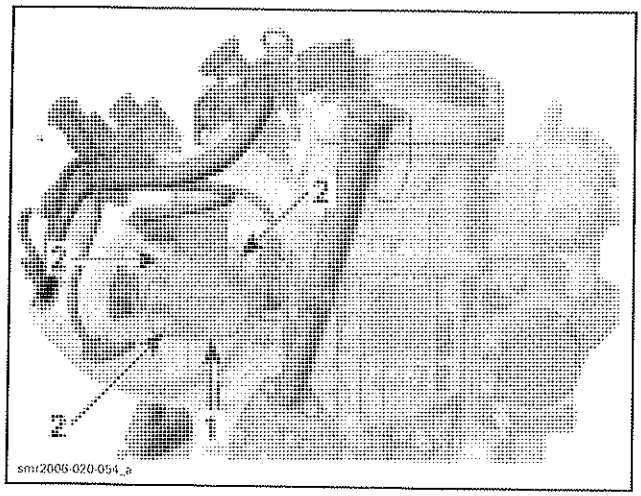
Refer to *THROTTLE POSITION SENSOR (TPS)* and *IDLE AIR CONTROL VALVE* further in this section.

Throttle Body Replacement

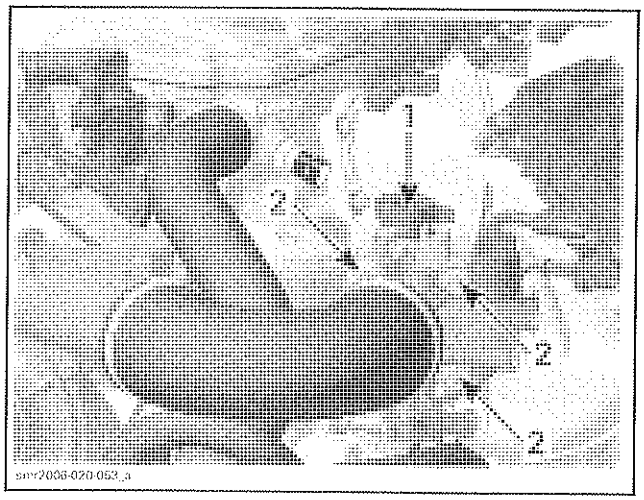
Removal

To remove the throttle body from engine, proceed as follows:

- Disconnect air intake silencer from throttle body. Move boot away.
- Remove retaining screws of throttle body.



1503 ENGINE
1. *Throttle body*
2. *Screws*



1503 SUPERCHARGED INTERCOOLED ENGINE
1. *Throttle body*
2. *Screws*

- Slightly pull throttle body out.
- Disconnect connectors from idle air control valve, and TPS.
- Disconnect throttle cable.

Installation

Installation of the new throttle body is the reverse of the removal procedure.

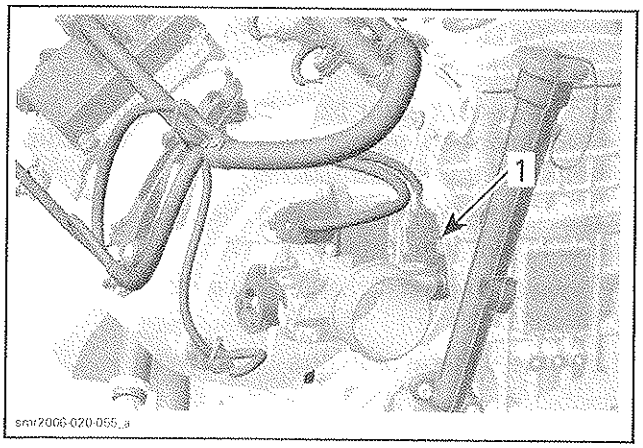
Make sure throttle cable is correctly adjusted.

Perform the Closed Throttle and Idle Actuator reset. See procedure in *BASIC ADJUSTMENTS*.

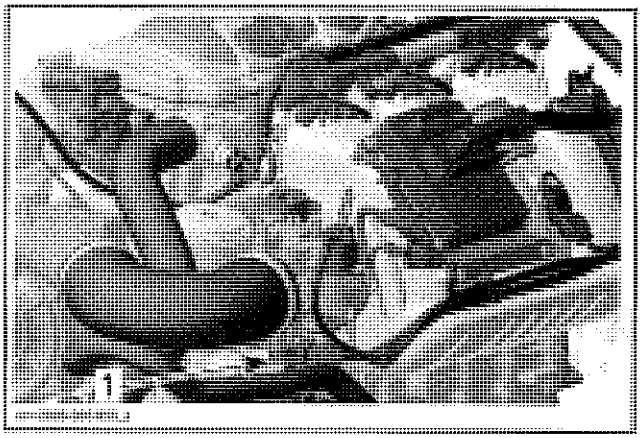
THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle plate angle.



1503 ENGINE
1. *Throttle position sensor (TPS)*



1503 SUPERCHARGED INTERCOOLED ENGINE
1. Throttle position sensor (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components are adequate according to *THROTTLE BODY* above.

The EMS may generate several fault codes pertaining to the TPS. Refer to *MONITORING SYSTEM AND FAULT CODES* section for more information.

TPS Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring** tab.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

TPS Voltage Test

Check the ECM voltage output from to the throttle position sensor.

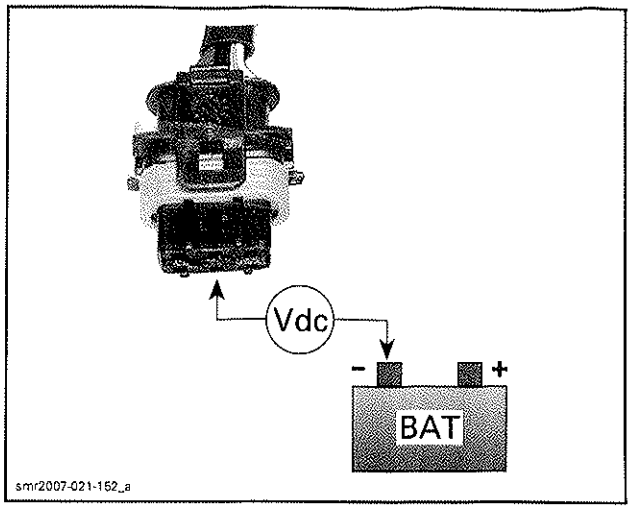
Disconnect connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab.

NOTE: On the **Supercharged** models, a mirror is useful to see under throttle body.

Remove and reinstall the DESS key to activate the ECM.

Check the voltage readings as follows.

CONNECTION	VOLTAGE
Terminal 1 with engine ground	0 V
Terminal 2 with engine ground	5 V
Terminal 3 with engine ground	4.5 - 5 V



If voltage test is good, replace the TPS.

If voltage test is not good, check the resistance of the TPS circuit.

TPS Resistance Test

Reconnect the TPS.

Disconnect the ECM connector A on the ECM.

Use ECM adapter (P/N 420 277 010) and a multimeter. Probe circuit as per following table.

ECM ADAPTER		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN	PIN	RESISTANCE Ω	
A-24	A-25	1000 - 1100	2600 - 2700
A-25	A-39	1600 - 2400	1600 - 2400
A-24	A-39	2500	1000 - 1100

NOTE: The resistance value should change smoothly and proportionally to throttle movement. Otherwise, replace TPS.

If resistance values are correct, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

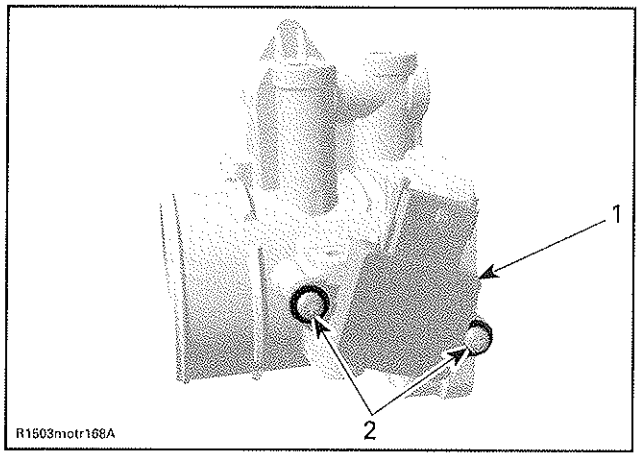
If resistance values are incorrect, replace TPS.

TPS Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS

Apply Loctite 243 on screw threads and secure screws.

Reinstall remaining removed parts.

Proceed with the Closed Throttle and Idle Actuator reset as described in *BASIC ADJUSTMENTS*.

IDLE AIR CONTROL VALVE (IACV)

An idle air control valve with good resistance measurement can still be faulty. It is also possible that a mechanical failure occurs which is not detectable without measuring the air flow. Replacing the idle air control valve may be necessary as a test.

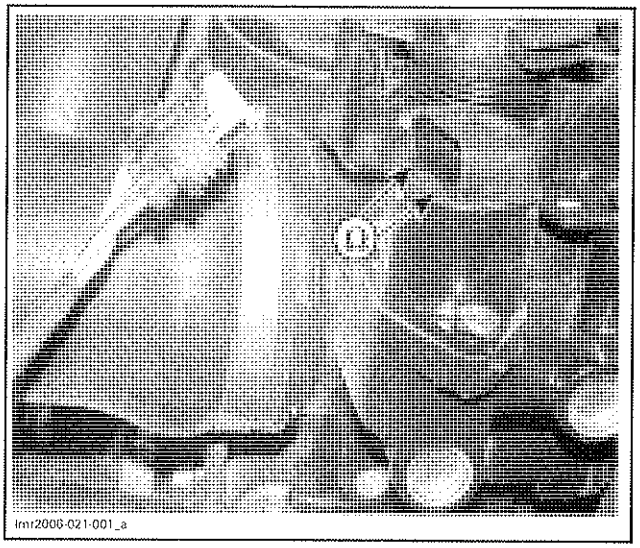
If an erratic engine idle is experienced, clean the idle air bypass in throttle body.

IACV Resistance Test (at Component)

Disconnect idle air control valve connector.

Check the resistance between pins as follows.

IDLE AIR CONTROL VALVE		MEASUREMENT
PIN		RESISTANCE @ 20°C (68°F)
A	D	Approximately 50 Ω
B	C	



If the resistance of any winding is inadequate, replace the idle air control valve.

If resistance test of valve windings is good, check continuity of circuits A-35, A-36, A-37, A-38.

IACV Resistance Test (at ECM Connector)

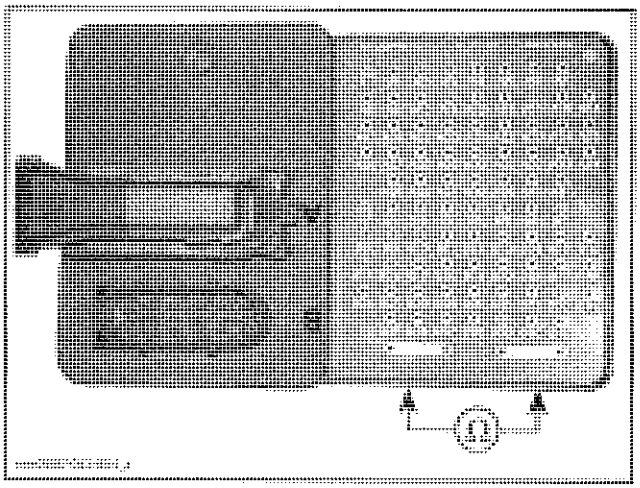
Reconnect IACV connector.

Disconnect ECM A connector.

Use ECM adapter (P/N 420 277 010) and a multimeter.

Set multimeter to Ω and read resistance as follows.

ECM CONNECTOR		MEASUREMENT
PIN		RESISTANCE @ 20°C (68°F)
A-35	A-36	See above.
A-37	A-38	



If any resistance test failed, repair/replace wiring/connectors between IACV and ECM.

If resistance test are good and all valve tests has been done, try a new ECM. Refer to *ECM*.

Visual Inspection

Remove DESS key from its post.

Remove idle air control valve from throttle body.

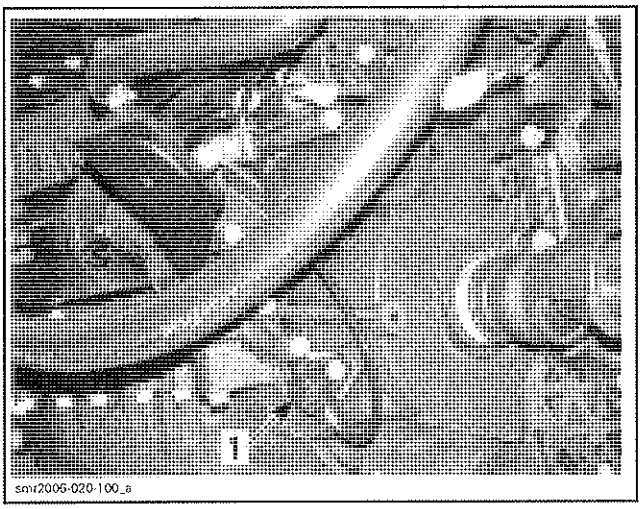
Check the piston and bypass channel for dirt/deposits which can cause a sticking piston.

CAUTION: Do not try to operate the piston of the idle air control valve when it is dismounted. Also do not move the piston by hand. The screw drive is very sensitive and will be destroyed.

Clean the parts and install the idle air control valve on the throttle body.

Proceed with the Closed Throttle and Idle Actuator reset as described in *BASIC ADJUSTMENTS*.

CRANKSHAFT POSITION SENSOR (CPS)



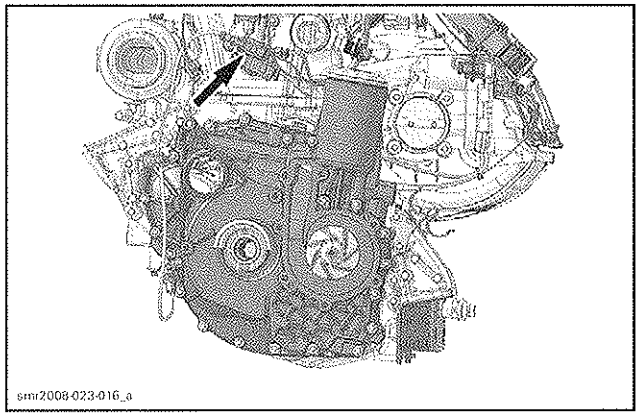
1. Crankshaft Position Sensor (CPS)

Ensure that information center works. Check for RPM display at the information center while cranking in engine drowned mode. Approximately 300 RPM should display. Otherwise perform the following tests.

NOTE: Take into account that a CPS fault can be triggered by a bent or missing trigger wheel tooth. First check fault codes then CPS as per following procedure; if it tests good, verify trigger wheel teeth condition. Refer to *PTO HOUSING AND MAGNETO* in the *ENGINE* section.

CPS Voltage Test

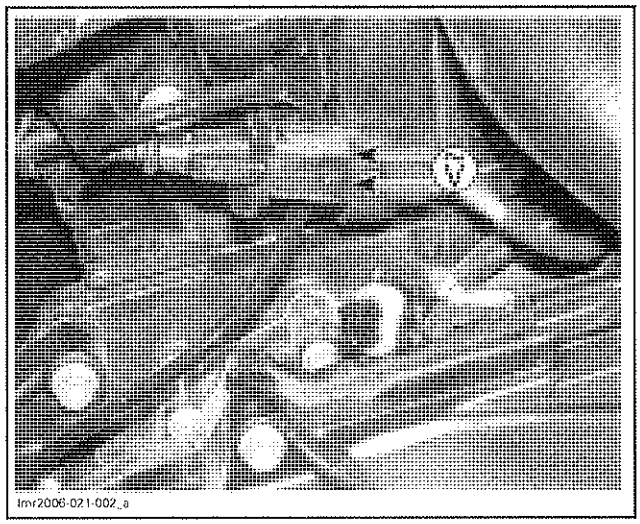
Disconnect CPS connector besides the ECM.



TYPICAL

Probe terminals while cranking, as shown.

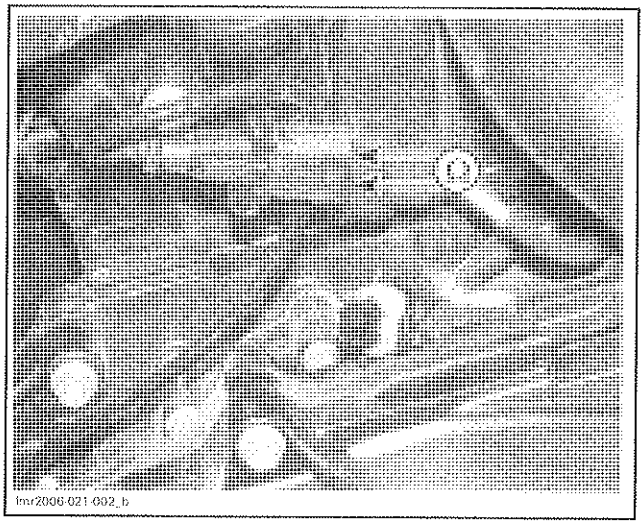
CPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1	2	Approximately 2.3 Vac



CPS Resistance Test

Disconnect CPS connector. Probe terminals as follows.

CPS CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	700 - 900 Ω



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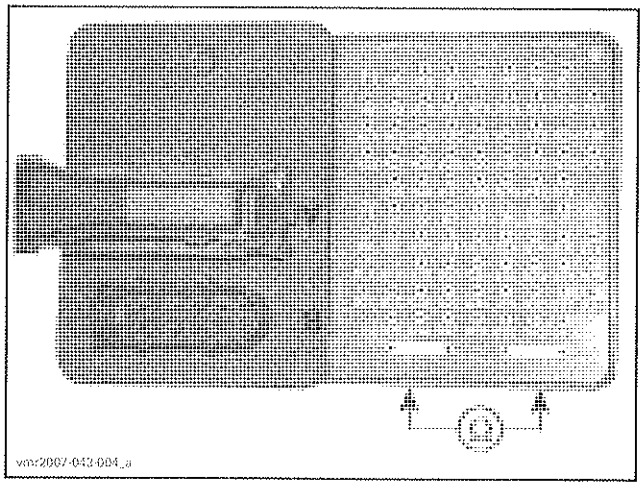
If resistance is not within specifications, replace the CPS.

If resistance tests good, reconnect the CPS and disconnect the ECM connector A on the ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), recheck circuit resistance as per table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE @ 20°C (68°F)
A-5	A-19	See above



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If resistance value is correct, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

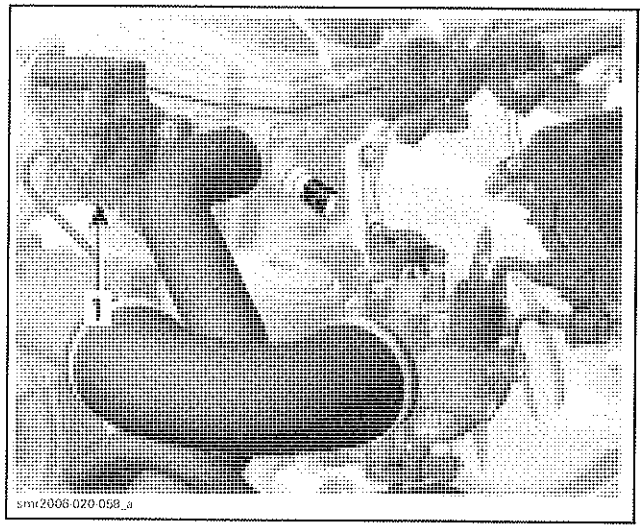
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

CPS Replacement

Drain oil from PTO housing. Refer to *PTO HOUSING AND MAGNETO*.

NOTE: It is not necessary to drain oil from engine.

Disconnect CPS connector.



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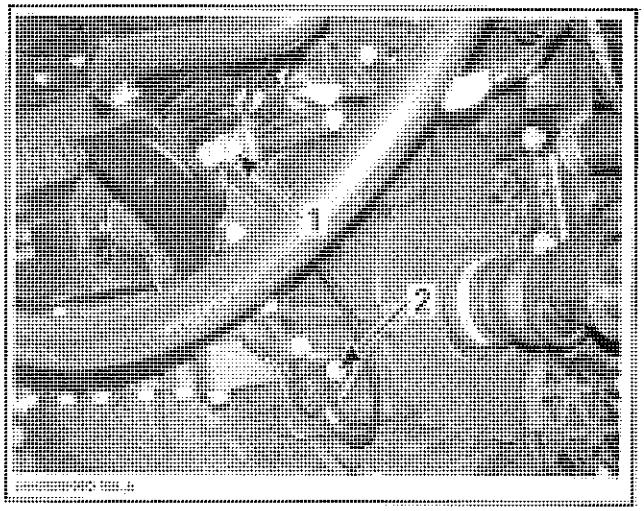
1. CPS connector

Remove wire retaining clip.

Remove CPS retaining screw.



1. Wire retaining clip
2. CPS retaining screw

Pull out CPS.

Reverse procedure for installation. However, pay attention to the following.

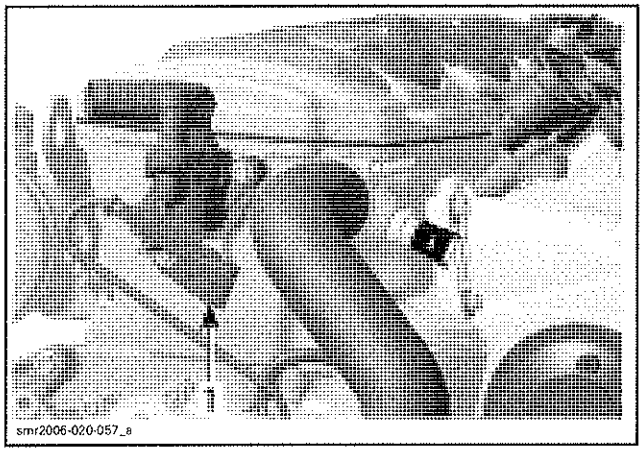
Apply Loctite 243 (P/N 293 800 060) on screw threads then torque to 9 N•m (80 lbf•**in**).

Readjust the engine oil level.

Trigger Wheel Inspection

Refer to *PTO HOUSING AND MAGNETO* in the *ENGINE* section.

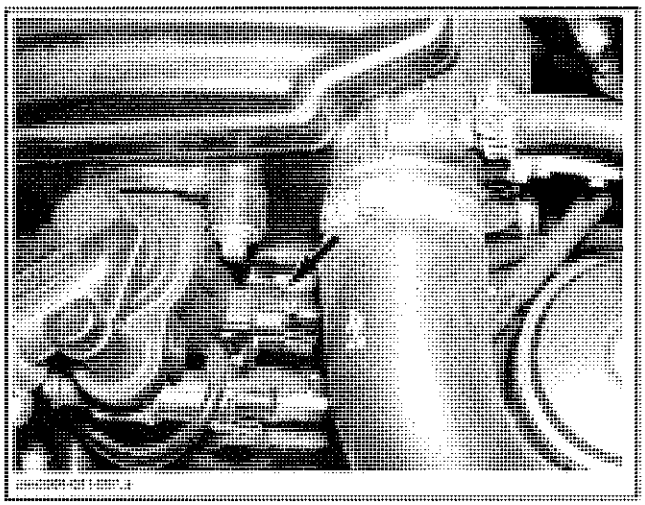
CAMSHAFT POSITION SENSOR (CAPS)



1. CAPS

CAPS Voltage Test (Harness Side)

Disconnect CAPS connector.

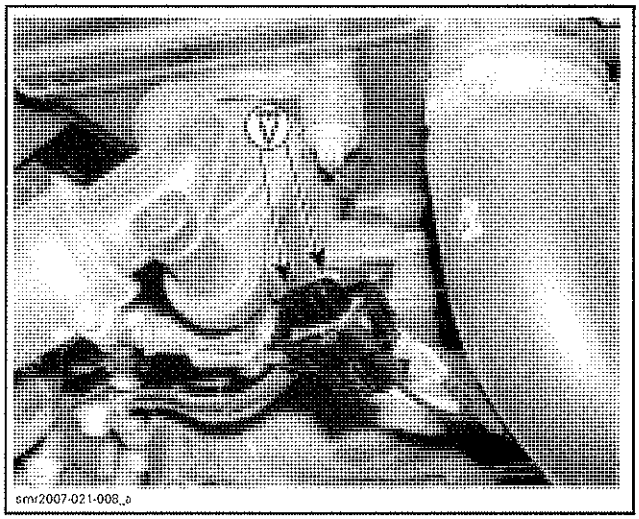


CAPS HIDDEN BEHIND ANOTHER CONNECTOR

Install DESS key.

Probe terminals as shown.

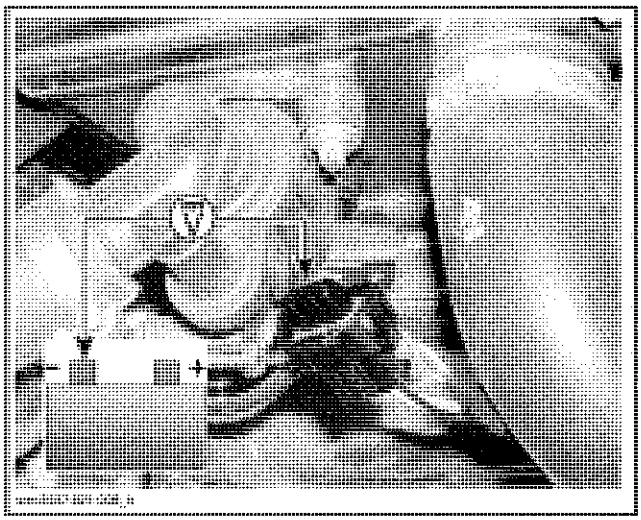
CAPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
3	1	Battery voltage



If 12 V is read, proceed with *CAPS DYNAMIC TEST* further.

If 12 V is not read, probe circuit as shown.

CAPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
3	Battery ground	Battery voltage

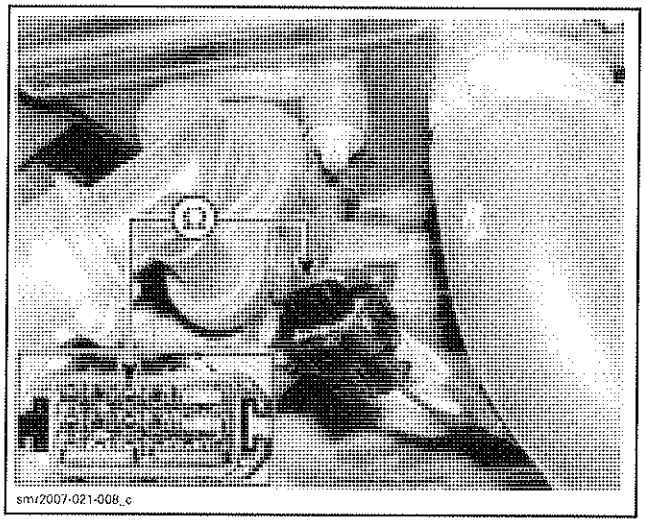


If voltage is now read, check ground circuit A-20 for continuity. Repair wire/connector if defective.

If voltage is still not read, check power supply circuit for continuity as follows.

NOTE: To probe terminal of relay fuse box, remove relay.

RELAY FUSE BOX	CAPS CONNECTOR	RESISTANCE
TERMINAL	PIN	Ω
A4	3	Close to 0 Ω (continuity)



Repair wire/connector if defective.

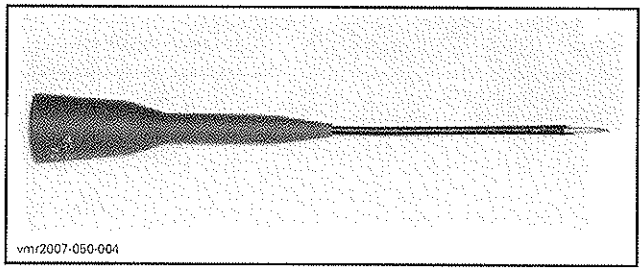
Reinstall relay.

CAPS Dynamic Test

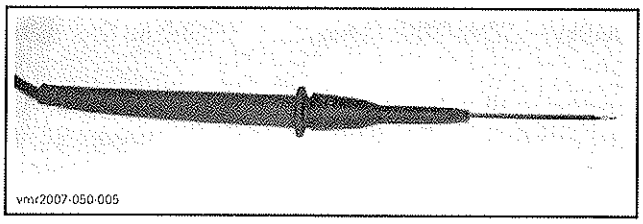
Remove CAPS sensor from engine.

Back-probe connector and read voltage as follows.

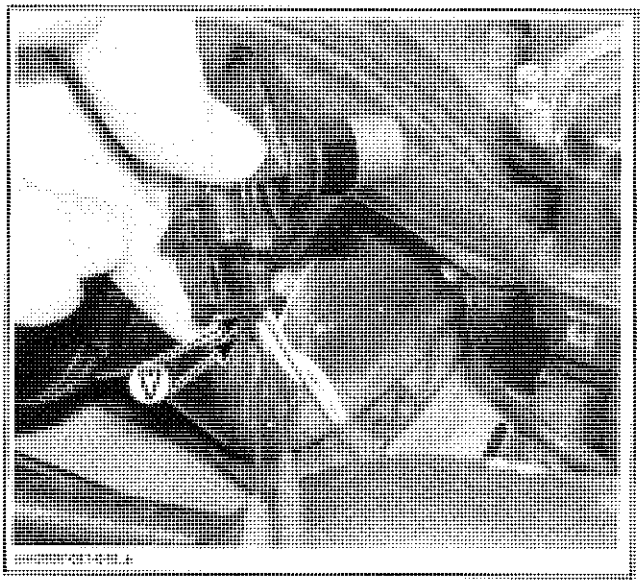
NOTE: To easily probe wire terminals through the back of their connectors, Fluke rigid back probe (P/N TP88) or equivalent can be used.



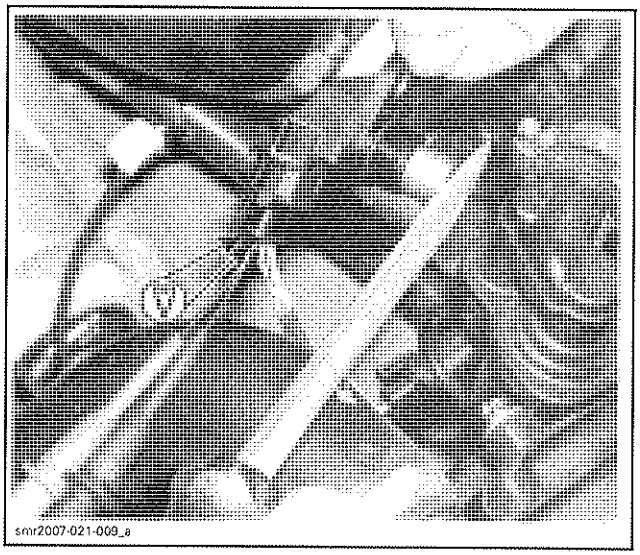
They can be inserted at the end of the standard probes of the Fluke 111 multimeter (P/N 529 035 868).



CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Free	3	2	Close to 0 Vdc



CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Metallic object on sensor	3	2	Battery voltage



If voltage is appropriate, check/repair wiring/connector between sensor and ECM. If it is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)*.

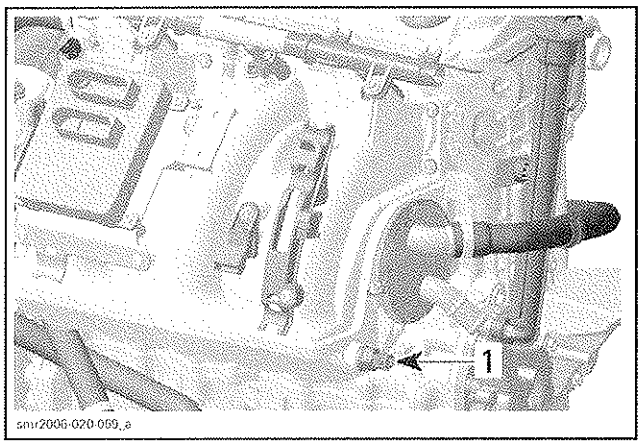
If voltage is wrong, try a new CAPS.

CAPS Replacement

Unscrew the retaining screw and replace the CAPS. Ensure to reinstall O-ring.

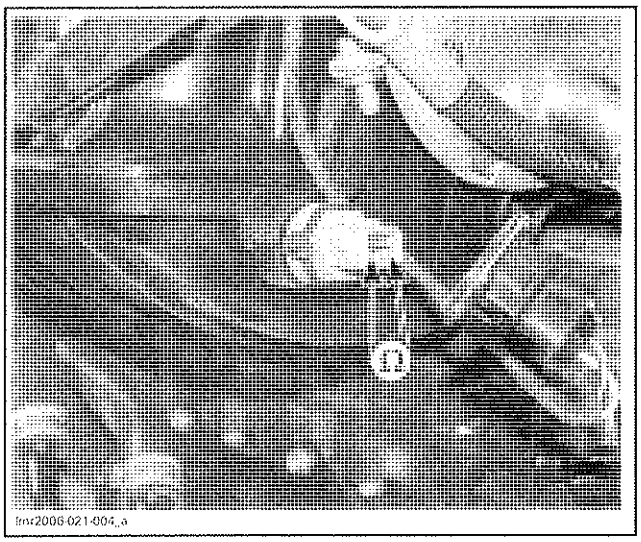
Apply Loctite 243 (blue) on thread and torque to 6 N•m (53 lbf•**in**).

MANIFOLD AIR TEMPERATURE SENSOR (MATS)



TYPICAL — INTAKE MANIFOLD
1. Manifold air temperature sensor (MATS)

MATS Resistance Test



The resistance should be as per following chart.

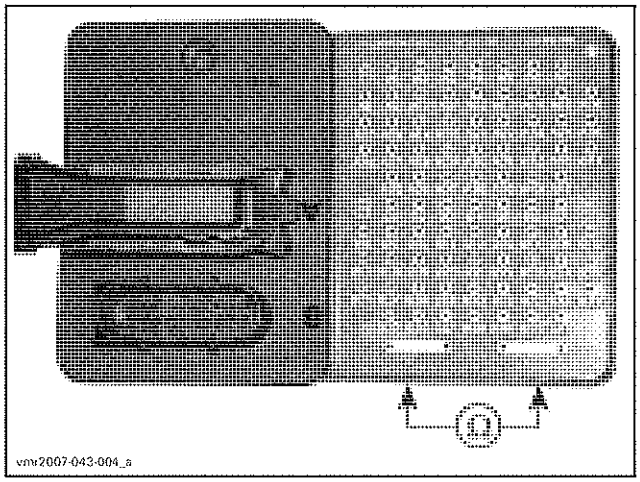
Otherwise, replace the MATS.

If resistance tests good, reconnect the MATS and disconnect the ECM connector A on the ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), check the circuit resistance as per table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω
A-7	A-21	See table below

TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	NOMINAL	LOW	HIGH
- 30	- 22	12600	11800	13400
- 20	- 4	11400	11000	11800
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930
60	140	630	510	750
70	158	440	370	510
80	176	325	280	370
90	194	245	210	280
100	212	195	160	210
110	230	145	125	160
120	248	115	100	125



If resistance value is correct, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

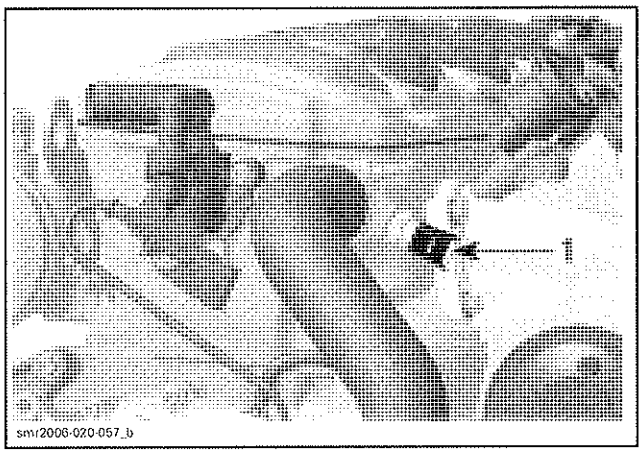
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the MATS.

MATS Replacement

Disconnect the connector of the MATS.

Screw MATS out and install the new one. Torque to 18 N•m (159 lbf•**in**).

COOLANT TEMPERATURE SENSOR (CTS)



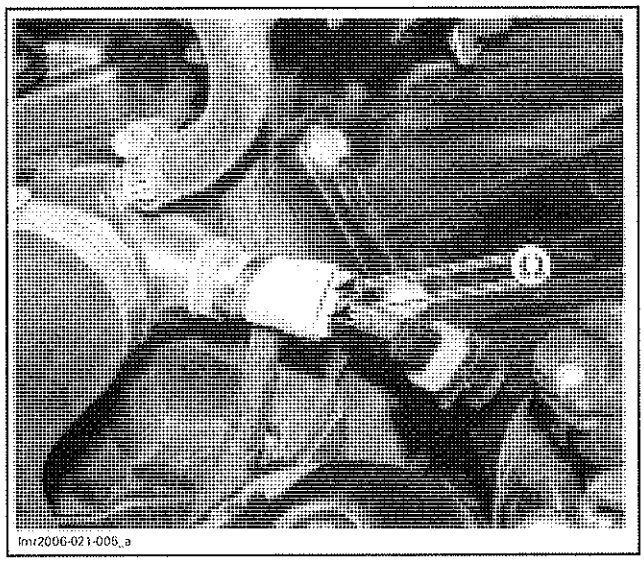
1. Coolant temperature sensor (CTS)

NOTE: Overheat signals will appear when coolant temperature reaches:

ENGINE	TEMPERATURE
All 1503	110°C (230°F)

CTS Resistance Test

Disconnect the connector from the CTS and check the resistance of the sensor itself.



The resistance should be as per following chart.

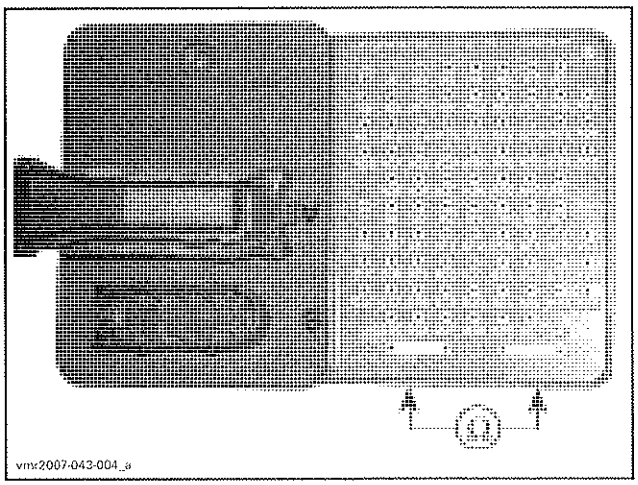
Otherwise, replace the CTS.

If resistance tests good, reconnect the CTS and disconnect the ECM connector A on the ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), check the circuit resistance as per table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω
A-11	A-27	See table below

TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	NOMINAL	LOW	HIGH
- 30	- 22	12600	11800	13400
- 20	- 4	11400	11000	11800
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930
60	140	630	510	750
70	158	440	370	510
80	176	325	280	370
90	194	245	210	280
100	212	195	160	210
110	230	145	125	160
120	248	115	100	125



If resistance value is correct, check ECM. Refer to *ECM* elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

CTS Replacement

Unlock expansion separator and temporarily move away to gain access.

Remove the fuel rail cover.

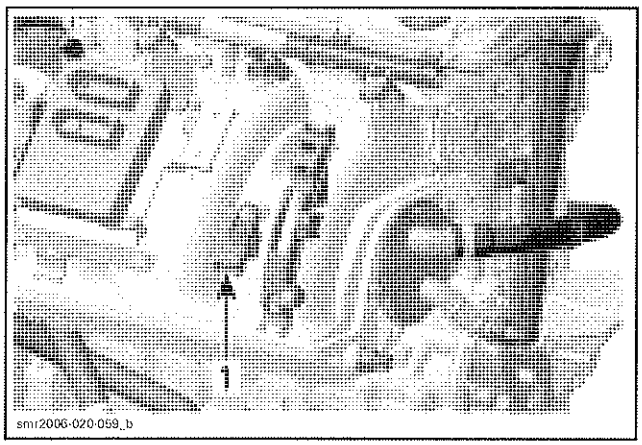
Disconnect CTS connector and remove CTS.

Install the new CTS and torque to 18 N•m (159 lbf•**in**).

Reinstall remaining removed parts.

MANIFOLD AIR PRESSURE SENSOR (MAPS)

IMPORTANT: Never mix up MAPS of naturally-aspirated and supercharged intercooled engines. Doing so will automatically lead to a misfunction of the ECM and will cause a bad engine calibration.



TYPICAL
1. Manifold air pressure sensor (MAPS)

NOTE: This sensor is a dual function device. When engine is started and it runs at idle speed, the sensor takes the atmospheric pressure and stores it in the ECM. Thereafter, it takes the manifold air pressure at operating RPMs.

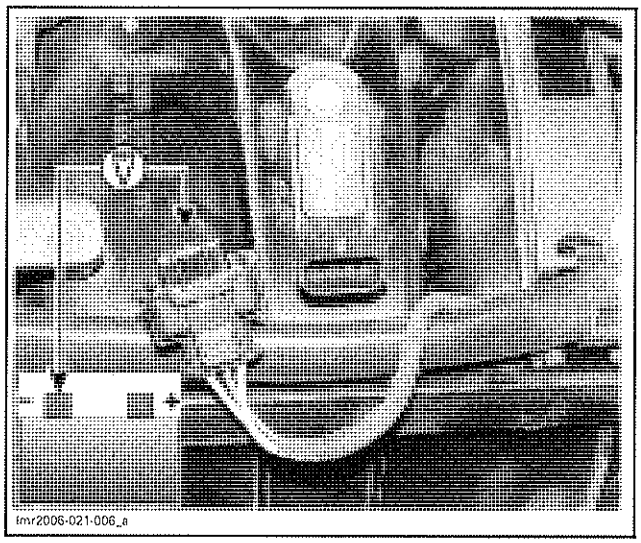
Ensure sensor is correctly installed on intake manifold. Otherwise, the MAPS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

MAPS Voltage Test

Check the voltage output from ECM to the manifold air pressure sensor (MAPS).

Disconnect connector from MAPS and connect a voltmeter to the terminals of the wiring harness as per the following table.

CONNECTION	VOLTAGE
Terminal 1 with engine ground	5 V
Terminal 2 with engine ground	0 V
Terminal 3 with engine ground	0 V



Remove and reinstall the DESS key to activate the ECM.

If voltage test is good, replace the MAPS.

If voltage test is not good, check the continuity of the MAPS circuit.

MAPS Resistance Test

Disconnect the ECM connector A on the ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), check the resistance of circuit A-12, A-28 and A-40.

If wiring harness is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

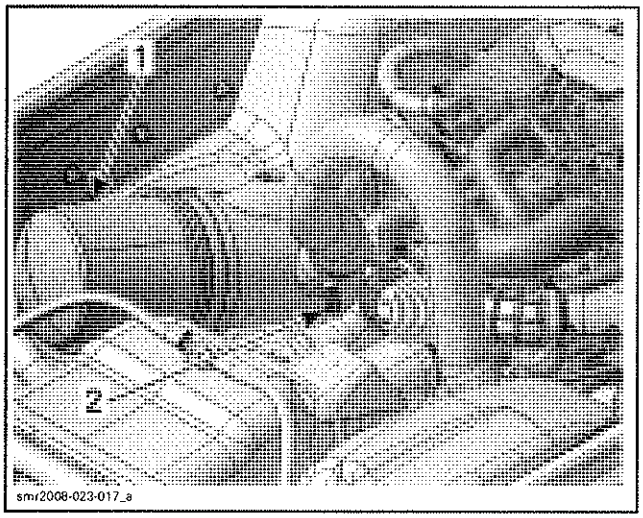
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the MAPS.

MAPS Replacement

Disconnect MAPS connector and remove the MAPS.

Install the new MAPS paying attention to index its tab into the adaptor notch. Apply Loctite 243 (blue) on screw then torque to 10 N•m (89 lbf•**in**).

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



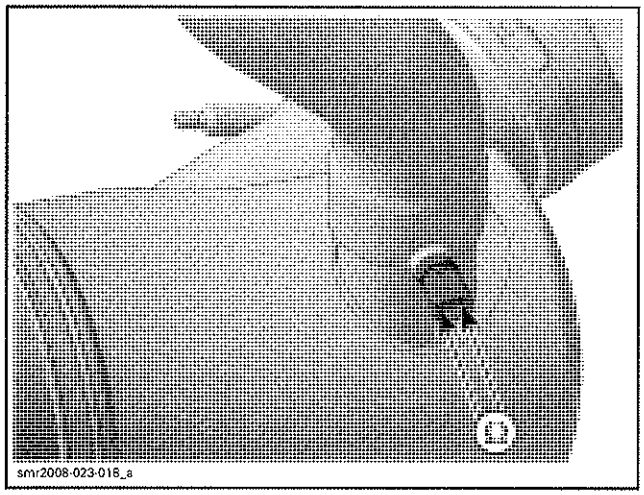
TYPICAL
1. *Muffler*
2. *Exhaust gas temperature sensor (EGTS)*

NOTE: Overheat signals will appear when exhaust temperature reaches:

ENGINE	TEMPERATURE
All 1503	115°C (239°F)

EGTS Resistance Test

Disconnect the connector from the EGTS and check the resistance of the sensor itself.



The resistance should be as per following chart.

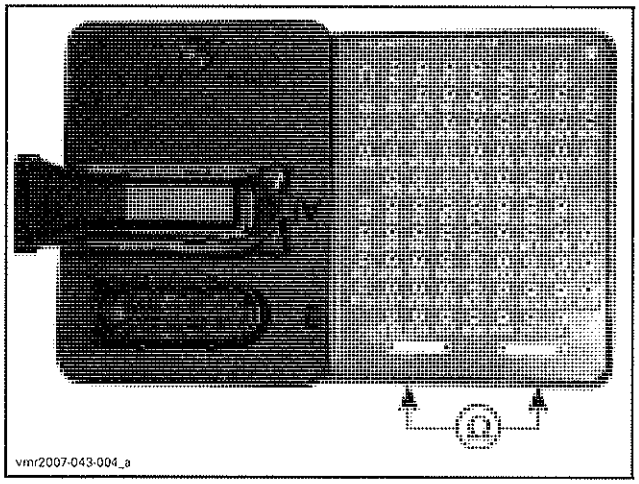
Otherwise, replace the EGTS.

If resistance tests good, reconnect the EGTS and disconnect the ECM connector A on the ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), check the circuit resistance as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω
A-10	A-26	See table below

TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	NOMINAL	LOW	HIGH
- 30	- 22	12600	11800	13400
- 20	- 4	11400	11000	11800
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930
60	140	630	510	750
70	158	440	370	510
80	176	325	280	370
90	194	245	210	280
100	212	195	160	210
110	230	145	125	160
120	248	115	100	125



If resistance value is correct, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

If resistance value is incorrect, repair the connector or replace the wiring harness between ECM connector and the EGTS.

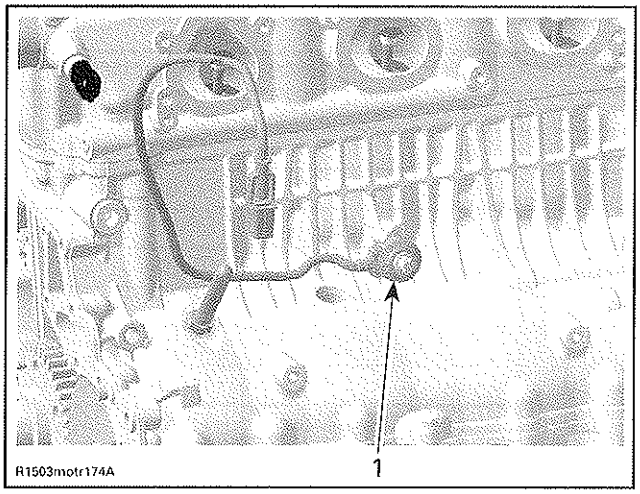
EGTS Replacement

Disconnect EGTS connector and remove EGTS.

Apply Loctite 518 on threads of the EGTS then install.

Replug connector.

KNOCK SENSOR (KS)



1. Knock sensor (KS)

KS Dynamic Test

Using the B.U.D.S. software, monitor the knock sensor using the Faults section.

Start the engine and bring engine RPM above 5000 RPM. If no fault code occurs, the knock sensor is good.

Otherwise, do the following.

Ensure sensor and cylinder head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

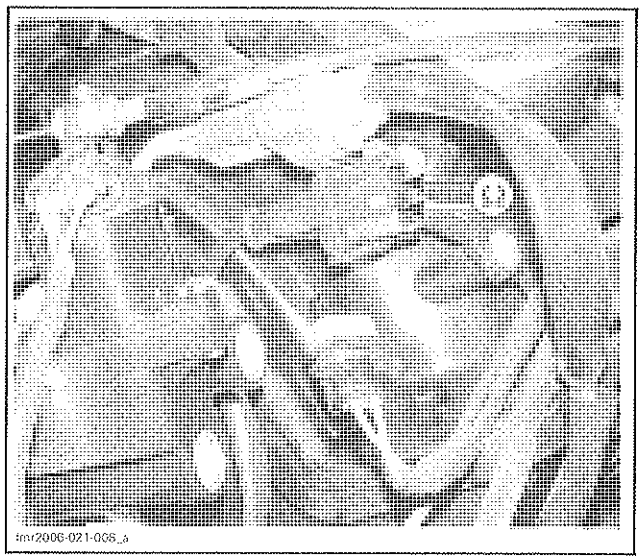
NOTE: It is necessary to remove intake manifold to inspect contact surfaces. Refer to *INTAKE MANIFOLD AND INTERCOOLER* section.

Check the knock sensor resistance.

KS Resistance Test

Disconnect the connector from knock sensor harness.

Using a multimeter, check the resistance between both terminals on the knock sensor.



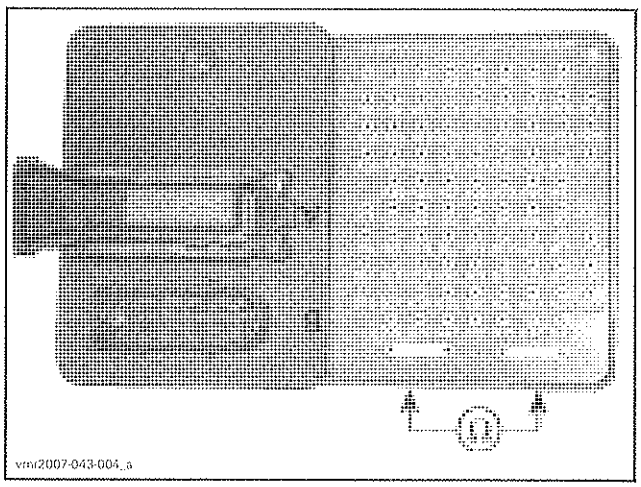
The resistance should be as per the following chart.

If resistance is not good, replace knock sensor.

If resistance is good, reconnect the knock sensor connector and disconnect connector A from ECM.

Using a multimeter and the ECM adapter (P/N 420 277 010), check circuit resistance as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
A-9	A-23	5 MΩ



If wiring harness is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

Otherwise, repair the connector or replace the wiring harness between ECM connector and knock sensor.

KS Replacement

Remove the intake manifold. Refer to *INTAKE MANIFOLD AND INTERCOOLER* in the *ENGINE* section.

Unscrew and remove knock sensor.

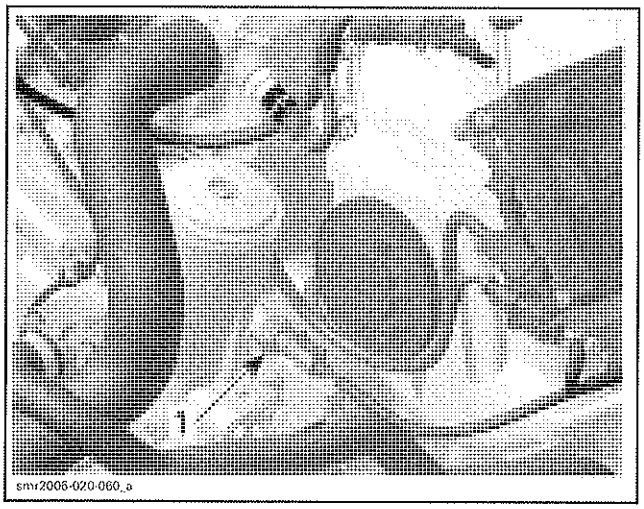
Clean contact surface, apply Loctite 243 in threaded hole then install the new knock sensor.

Torque screw to 24 N•m (18 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

OIL PRESSURE SENSOR (OPS)



TYPICAL
1. OPS

Oil Pressure Test

First, carefully check the condition of the connector terminals. Clean to remove dirt and corrosion that coud affect proper operation of the sensor.

IMPORTANT: Do not apply dielectric grease on terminal.

Before checking the function of the oil pressure sensor, an oil pressure test has to be performed to be sure the oil pressure is not in fault. Refer to *LUBRICATION SYSTEM* in the *ENGINE* section.

When the engine oil pressure tests good but the OIL message in the information center is present and the beeper sounds:

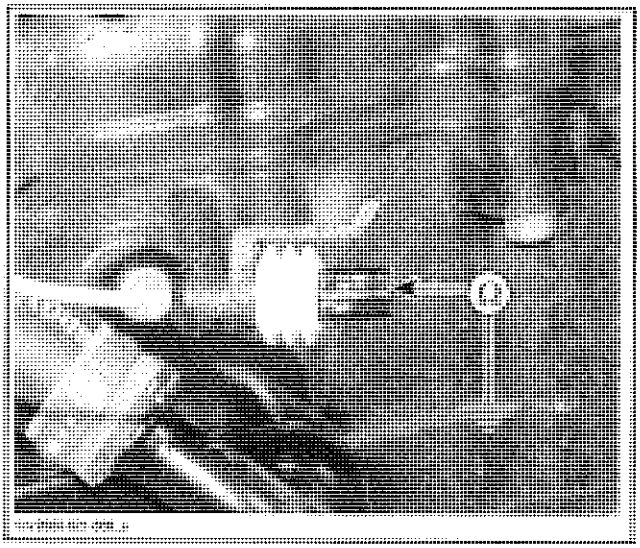
- Ensure OPS connector is plugged to the sensor.
- Check the resistance of the OPS while engine is off and while engine is running.

OPS Resistance Test

Disconnect the connector from the OPS.

Use a multimeter to check the resistance as shown.

OPS CONNECTOR		ENGINE NOT RUNNING	ENGINE RUNNING
PIN		RESISTANCE (Ω)	
1	Engine ground	Close to 0 Ω (normally closed switch)	Infinitely high (OL) when pressure reaches 180 - 220 kPa (26 - 32 PSI)



If resistance values are incorrect, replace OPS.

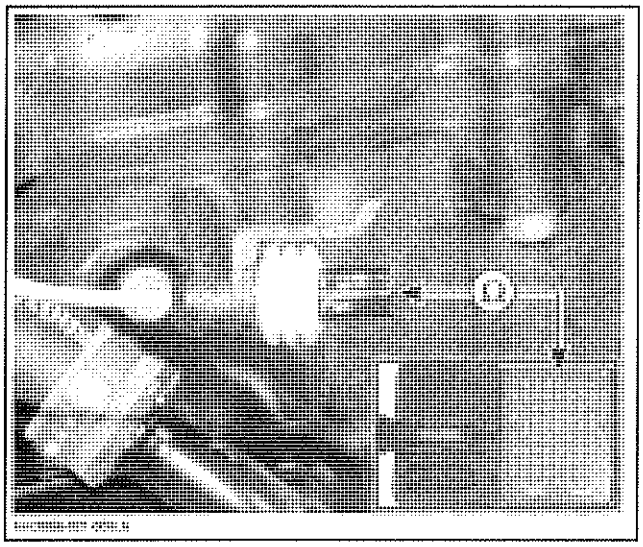
If the values are correct, check the continuity of the wiring harness.

Wiring Harness Continuity Test

Disconnect the ECM connector A from the ECM

Use the ECM adapter (P/N 420 277 010) and a multimeter. Check continuity of OPS circuit as per following table.

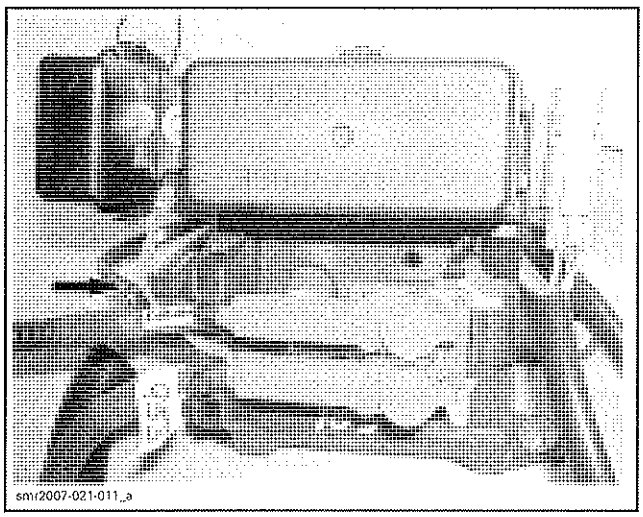
OPS CONNECTOR	ECM	RESISTANCE
Pin 1	Pin A-6	Close to 0 Ω (continuity)



If continuity test failed, repair/replace connector/wiring between ECM connector and OPS.

If continuity test succeeded, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

TOPS SWITCH



When watercraft tips over, that changes the TOPS switch state and signals the ECM to shut down engine by cutting the ignition and the fuel injection.

Test with B.U.D.S.

Check TOPS switch fuse F10 condition.

Use B.U.D.S. to monitor switch state. Look in **Monitoring** tab.

Remove TOPS switch from its bracket. Refer to *REPLACEMENT* below.

Keep switch connected and monitor as follows.

TOPS SWITCH POSITION	TOPS STATE IN B.U.D.S.
Normal upright	OFF
Upside down	ON

If TOPS state is wrong, do the following tests.

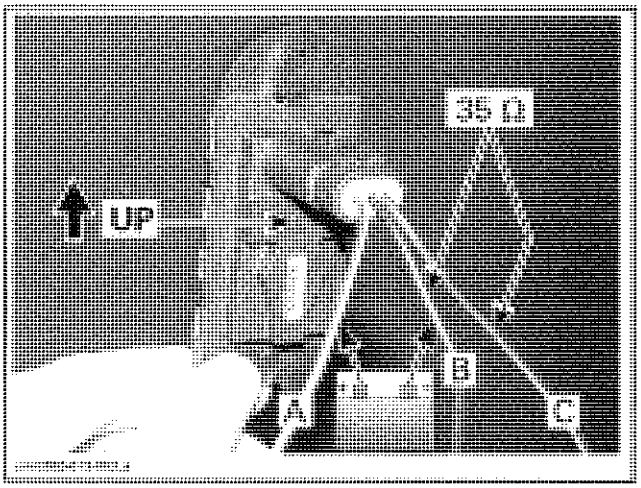
TOPS Switch Resistance Test

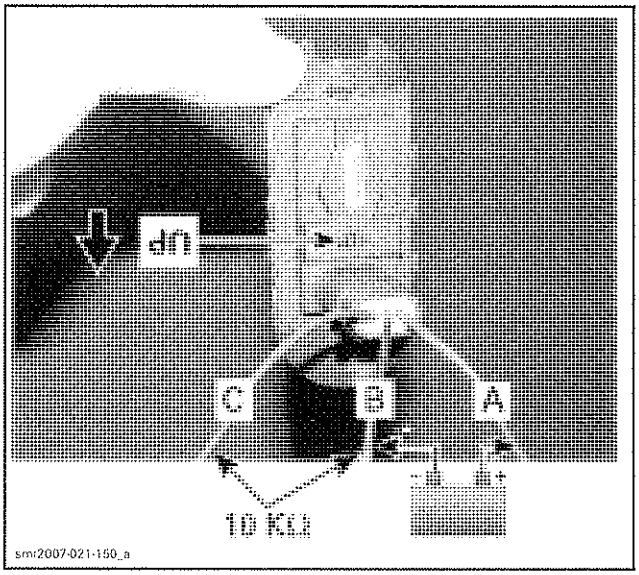
Install a temporary connector with 3 wires to TOPS switch.

Connect wires as shown.

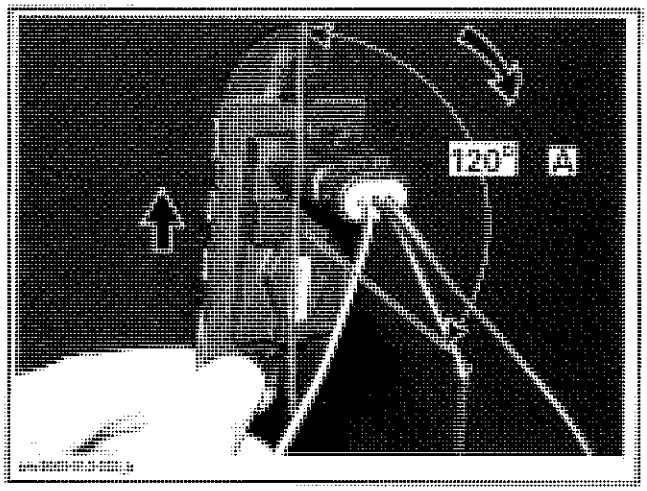
Measure resistance as follows.

SWITCH POSITION	PINS	RESISTANCE
Upright	B and C	Approximately 35 Ω
Upside down		Approximately 10 kΩ



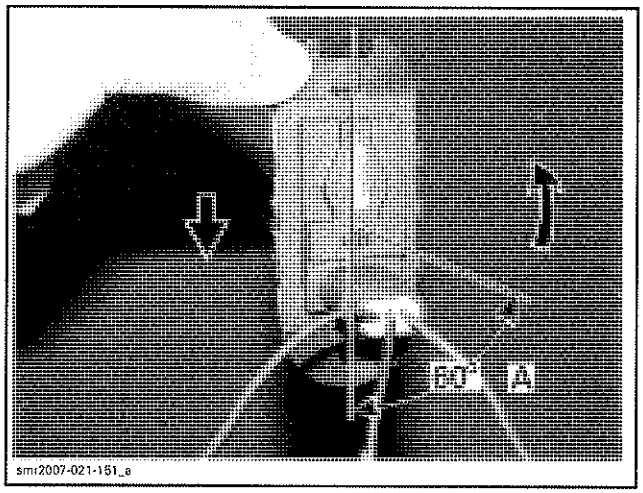


While turning switch upside down, ensure that switch resistance does not change before it reaches 120° ±10 from the vertical axis.



A. No resistance change in this area

From the upside down position, switch resistance should not change before 60° ±10 from the vertical axis.



A. No resistance change in this area

If any test failed, replace switch.

If switch tested good, carry out the *TOPS VOLTAGE TEST.*

TOPS Voltage Test

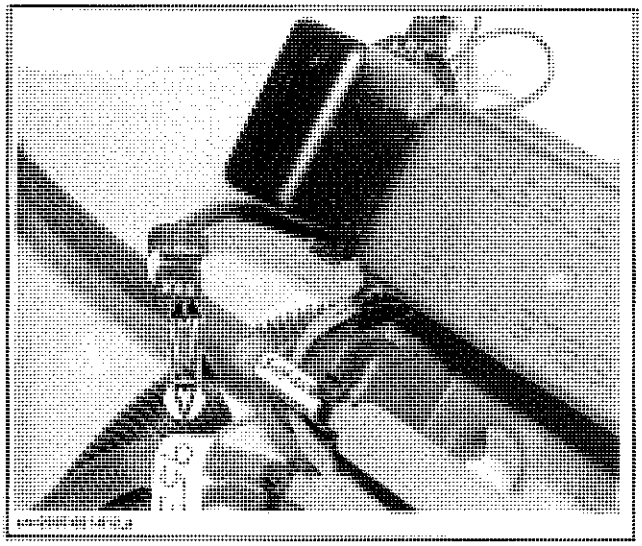
Test voltage at the switch.

Disconnect TOPS switch connector.

Install key to DESS post.

Read voltage as follows.

TOPS SWITCH CONNECTOR	VOLTAGE
Pins A and B	Battery voltage

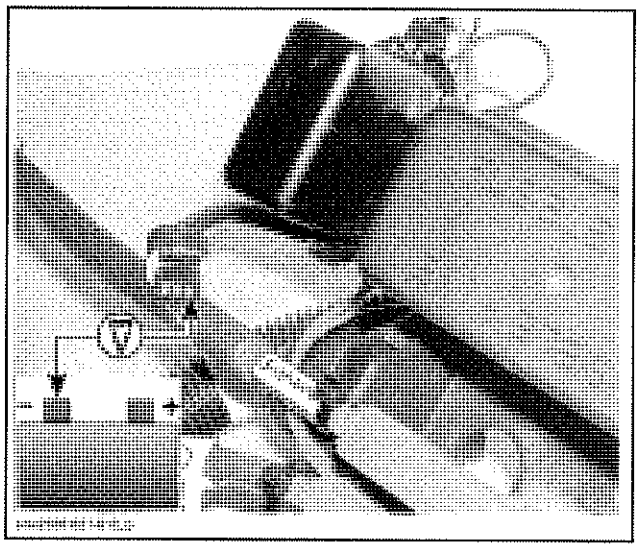


If battery voltage is not read, carry out the *POWER SUPPLY CIRCUIT TEST.*

Power Supply Circuit Test

Read voltage as follows.

TOPS SWITCH CONNECTOR	VOLTAGE
Pin A and battery ground	Battery voltage

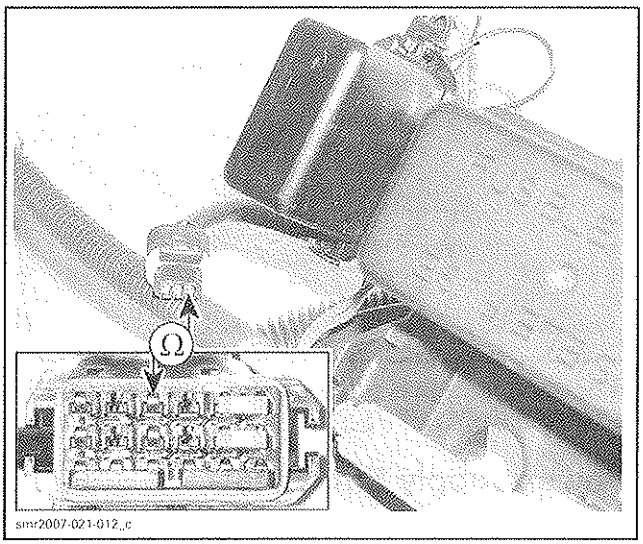


If there is voltage, problem is in the ground circuit. Carry out the *GROUND CIRCUIT TEST.*

If there is no voltage, check continuity of supply circuit as follows.

NOTE: To probe terminal of relay fuse box, remove relay.

RELAY FUSE BOX	TOPS SWITCH CONNECTOR	RESISTANCE
Terminal A4	Pin A	Close to 0 Ω (continuity)

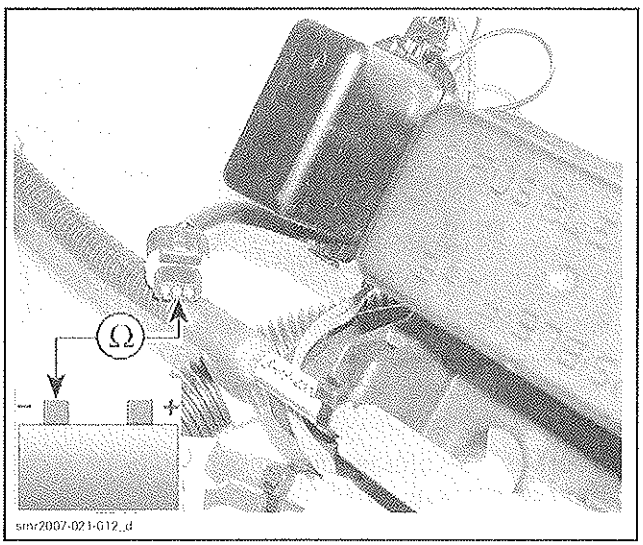


If continuity does not test good, repair/replace wiring/connector.

Ground Circuit Test

Check circuit continuity as follows.

TOPS SWITCH CONNECTOR	RESISTANCE
Pin B and battery ground	Close to 0 Ω

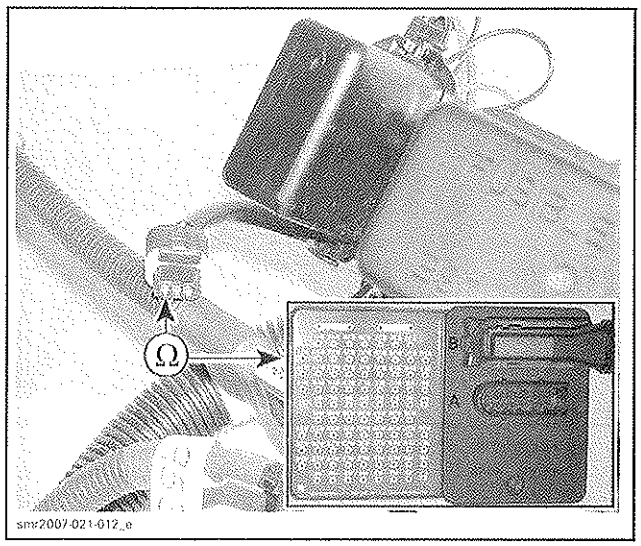


If continuity does not test good check ground connections or repair/replace wiring/connector.

Signal Circuit Test

Use the ECM adapter (P/N 420 277 010) and a multimeter. Check signal circuit resistance as per following table.

TOPS SWITCH CONNECTOR	ECM ADAPTER	RESISTANCE
Pin C	Pin B-9	Close to 0 Ω (continuity)



If continuity does not test good, repair/replace wiring/connector.

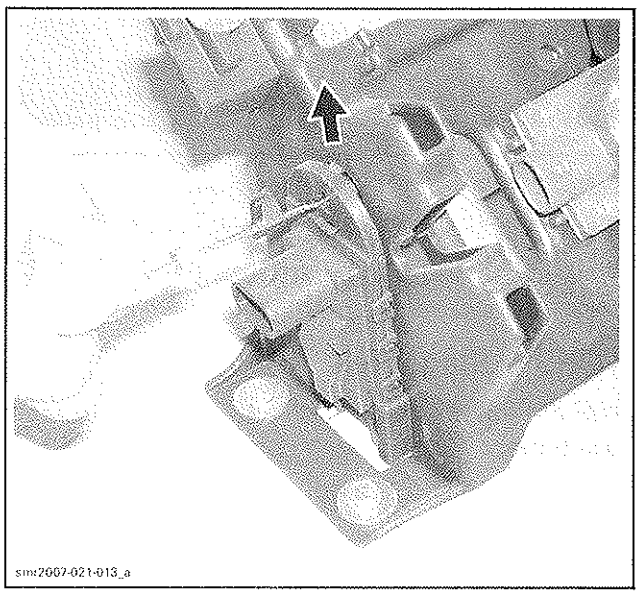
If it tests good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

Reinstall relay.

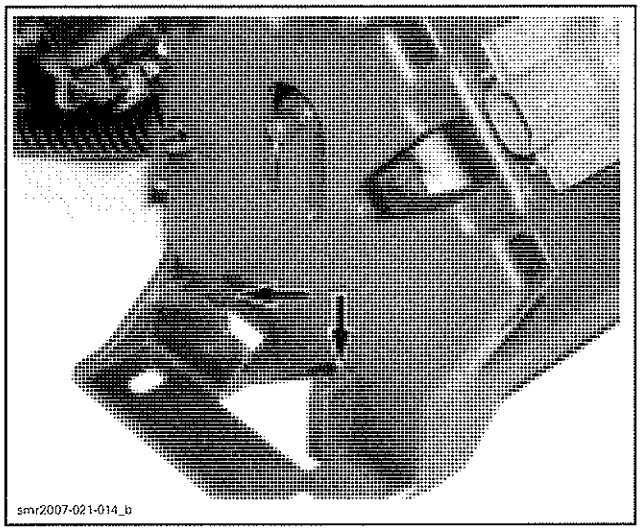
TOPS Switch Replacement

Disconnect TOPS switch connector.

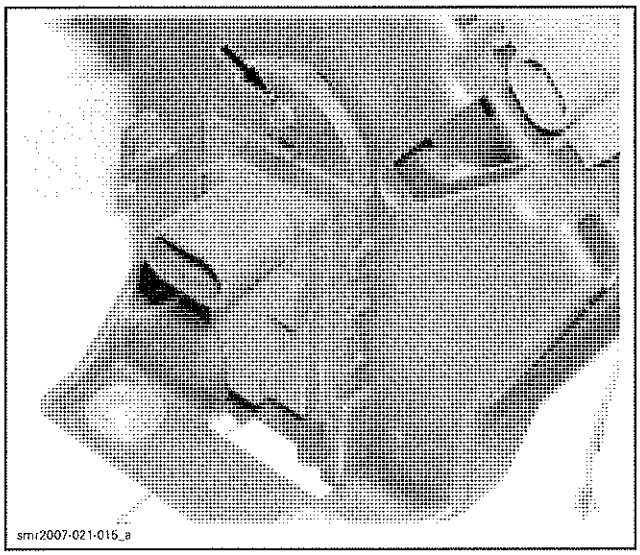
Using a small screwdriver, push small the pin and hold while sliding switch out.



At installation, ensure to properly insert switch in its sliders.



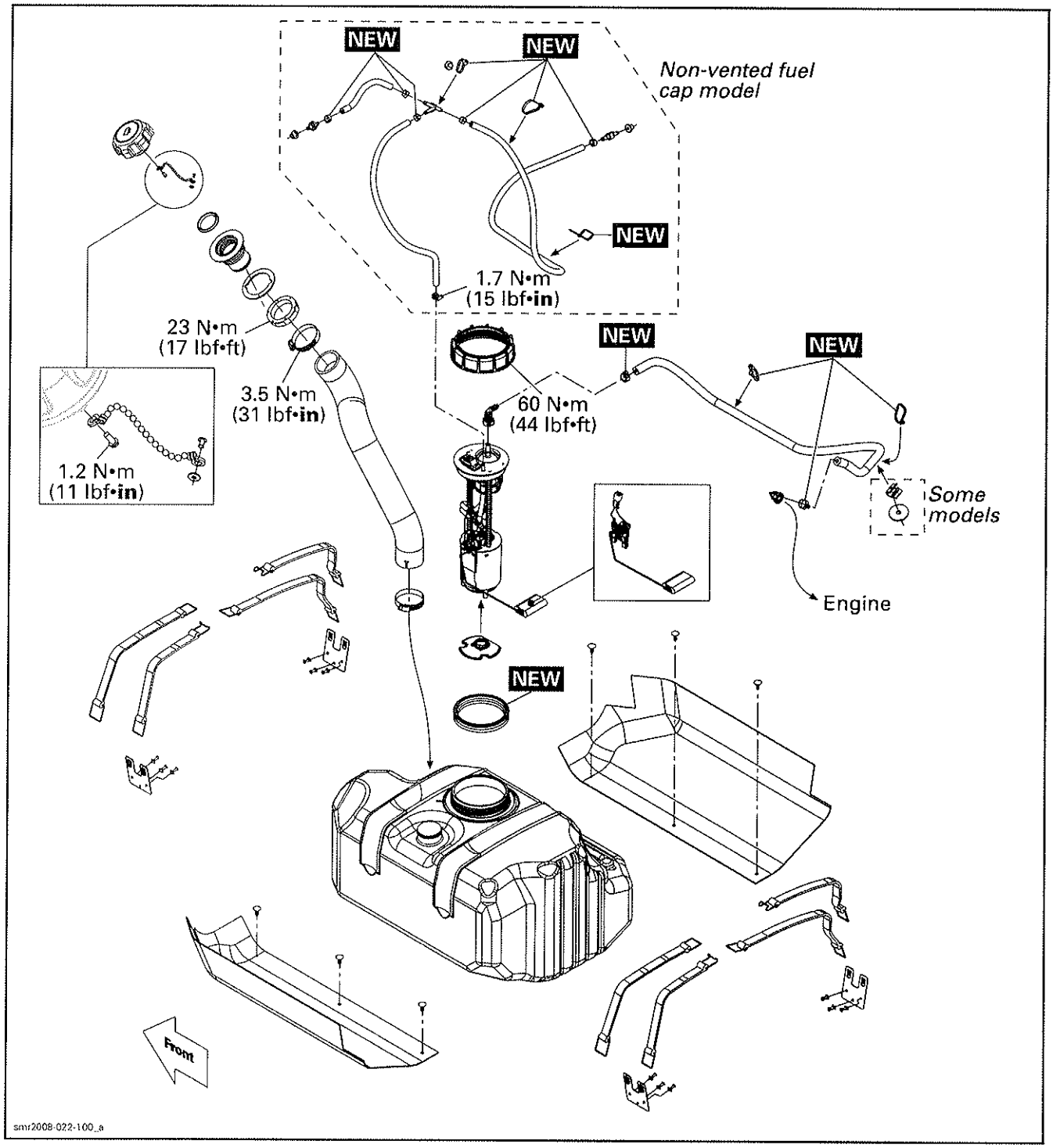
Ensure switch properly locks in place.



FUEL TANK/FUEL PUMP

SERVICE TOOLS

Description	Part Number	Page
Oetiker pliers	295 000 070	264
small hose pincher	295 000 076	260
ECM adapter	420 277 010	269
vacuum/pressure pump	529 021 800	260–262
leak test kit (fuel/oil)	529 033 100	260
fuel pressure gauge	529 035 709	263
Fluke 115 multimeter	529 035 868	268
T-fitting	529 036 023	263
fuel pump module socket	529 036 125	271
vented cap test adapter	529 036 141	262



GENERAL

⚠ WARNING

A watercraft engine equipped with a fuel injection system requires greater operating pressures than one equipped with a carburetor. Prior to disconnecting a fuel hose or removing a fuel system component, follow the recommendations described in this section.

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on a pressurized fuel system. Wear safety glasses.

⚠ WARNING

Always disconnect battery prior to working on the fuel system. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use B.U.D.S. software to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the bilge. Before reconnecting battery, make sure there is no fuel odor present and if so, vent the bilge area thoroughly.

⚠ WARNING

Whenever repairing the fuel system, always check for water infiltration in the fuel tank. Replace any damaged, leaking or deteriorated fuel line. When the repair is completed, ensure that hoses and connections from fuel rail to the fuel pump are properly secured. Then, pressurize the fuel system. After carrying out a fuel pump pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

⚠ WARNING

The fuel pump is energized for a few seconds each time the safety lanyard is installed, it builds fuel system pressure very quickly. Prior to installing the safety lanyard on the DESS post, ensure there are no disconnected or damaged fuel lines that may leak fuel in the vehicle. A high pressure leak test must be carried outwhenever a fuel system component has been disconnected.

NOTE: Before removing a fuel hose or fuel vent hose, take note of its routing for proper reinstallation.

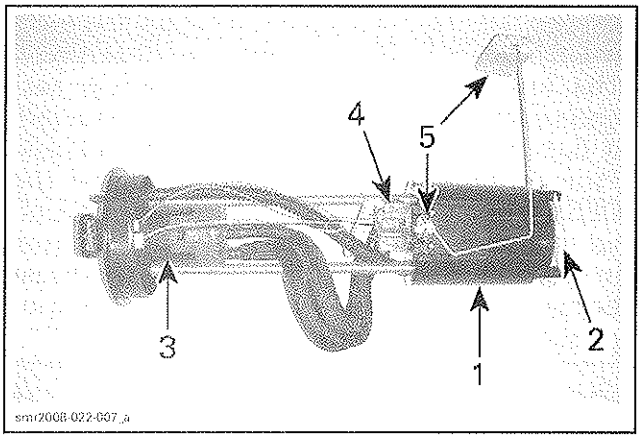
⚠ WARNING

Ensure wires and hoses are routed and secured away from any vibrating, rotating, moving or hot components or sharp edges. Use appropriate shields and fastening devices as required.

SYSTEM DESCRIPTION

The fuel tank/fuel pump system is comprised of:
- A fuel tank
- A fuel pump module mounted inside the fuel tank
- A fuel vent system, and
- A variety of hoses.

The fuel pump module is basically comprised of:
- An electric fuel pump mounted inside a canister type pump reservoir
- A lower inlet filter
- An upper outlet filter
- A pressure regulator
- A float type fuel level sensor.



FUEL PUMP MODULE
1. *Fuel pump reservoir*
2. *Lower inlet filter*
3. *Upper outlet filter*
4. *Pressure regulator*
5. *Float type fuel level sensor*

Fuel Pump Operation

When the pump is in operation, it draws fuel into the canister through a lower inlet filter and a disk type valve.

The pressurized fuel is pushed through an upper outlet filter to the engine injector rail.

Excess fuel pressure generated by the pump is routed from the upper filter back to the pump canister reservoir by a pressure regulator mounted on the pump reservoir cover.

When the safety lanyard (DESS key) is installed, the electrical system is powered. The fuel pump will come on for approximately 2 seconds to pressurize the fuel injector rail in preparation for the engine start.

The ECM supplies the ground signal to turn on the fuel pump motor.

The pressure regulator will ensure appropriate but not excessive fuel pressure is supplied to the injector system.

When the ECM receives a signal to shut down the engine (start/stop switch, safety lanyard, or T.O.P.S. sensor) it removes the fuel pump ground signal.

Fuel Level Indication

An electric float type fuel level sensor is mounted on the side of the fuel pump reservoir. As the float moves with changing fuel levels, it varies a resistance that changes the voltage signal sent to the ECM, this signal is representative of the fuel level.

The ECM interprets the fuel level voltage signal it receives from the fuel level sensor. It then sends a signal through the communication bus to the information center to display fuel quantity levels, or a low fuel warning message when required.

The ECM will also supply the ground signal to the beeper which produces the appropriate beep signal to warn the driver of a low fuel condition.

The fuel level sensor resistance is at its lowest value when the fuel tank is full, and at its highest value when the tank is empty.

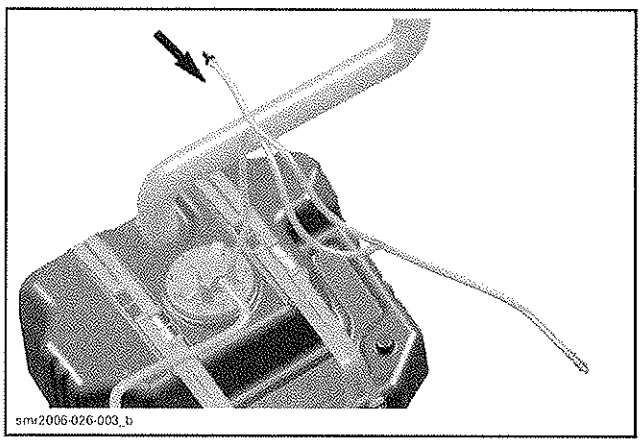
Refer to the *GAUGE/FUSES* section for fuel level sensor testing procedures.

Fuel Tank Vent System Operation

Models with Separate Vent System Components

The fuel tank is equipped with a vent system that provides over pressure relief and negative pressure relief of the fuel tank.

Air can enter the fuel tank at all times through the vent system **inlet check valve**. This prevents negative pressure within the fuel tank which could cause fuel starvation.

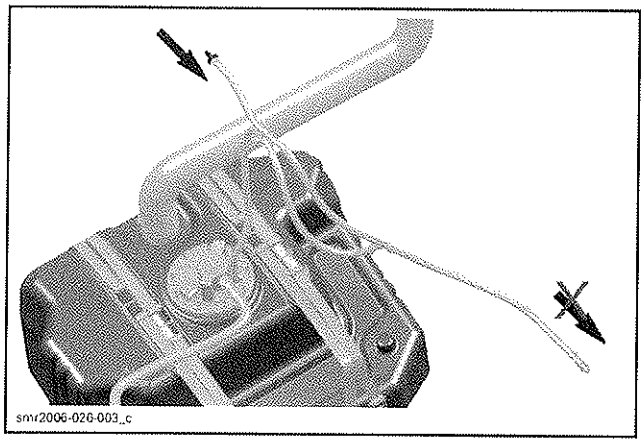


TYPICAL – AIR ENTERS THROUGH INLET CHECK VALVE

The vent inlet check valve also prevents fuel from flowing out through the inlet of the vent system.

The **pressure relief valve** prevents fuel tank overpressure.

Air cannot leave the tank through the pressure relief valve until the internal tank pressure reaches maximum operating pressure.



TYPICAL – PRESSURE RELIEF VALVE OPENS AT MAXIMUM OPERATING PRESSURE

If the pressure in the fuel tank builds up and exceeds 3.5 kPa (.5 PSI), the **pressure relief valve** opens and lets the excess pressure evacuate through the vent system OUTLET.

⚠ WARNING

If the pressure relief valve is stuck, the pressure in the fuel system will build up and may cause fuel to leak in the engine compartment.

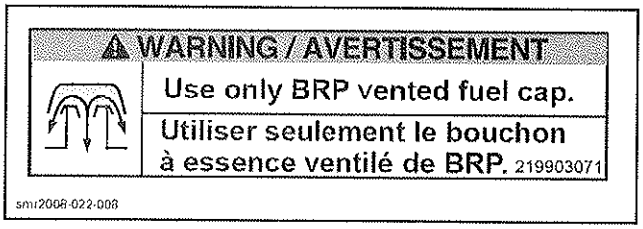
NOTE: If the fuel tank cap is replaced on a fuel tank with separate vent system components, the vented cap may be installed instead of the non-vented type. This will only double the vent protection of the fuel tank.

Models with a Vented Fuel Tank Cap

On later 2008 models, the vent system composed of separate valves and hoses, has been replaced by a vented fuel tank cap which replaces the more complex vent system of earlier models.

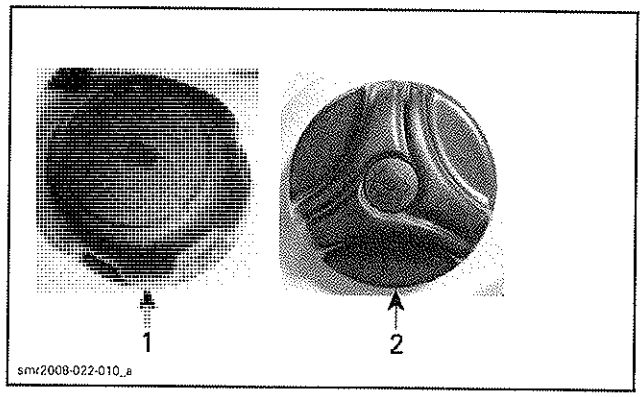
It can be identified by the following items:

– Decal identifying use of a vented fuel tank cap next to filler neck.



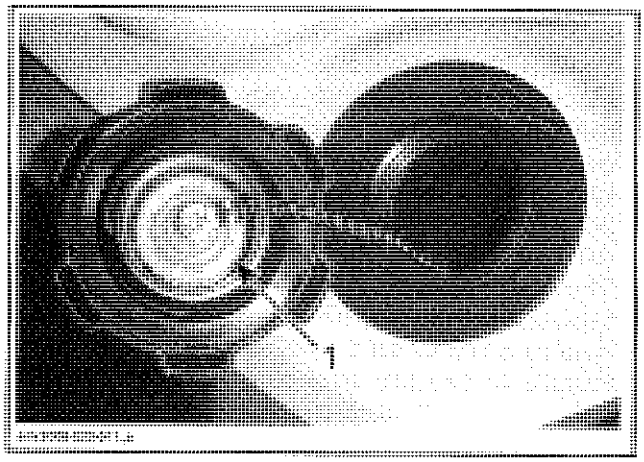
DECAL FOR FUEL TANK WITH VENTED CAP

– The vented cap has a different look



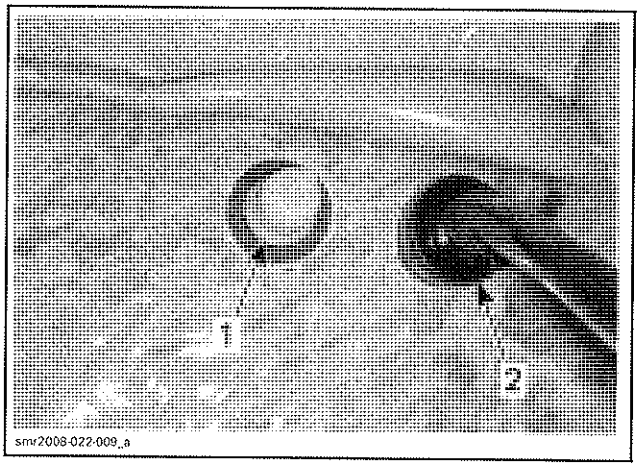
1. *Vented fuel tank cap*
2. *Non-vented fuel tank cap*

– Entire vent system is incorporated within the fuel tank cap.



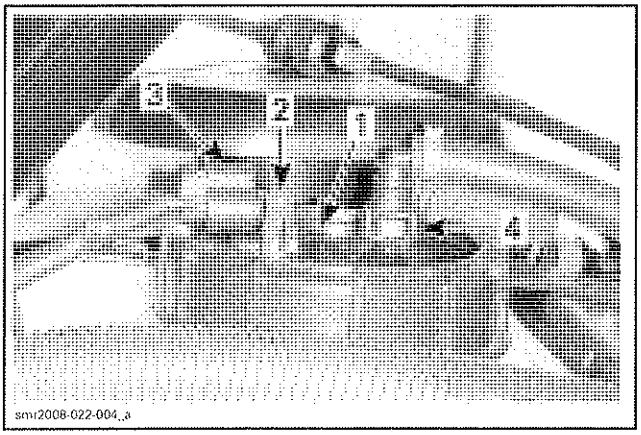
1. *Inlet check valve/pressure relief valve*

– Vent inlet and outlet ports on the hull are blanked off.



1. *Fuel system outlet vent blanked off*
2. *Battery vent*

– Fuel tank vent outlet fitting on the fuel pump module is capped.



MODELS WITHOUT VENT LINES
1. *Fuel pump module*
2. *Fuel tank vent fitting capped*
3. *Fuel pump module electrical connector*
4. *Fuel pump outlet quick disconnect fitting*

⚠ WARNING

On models equipped with the vented fuel tank cap, if the cap requires replacement, it must be replaced with an approved vented cap of the same type supplied by BRP. Use of any other cap, or use of the non-vented cap will not allow proper venting of the fuel tank. The result may be engine fuel starvation, fuel tank overpressure, or fuel leaks which could lead to a fire or an explosion.
Failure to comply with this warning may result in equipment damage, serious injury, or death.

NOTE: BRP is the only supplier of the vented fuel tank cap. There is no equivalent vented fuel tank cap available on the market today.

INSPECTION

FUEL TANK LEAK TEST

Models with Separate Vent System Components

NOTE: The fuel tank leak test also tests for leaks in the vent system hoses.

Fill up fuel tank, reinstall and tighten fuel cap.

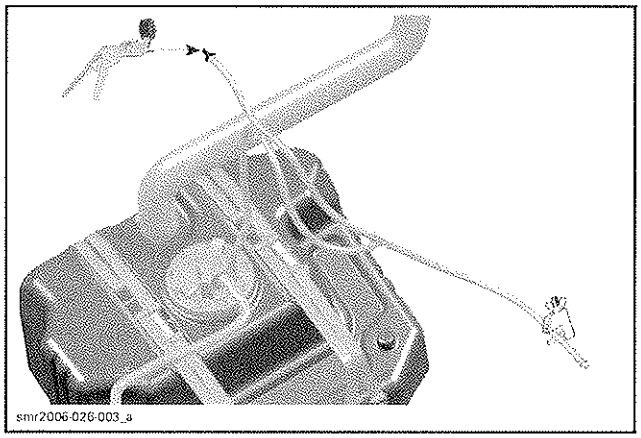
Open the front storage compartment cover and remove the storage bin.

Install a small hose pincher (P/N 295 000 076) on the vent outlet line near the pressure relief valve.

Remove the vent inlet check valve from the vehicle body.

Using the vacuum/pressure pump (P/N 529 021 800), pressurize the fuel tank through the vent line (INLET side) as per following table.

FUEL TANK LEAK TEST (NON VENTED CAP)	
PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	10 minutes



TYPICAL – FUEL TANK LEAK TEST

If the pressure drops, locate fuel leak(s), repair/replace leaking component(s) and carry out a new fuel system leak check to validate repair and ensure there are no other leaks.

To locate a leak, check for a fuel smell or leaking fuel.

If a fuel smell is detected but a leak is not visible, spray a soapy water solution on components to ease locating the leak(s); bubbles will indicate leak location(s).

CAUTION: When the fuel system leak test is complete, thoroughly rinse all components of the soapy water solution with clear water. A soapy water residue may cause premature deterioration and must be rinsed away.

⚠ WARNING

If a leak is found, do not start the engine. Wipe off any fuel that leaked and ventilate the hull thoroughly to remove any accumulated fuel vapors. Do not use electric powered tools on watercraft unless system has passed the leak test.

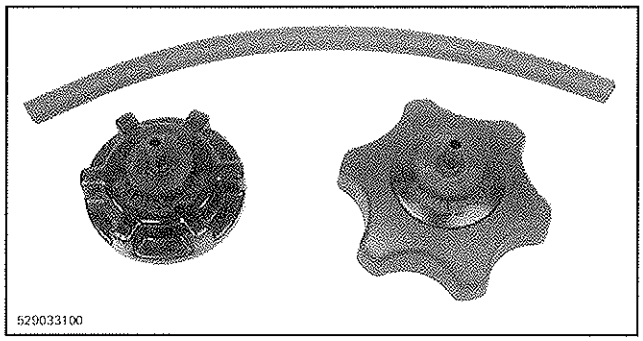
NOTE: Do not release air pressure within fuel tank. Carry out the *CHECK VALVE AND PRESSURE RELIEF VALVE TEST* to ensure proper vent system operation.

Models with Vented Fuel Tank Cap

Fill up fuel tank.

Install the fuel tank leak test cap from the leak test kit (fuel/oil) (P/N 529 033 100) onto the fuel tank filler neck.

NOTE: The LH cap in the following illustration is the test cap required for this test.



LEAK TEST KIT (FUEL OIL)

Open the front storage compartment cover and remove the storage bin.

Using the vacuum/pressure pump (P/N 529 021 800), pressurize the fuel tank through the fuel tank leak test cap as per following table.

FUEL TANK LEAK TEST (VENTED CAP)	
PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	10 minutes

If the pressure drops, locate fuel leak(s), repair/replace leaking component(s) and carry out a new fuel system leak check to validate repair and ensure there are no other leaks.

To locate a leak, check for a fuel smell or leaking fuel.

If a fuel smell is detected but a leak is not visible, spray a soapy water solution on components to ease locating the leak(s); bubbles will indicate leak location(s).

CAUTION: When the fuel system leak test is complete, thoroughly rinse all components of the soapy water solution with clear water. A soapy water residue may cause premature deterioration and must be rinsed away.

⚠ WARNING

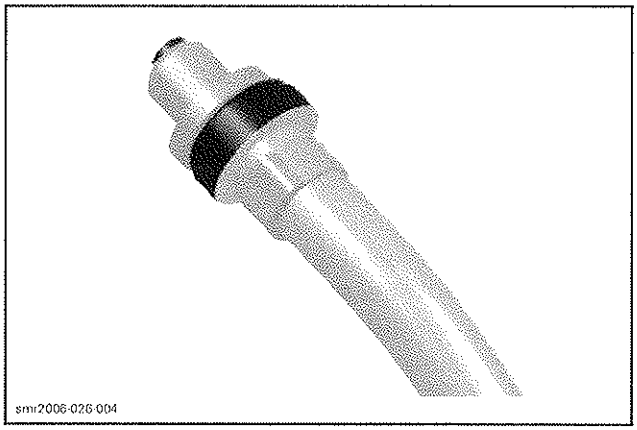
If a leak is found, do not start the engine. Wipe off any fuel that leaked and ventilate the hull thoroughly to remove any accumulated fuel vapors. Do not use electric powered tools on watercraft unless system has passed the leak test.

Release air pressure in fuel tank.

Check Valve and Pressure Relief Valve Test

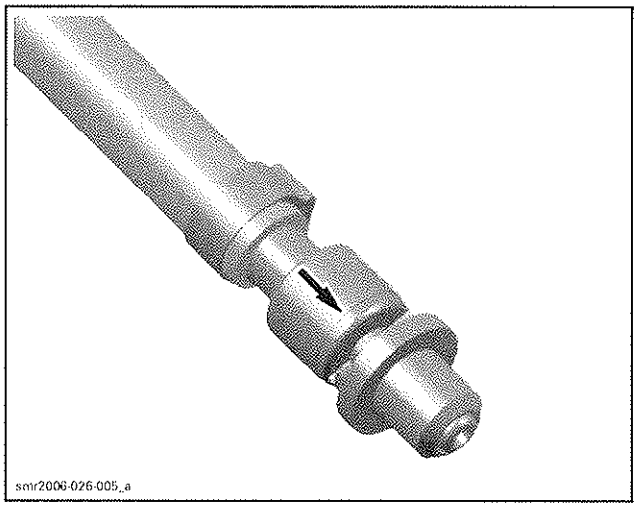
Early 2008 Models with Separate Vent System Components

Ensure fuel vent inlet check valve is installed with the black side facing in towards the vent line as illustrated.



FUEL VENT INLET CHECK VALVE INSTALLED WITH BLACK SIDE FACING IN WARDS TOWARDS THE VENT LINE

Ensure the pressure relief valve is installed with the arrow on the valve facing outwards, away from vent line as illustrated.

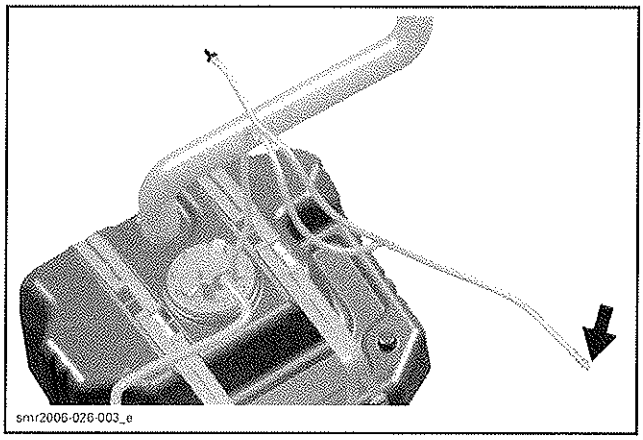


PRESSURE RELIEF VALVE INSTALLED WITH ARROW ON VALVE FACING OUTWARDS AWAY FROM VENT LINE

Pressure Relief Valve Test

With fuel tank still pressurized from the previous fuel tank leak test, carry out the following procedure:

When removing the hose pincher from the fuel tank vent outlet line, alternately touch and release the end of the pressure relief valve. You should feel pressurized air flowing out indicating the relief valve is working.



TYPICAL – TEST FOR AIR FLOWING OUT WHEN REMOVING HOSE PINCHER

Using the pressure/vacuum pump, increase fuel tank pressure until the pressure relief valve opens.

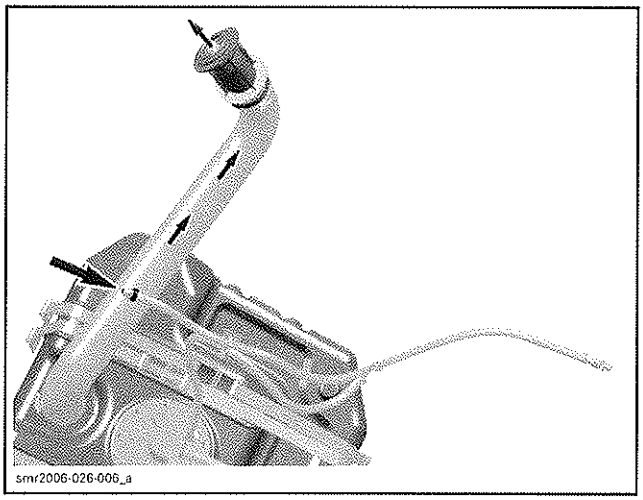
NOTE: Pressure relief valve should open when the fuel tank pressure is between 2.76 to 7.6 kPa (.4 to 1.1 PSI) preventing fuel tank overpressure. This validates pressure relief valve operation.

Remove fuel tank cap.

NOTE: You should here remaining air pressure within fuel tank escape as fuel cap seal is loosened.

Inlet Check Valve Test

Blow low pressure air into fuel tank through vent system inlet check valve. Air must flow freely through inlet check valve and out fuel tank filler neck.



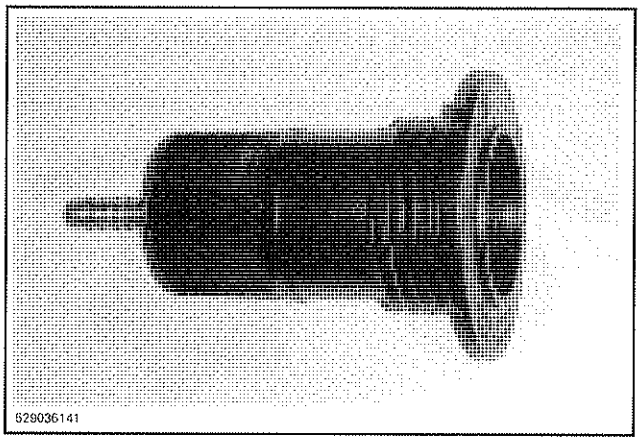
Reinstall vent inlet check valve in its grommet.

Remove all tools and install any removed parts.

Late 2008 Models with Vented Fuel Tank Cap

Inlet Check Valve Function Test

Install the vented fuel tank cap onto the vented cap test adapter (P/N 529 036 141).



VENTED CAP TEST ADAPTER

Set the vacuum/pressure pump (P/N 529 021 800) to the vacuum function and connect it to the opposite end of the test adapter.

Squeeze the vacuum/pressure pump handle several times to draw air in through the fuel tank vent cap.

Air should be drawn in freely and vacuum pressure indication on vacuum pump should remain at zero. If vacuum pressure rises, replace the fuel tank vented cap.

Pressure Relief Valve Function Test

Set the vacuum/pressure pump (P/N 529 021 800) to the pressure function.

Apply pressure to the vented cap test adapter and observe the pressure rise.

When pressure in the adapter has reached 1.38 to 12.4 kPa (0.2 to 1.8 PSI), the pressure relief valve should open preventing a further increase in pressure.

If pressure increases above specification, replace the vented fuel tank cap.

FUEL SYSTEM HIGH PRESSURE LEAK TEST

⚠ WARNING

A high pressure leak test must be carried out before starting the engine anytime a fuel system component has been disconnected for maintenance, or replacement.

Visually inspect fuel system to ensure all fuel system connections are installed. Lightly pulling on hoses at each connection will ensure they are properly locked at the quick disconnects, and secured to each fitting.

Install safety lanyard, this will turn on the fuel pump for a few seconds and pressurize the high pressure fuel system. **Do not start engine at this time.**

Check for fuel odor and visually inspect hoses, fittings and components for leaking fuel.

If a leak is detected, repair or replace the leaking component and carry out a high pressure leak test after the repair.

If no leak is found, engine can be started.

FUEL PUMP PRESSURE TEST

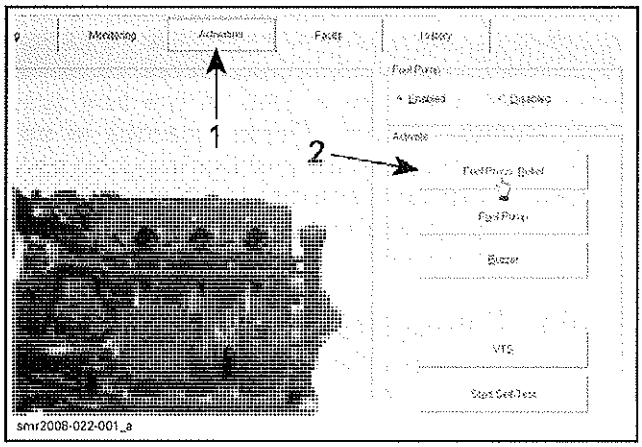
Before proceeding to the pressure test ensure the battery is fully charged. Battery voltage must be over 12 volts.

Connect to the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Select the **Read Data** button.

Select the **Activation** tab.

On the RH side of the activation page, select **Fuel Press Relief** button to release the fuel pressure in the system.



RELEASING FUEL SYSTEM PRESSURE
1. *Activation page tab*
2. *Fuel Press Relief button*

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and tests for leaks in the system.

Open front storage compartment cover.

Remove the storage basket (if so equipped).

Remove glove box for access to fuel pump. Refer to *BODY* section.

Cut locking tie retaining the aft end of the front hull ventilation tube, detach it from its forward retaining clip, and remove it for access to the fuel pump.

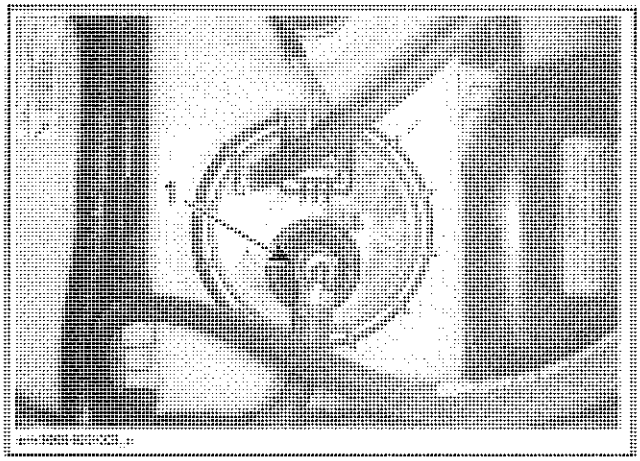
Ensure hoses and fittings are not leaking. Repair any leak.

Ensure there is enough gas in fuel tank.

⚠ WARNING

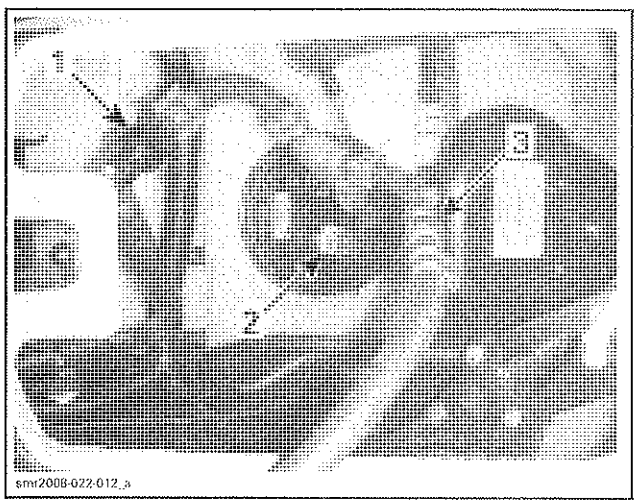
The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release any residual pressure. Wipe off any fuel spillage inside bilge.

Disconnect the pressure outlet hose from the fuel pump.



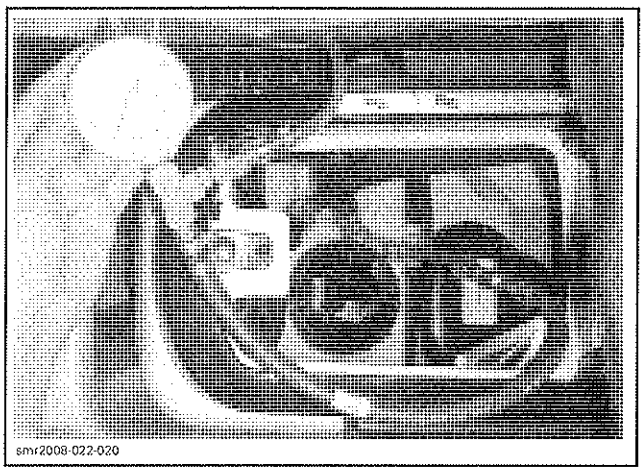
1. *Pressure outlet hose to disconnect*

Install thefuel pressure gauge (P/N 529 035 709) and the T-fitting (P/N 529 036 023) between disconnected hose and fuel pump fitting (inline installation).



1. *Fuel pump quick disconnect to T-fitting*
2. *T-fitting to fuel pump*
3. *Fuel pressure gauge hose to T–fitting*

Install safety lanyard and observe fuel pressure. Do not crank engine. Repeat twice. Release pressure in system using B.U.D.S. between each test so that gauge returns to zero (0).



FUEL PUMP PRESSURE TEST

MODELS	FUEL PRESSURE (when installing safety lanyard)
4-TEC naturally aspirated	290 - 310 kPa (42 - 45 PSI)
4-TEC supercharged intercooled	386 - 414 kPa (56 - 60 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is good, fuel pump and pressure regulator are functioning correctly.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If leak occurs while installing safety lanyard on DESS post and fuel rail is not leaking, then replace fuel pump module.

A slow pressure drop indicates leakage either from a fuel injector or from the fuel pressure regulator in the fuel pump module. To check fuel injectors for leaks, refer to the *ELECTRONIC FUEL INJECTION (EFI)* section. If injectors are not leaking, then replace fuel pump.

Release fuel pressure in system using B.U.D.S. as described in the beginning of this procedure.

Remove pressure gauge and reinstall fuel hose on fuel pump module.

⚠ WARNING

Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall all removed parts.

PROCEDURES

FUEL HOSES AND OETIKER CLAMPS

Fuel Hose Inspection

Inspect all fuel hoses for wear, kinks, cracks or any other types of damages.

Inspect all clamps for tightness.

Fuel Hose Replacement

When replacing fuel lines on all SEA-DOO watercraft models, be sure to use "A1" type hose approved by BRP for pressurized hoses, and "B1" type hose approved by BRP for ventilation hoses. These hoses available from BRP meet our system requirements and will ensure continued proper and safe operation.

⚠ WARNING

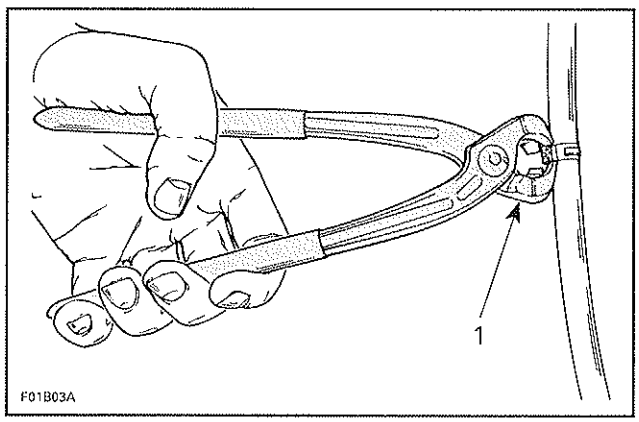
Use of fuel lines other than those recommended by BRP may compromise fuel system integrity.

⚠ WARNING

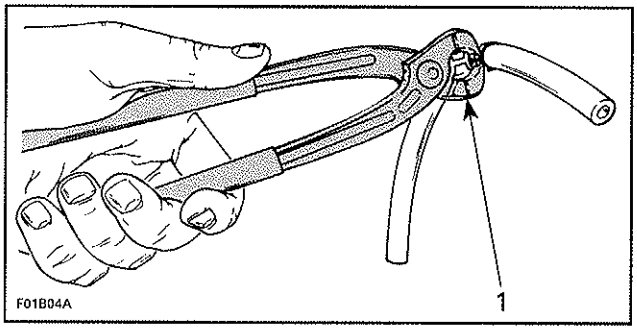
Whenever removing a hose in the fuel system, always use new Oetiker clamps at assembly. Then, validate fuel tightness by performing a fuel tank leak test or a high pressure leak test as applicable.

Oetiker Clamp Replacement

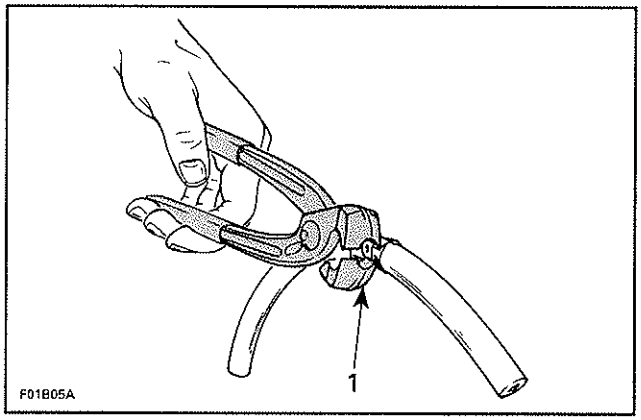
To secure or cut Oetiker clamps on fuel lines, use Oetiker pliers (P/N 295 000 070).



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

FUEL FILTER

Fuel Filter Removal

NOTE: The lower fuel filter on the fuel pump module does not require replacement under normal operating conditions. Replace only if permanently clogged or damaged. The fuel pump assembly must be removed from the fuel tank to access the lower fuel filter.

Remove fuel pump. Refer to *FUEL PUMP* in this section.

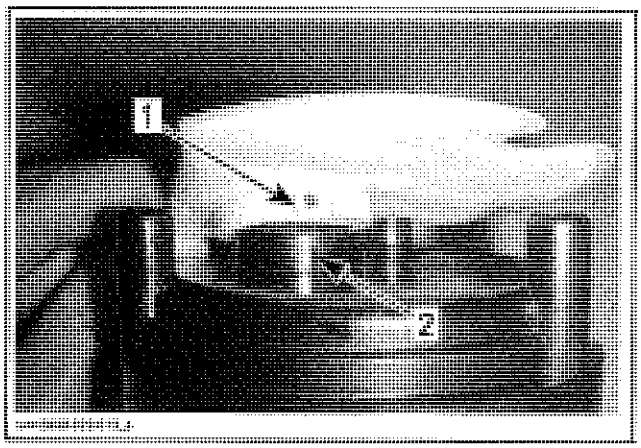
⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position. Turn fuel pump module upside down in an appropriate container to drain it of all fuel prior to performing any maintenance on the assembly.

Turn fuel pump upside down.

NOTE: Take note of lower filter alignment with pump reservoir housing for reinstallation.

Using a small flat screwdriver, pry up the filter locking tabs (one each side) to release it from its locking pins on the fuel pump reservoir housing.



1. Fuel filter locking tab (x2)
2. Filter locking pin (x2)

Pull filter off fuel pump reservoir housing.

Fuel Filter Inspection

Check if particles are present in fuel filter. If so, replace it.

Fuel Filter Installation

Align new filter with pump reservoir housing.

Press new filter on by hand. Ensure it is fully seated and locked onto the pump reservoir housing.

Reinstall fuel pump as per procedure in this section.

Carry out a *FUEL SYSTEM HIGH PRESSURE LEAK TEST* as described in this section.

FUEL TANK

Fuel Tank Inspection

Inspect fuel tank retaining straps for wear, cracks or any other damages.

Inspect fuel tank for wear caused by any abnormal contact or rubbing with other component(s).

Disconnect fuel filler hose.

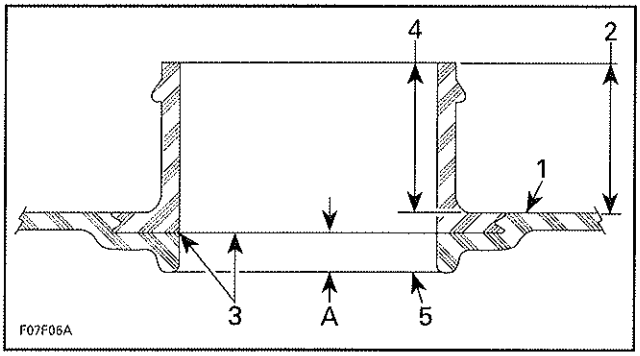
Inspect fuel tank filler hose for wear, cracks or other damages.

Visually inspect the inside and outside of the fuel tank filler necks for crack(s). If crack(s) are found, replace fuel tank.

With your fingers, feel the inside and outside surfaces of fuel tank, especially near the filler neck.

Flex fuel tank necks to ensure there are no hidden cracks.

NOTE: A fuel tank is comprised of 2 components: the tank and the filler neck. The necks are injection molded and the tank is then blow molded over the necks. During the molding process, a small molding seam may appear on the inner side of the necks at approximately 4 mm (5/32 in) from the base of the neck. It is a normal situation to have a molding seam and it should not be confused with a crack.



1. *Tank upper surface area*
2. *Inspect outer upper surface at filler neck*
3. *Normal molding seam*
4. *Inspect upper surface area inside filler neck*
5. *Base of filler neck*

A. *Approx. 4 mm (5/32 in)*

Install filler hose.

NOTE: Always ensure that filler hose retaining clamps are properly positioned and tightened to 3.5 N•m (31 lbf•**in**).

Fuel Tank Removal

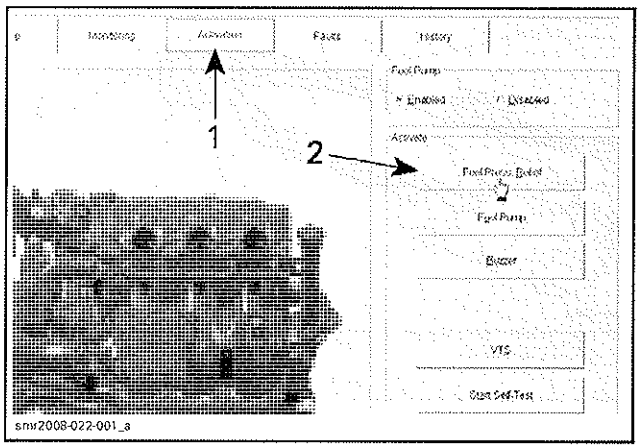
Remove seat and glove box, refer to *BODY* section.

Connect to the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Select the **Read Data** button.

Select the **Activation** tab.

On the RH side of the activation page, select **Fuel Press Relief** button to release the fuel pressure in the system.



RELEASING FUEL SYSTEM PRESSURE
1. *Activation page tab*
2. *Fuel Press Relief button*

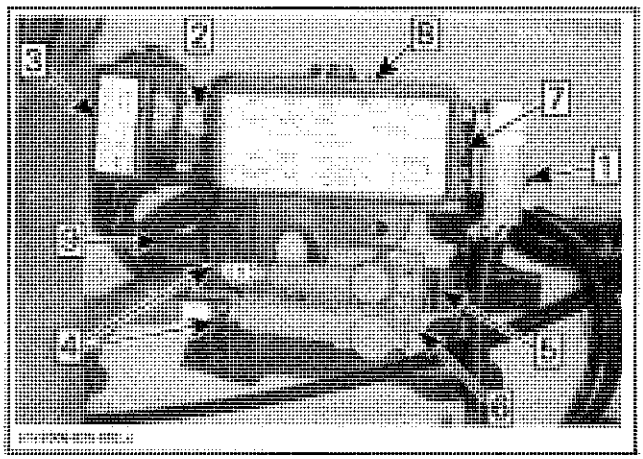
Siphon fuel tank.

Disconnect and remove battery, refer to the *CHARGING SYSTEM* section.

Remove engine, refer to the *ENGINE REMOVAL/INSTALLATION* section for procedures.

Models with Battery and Fuse Box Support Ahead of Engine

Remove the following items from the fuse box support:



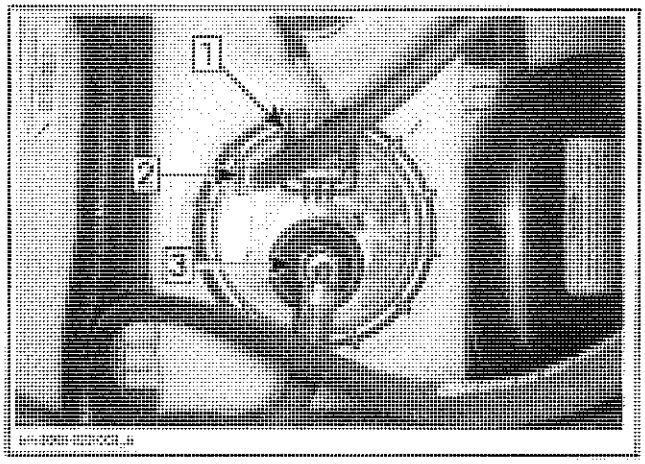
Step 1: Remove diagnostic connector and storage cap
Step 2: Remove screw securing relay fuse box
Step 3: Remove relay fuse box from support
Step 4: Cut locking ties securing starter solenoid cables
Step 5: Press in on solenoid retaining tab to release
Step 6: Pull out solenoid and set aside
Step 7: Release main fuse box retaining tabs (one each side) using a small flat screwdriver
Step 8: Pull out main fuse box and set aside
Step 9: Pull up on TOPS switch to remove

With the above items removed from the fuse box support, cut the locking ties securing the wiring harness to the back of the support, then move the harness and components aside as required to allow removal of fuel tank.

NOTE: On some models, it will be necessary to completely remove the fuse box support by drilling out the four retaining rivets.

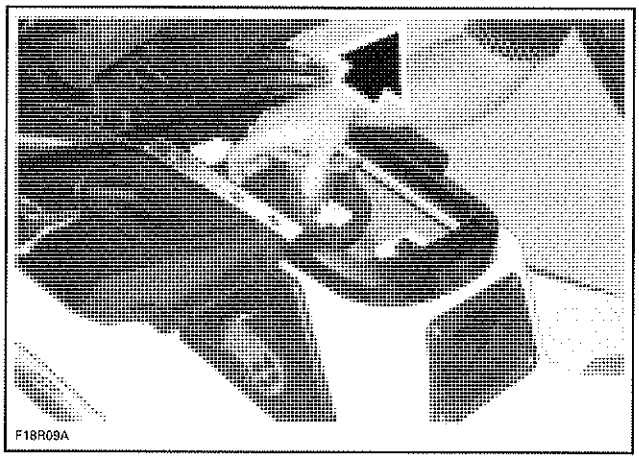
All Models

Through the glove box opening, disconnect fuel pump connections.



1. *Harness connector*
2. *Vent hose (non-vented cap models)*
3. *Pump pressure outlet quick disconnect*

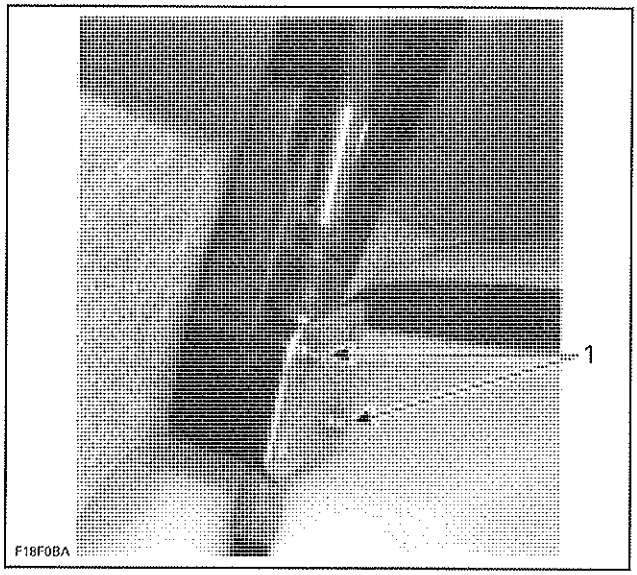
Carefully remove fuel pump from fuel tank, refer to *FUEL PUMP* in this section for details.



TYPICAL

Detach reverse system cable from its support by removing the two plate retaining screws and pulling the cable from the support.

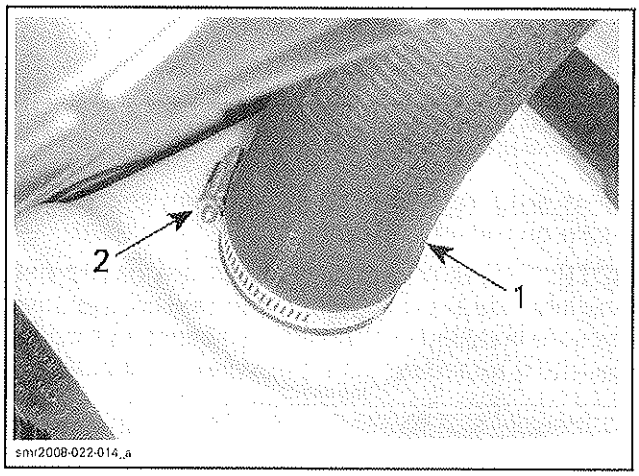
CAUTION: When removing reverse system cable from its support, it is important to note position of cable in support for reinstallation. If cable is not reinstalled correctly, reverse system will not function properly.



1. *Locking plate screws (reverse cable support)*

Open front storage cover and remove storage bin.

Disconnect fuel tank filler hose.



1. *Filler hose at fuel tank*
2. *Retaining clamp*

Cut locking ties as required to release wiring harness from air intake silencer, fuel tank retaining strap and reverse cable support.

NOTE: Take note of wire harness, hose and cable routing for proper reinstallation. Also note method used for securing with locking ties.

Detach fuel tank retaining straps.

Remove air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

Remove fuel tank from the vehicle.

Inspect hull and rubber pad for wear.

⚠ WARNING

Ensure that fiberglass is not exposed.

Fuel Tank Installation

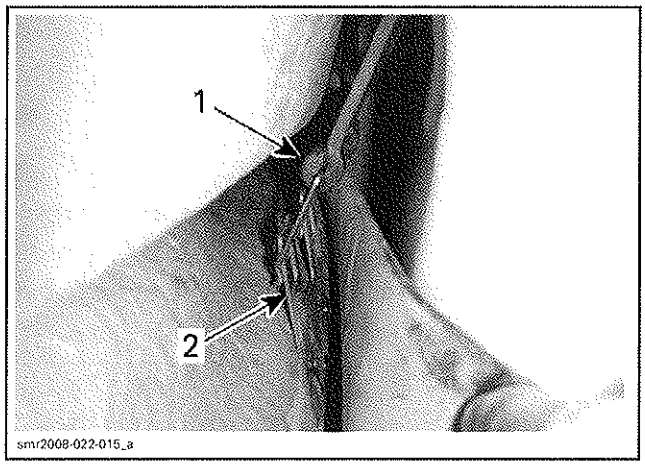
NOTE: Apply torque values as specified in the exploded view.

Ensure rubber pads are properly positioned.

Insert fuel tank in hull.

Position air intake silencer on fuel tank.

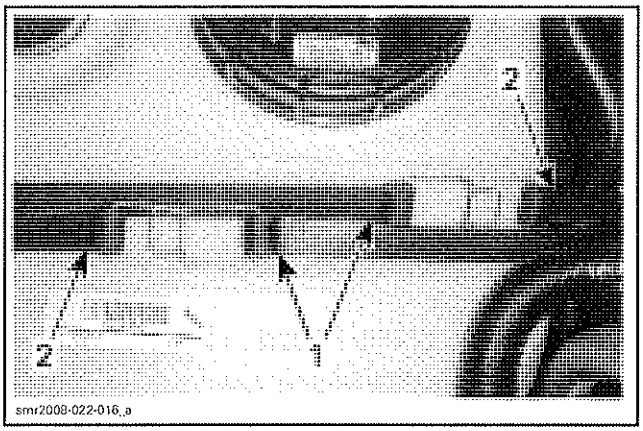
Place fuel tank retaining strap ends in anchoring clips (bottom) and in guides of air box. Use tape to hold straps on the top of fuel tank.



1. *Fuel tank retaining strap*
2. *Clip anchor securing strap to hull*

Insert long retaining strap ends in short strap hooks on top of fuel tank.

NOTE: Fuel tank retaining straps are paired one long and one short together, and two consecutive pairs are installed in opposing directions to stagger the metal retainers. See following illustration.



REAR FUEL TANK RETAINING STRAPS ILLUSTRATED (FRONT STRAPS SIMILAR)
1. *Long retaining straps*
2. *Short retaining straps*

Properly secure wire harness, cables and hose as prior to removal using appropriate locking ties.

Install fuel tank filler hose and torque retaining clamps, refer to exploded view for torque value.

Reinstall all other removed parts in the reverse order of removal.

NOTE: Refer to installation instructions specific to each component for installation details, torques, special tools and service products required for proper installation.

When vehicle reassembly is complete, carry out a *FUEL TANK LEAK TEST* and a *FUEL SYSTEM HIGH PRESSURE LEAK TEST* as described in this section.

FUEL PUMP

Fuel Pump Testing

NOTE: See also the fuel system diagnostic flow chart in the *TROUBLESHOOTING* section.

Connect safety lanyard to DESS post, the fuel pump should run for 2 seconds to build up fuel system pressure.

If the pump does not function, check fuse 6.

Ensure ECM is powered-up (information center comes on). If the information center does not come on, check fuse 16. If fuse 16 is good, refer to the *ENGINE MANAGEMENT SYSTEM* section.

If information center comes on, remove safety lanyard and carry out a *FUEL PUMP INPUT VOLTAGE TEST*.

Fuel Pump Input Voltage Test

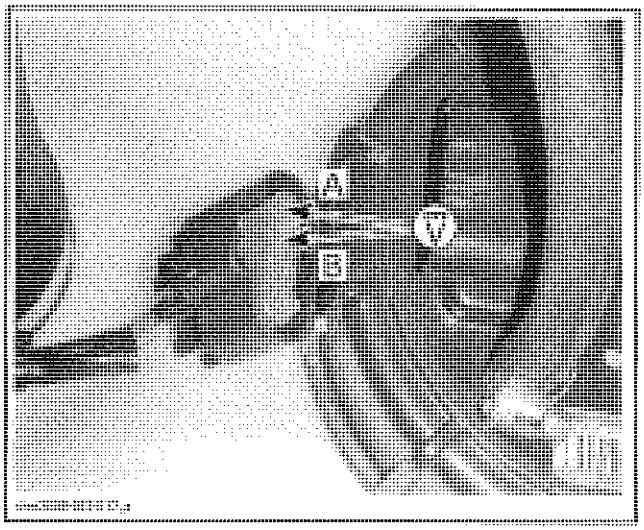
Disconnect fuel pump harness connector.

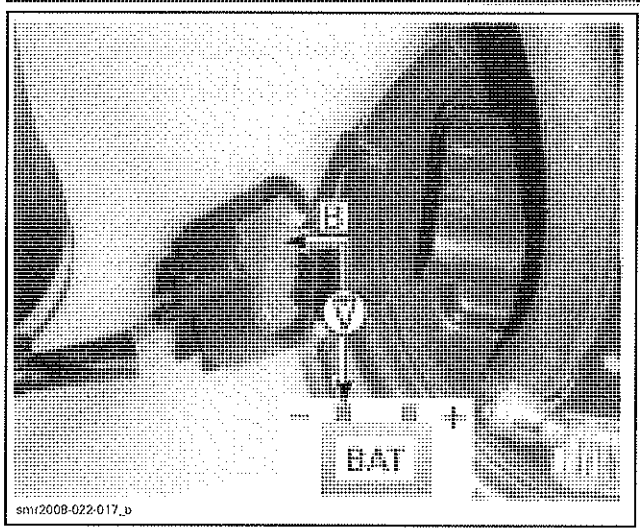
Set Fluke 115 multimeter (P/N 529 035 868) to Vdc.

Install safety lanyard.

Test for pump input voltage at fuel pump harness connector terminals as per following table.

FUEL PUMP INPUT VOLTAGE TEST		
FUEL PUMP HARNESS CONNECTOR		VOLTAGE
Pin B (+)	Pin A (-)	Battery voltage
Pin B (+)	Battery ground	





When installing safety lanyard, you should read battery voltage for approximately 2 seconds (then voltage will drop to approximately 11 V).

If battery voltage is read, the problem can be in the fuel pump or in the harness connector. Repair or replace as required.

If battery voltage is read to battery ground but not to pin A, test continuity of fuel pump ground wire to ECM. See *FUEL PUMP HARNESS CONTINUITY TEST* in this section.

If battery voltage is not read, test continuity of pump input voltage wire to relay fuse box. See *FUEL PUMP HARNESS CONTINUITY TEST* in this section.

Fuel Pump Harness Continuity Test

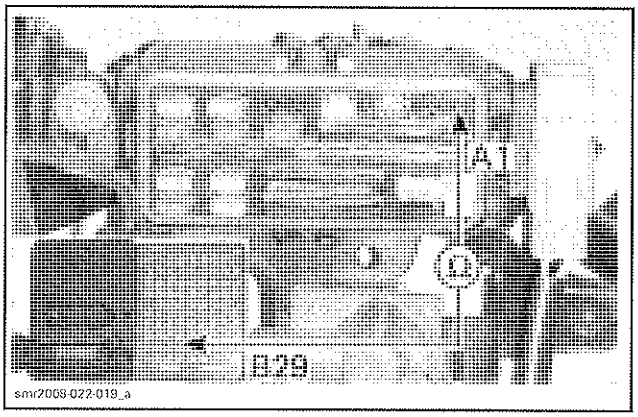
Reconnect the fuel pump harness connector.

Remove fuse 6 in main fuse box.

Remove ECM connector B and install it on the ECM adapter (P/N 420 277 010).

Set multimeter to Ω setting and test pump wiring continuity as per following tables.

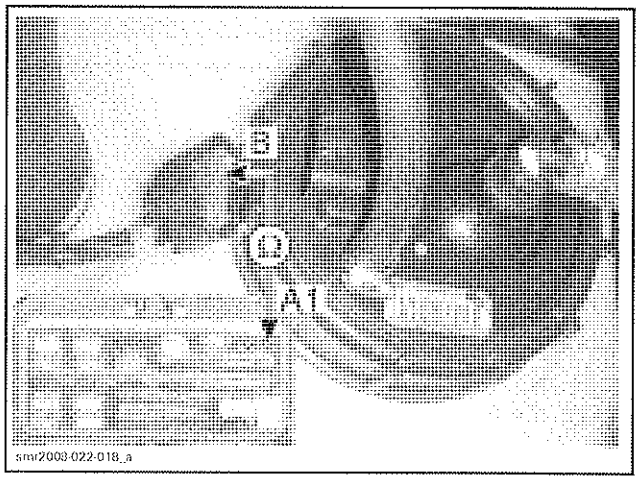
HARNESS CONTINUITY TEST THROUGH FUEL PUMP		
PROBE		RESISTANCE @ 20°C (68°F)
Main fuse box pin A 1	ECM connector B pin B 29	Approx. 12 Ω

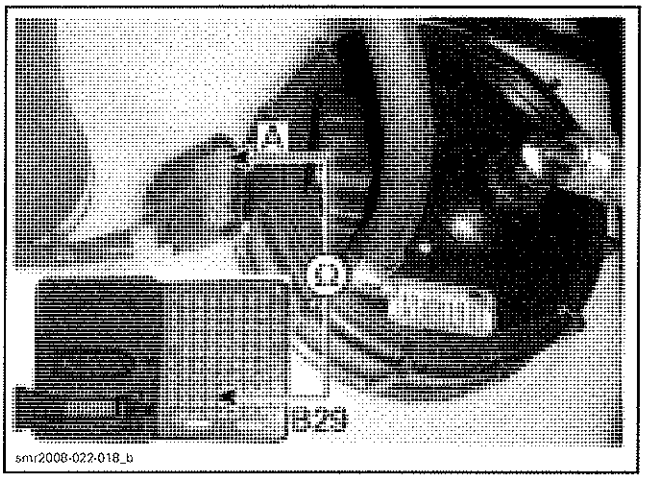


HARNESS CONTINUITY TEST THROUGH FUEL PUMP

If you obtained approximately 12 ohms, the fuel pump and its wiring harness are good.

FUEL PUMP HARNESS CONTINUITY TEST (WIRING ONLY)		
PROBE		RESISTANCE @ 20°C (68°F)
Pump harness connector pin B	Main fuse box pin A 1	Close to 0 Ω (continuity)
Pump harness connector pin A	ECM connector B pin B 29	





Repair or replace wiring as required.

Fuel Pump Removal

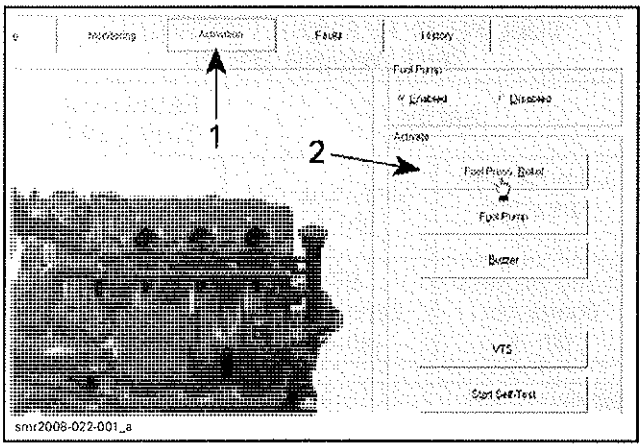
Remove seat, refer to the *BODY* section.

Connect to the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Select the **Read Data** button.

Select the **Activation** tab.

On the RH side of the activation page, select **Fuel Press Relief** button to release the fuel system pressure.



RELEASING FUEL SYSTEM PRESSURE
1. *Activation page tab*
2. *Fuel Press Relief button*

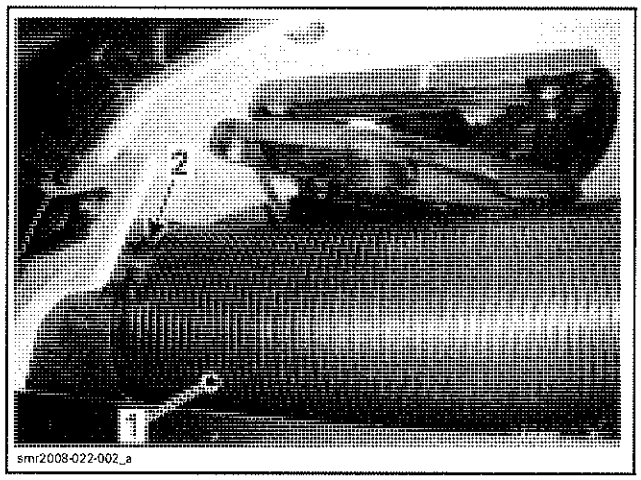
Disconnect the negative battery terminal, refer to *CHARGING SYSTEM* section.

Open front storage compartment cover.

Remove the storage basket (if so equipped).

Remove glove box, refer to the *BODY* section.

On certain models, cut locking tie securing the aft end of the front hull ventilation tube(s), detach it from its forward retaining clip and remove it for ease of access to the fuel pump.

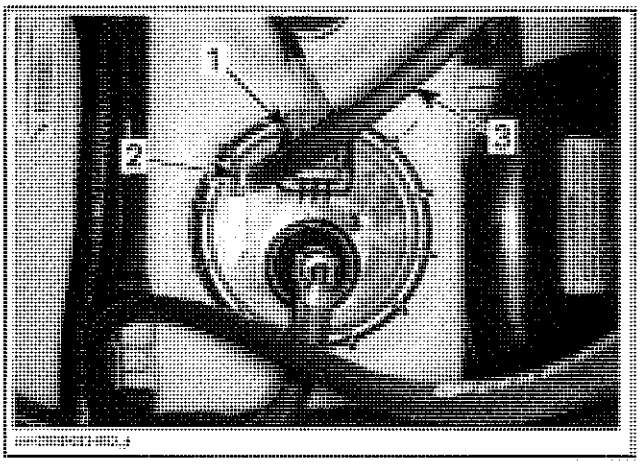


1. *Front hull ventilation tube*
2. *Locking tie*

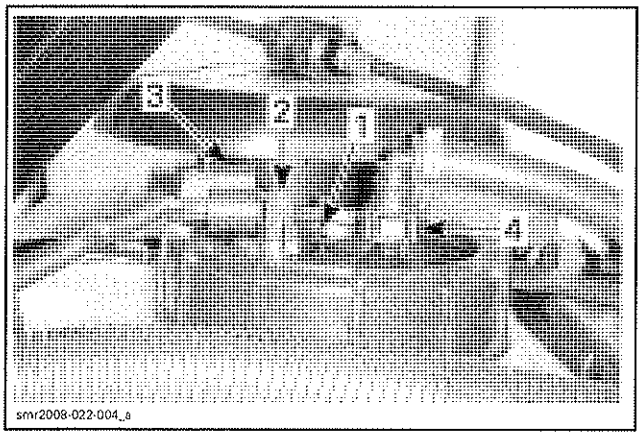
Disconnect fuel pump electrical connector.

Disconnect the vent tube from the fuel pump (as applicable).

NOTE: Some models use a fuel tank vented cap instead of a vent system comprised of separate components. On these models, the vent fitting on the fuel pump module will be capped.

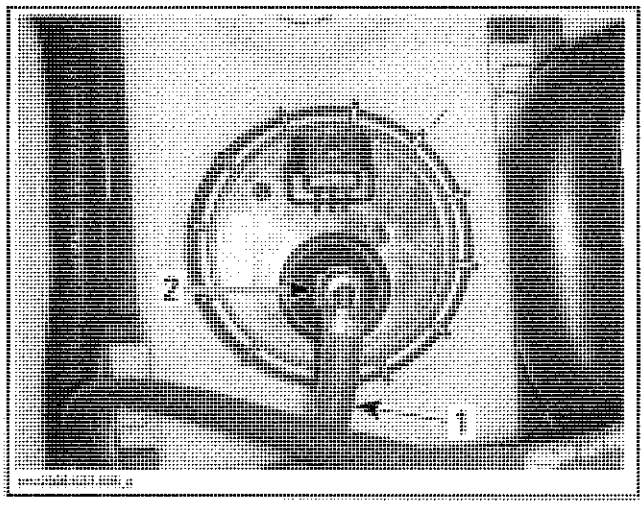


1. *Harness connector*
2. *Vent hose (non-vented cap models)*
3. *Pump pressure outlet quick disconnect*



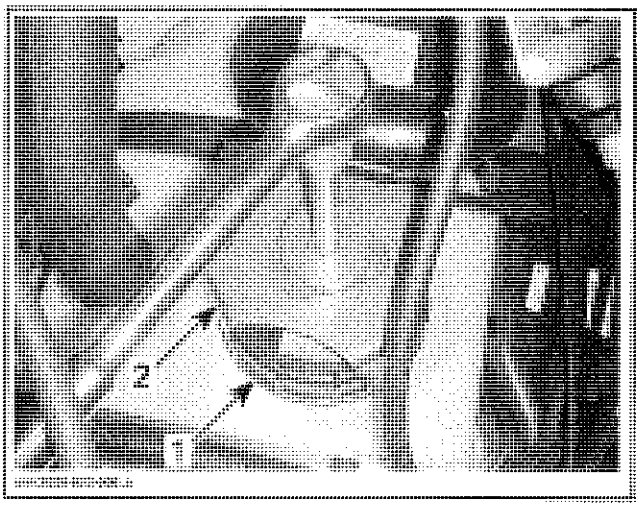
MODEL WITHOUT VENT LINES
1. *Fuel pump module*
2. *Fuel tank vent fitting capped*
3. *Fuel pump module electrical connector*
4. *Fuel pump outlet quick disconnect fitting*

Wrap shop rags around the base of the fuel pump pressure hose fitting, the press on the quick disconnect fitting release button and remove the pump pressure hose from the fuel pump fitting.



1. *Fuel pump pressure hose*
2. *Quick disconnect fitting*

Reach in through the glove box opening and remove the fuel pump retaining nut using the fuel pump module socket (P/N 529 036 125).



1. *Fuel pump retaining nut*
2. *Fuel pump module socket*

CAUTION: While pulling out the fuel pump module, pay attention to the corrugated tubes and fuel sensor float arm. Float arm can get caught up and bend which will reduce fuel sensor accuracy. If fuel pump module is dropped or damaged, it must be replaced.

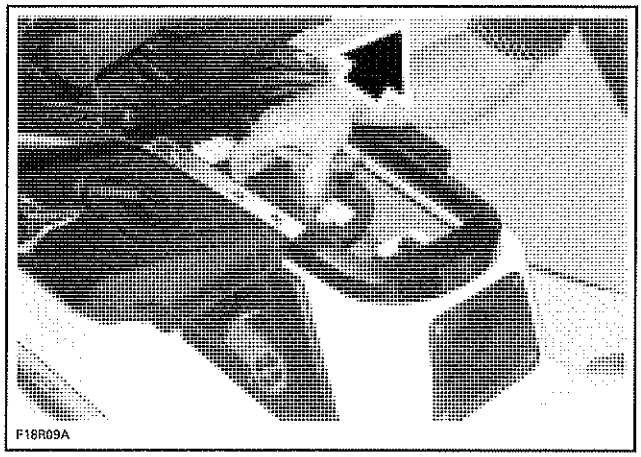
Slowly pull fuel pump module up through opening until corrugated tubes contact sides of opening. Tilt the fuel pump module and gently press the tubes inwards as you slowly pull the pump upwards.

⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position.

When the float arm makes contact with the top of the fuel tank, tilt the pump module towards the float as you pull the pump out of the tank.

Carefully pull fuel pump module out through glove box opening.



TYPICAL

⚠ WARNING

Always wipe off any fuel spillage from the watercraft. When working with fuel or fuel system and its components, always work in a well ventilated area.

Installation

Reverse the removal procedure however, pay attention to the following.

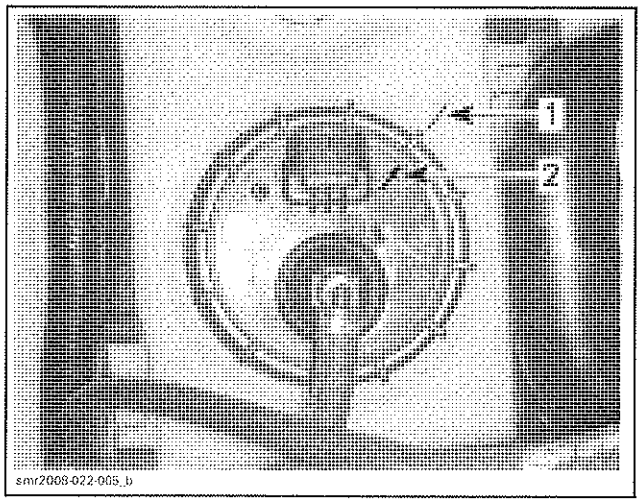
Install a new fuel pump module gasket each time the module is reinstalled.

Apply torque values as specified in the exploded view.

Carefully insert fuel pump module in fuel tank so as not to bend float arm.

Align arrow on top of fuel pump module with index mark on top of fuel tank or fuel sensor accuracy will be affected.

NOTE: Index mark and arrow locations are highlighted for clarity in following illustration.

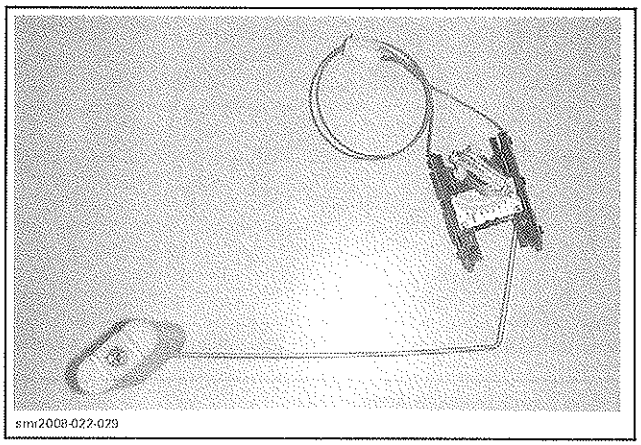


FUEL PUMP MODULE INDEXING
1. *Index mark on fuel tank*
2. *Fuel pump module alignment arrow*

Carry out a *FUEL TANK LEAK TEST* and a *FUEL SYSTEM HIGH PRESSURE LEAK TEST*. See procedures in this section.

FUEL LEVEL SENSOR

Fuel Level Sensor Removal



FUEL LEVEL SENSOR

Remove fuel pump module from fuel tank, see *FUEL PUMP REMOVAL* in this section.

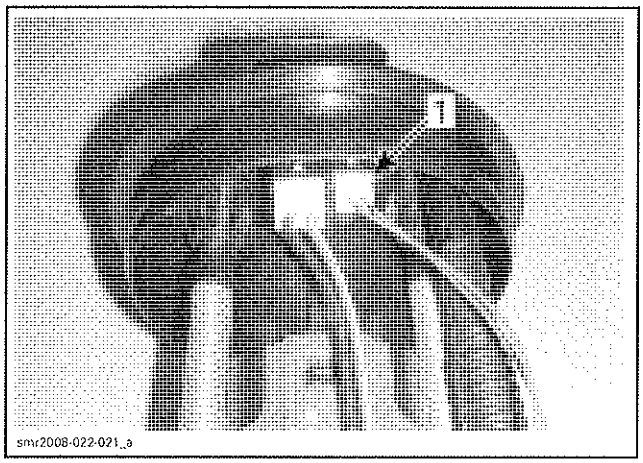
⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position. Turn fuel pump module upside down in an appropriate container to drain it of all fuel prior to performing any maintenance on the assembly.

Drain all fuel from the upper fuel filter and fuel pump reservoir in an appropriate container.

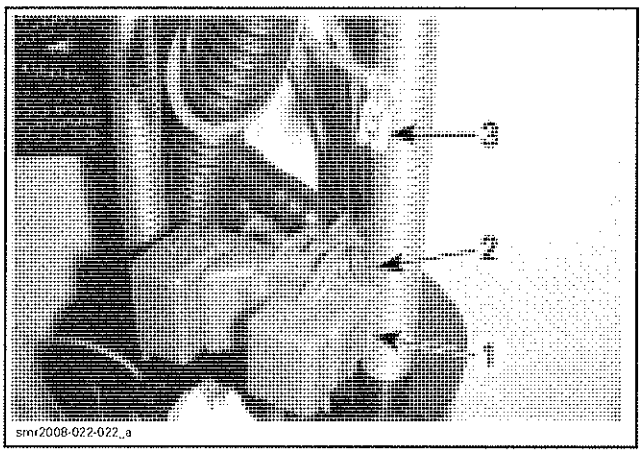
NOTE: Note routing of fuel level sensor wires prior to disconnecting the sensor from the fuel pump module flange.

Disconnect the fuel level sensor connector from the fuel pump module upper flange.



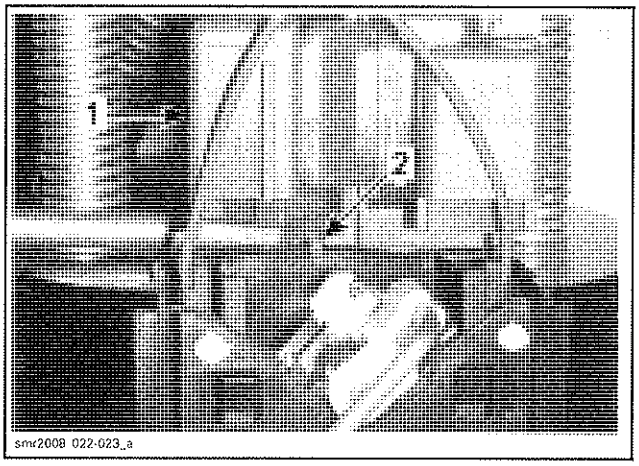
1. *Fuel level sensor connector*

Disconnect the ground wire from the pressure regulator. Be careful not to bend the ground contact on the pressure regulator.

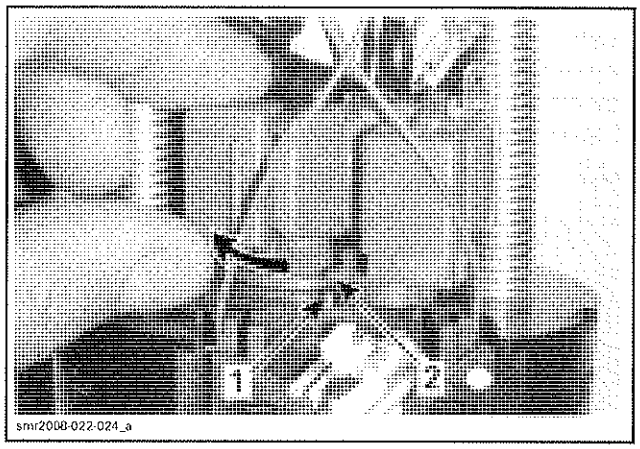


1. *Pressure regulator*
2. *Ground wire contact on pressure regulator*
3. *Ground wire disconnected*

Using a flat screwdriver, press down on the locking tab just below the pressure regulator to release it from the pump reservoir cover, and rotate it clockwise simultaneously so that it slips over the locking tab.

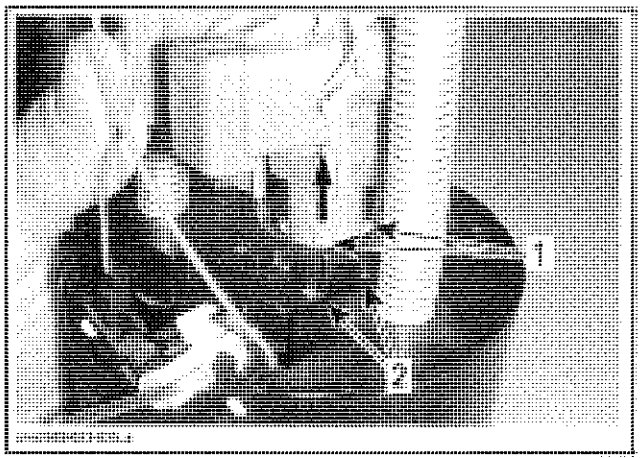


1. *Pressure regulator*
2. *Pressure regulator locking tab*



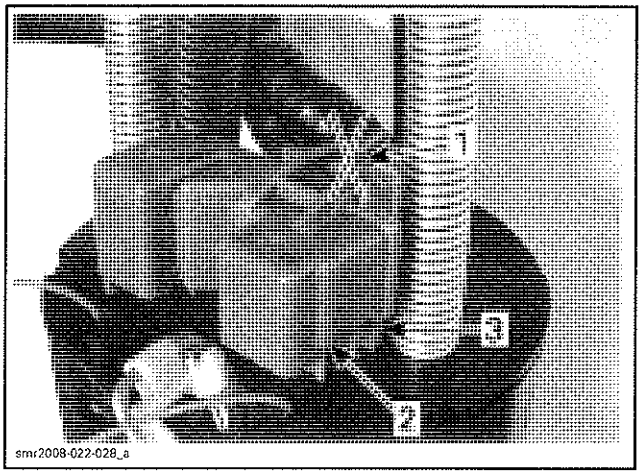
1. *Pressure regulator locking tab*
2. *Pressure regulator rotated clockwise over locking tab*

Once the pressure regulator is rotate over the locking tab, pull up on it to remove it from the pump reservoir cover.



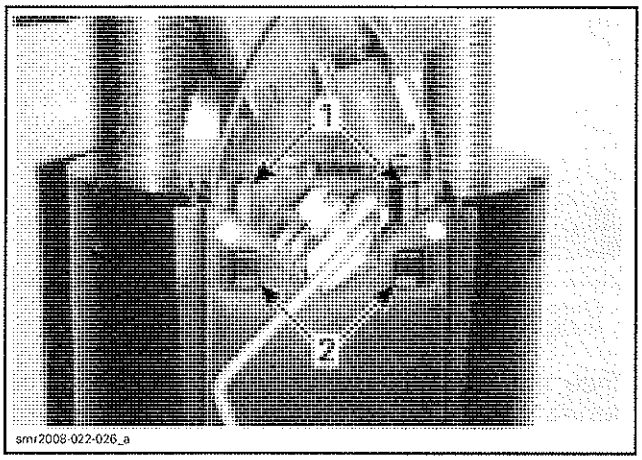
1. *Pressure regulator alignment tabs*
2. *Fuel pump reservoir alignment tabs*

NOTE: The pressure regulator cover must not be removed from the pressure regulator housing assembly.

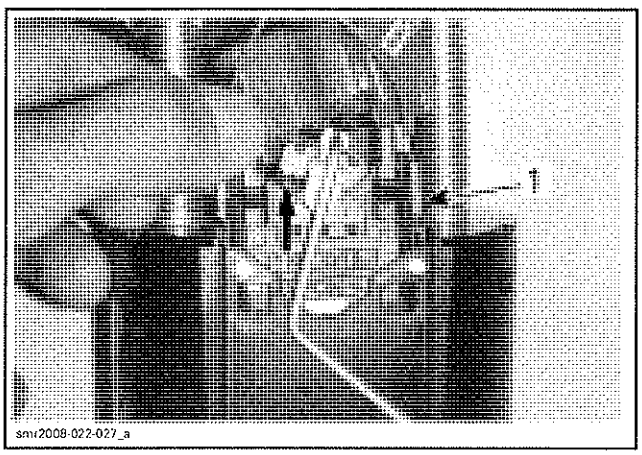


1. *Do not remove pressure regulator cover at locking tabs*
2. *Pressure regulator cover*
3. *Pressure regulator housing*

Push in on the release tabs at the top of the fuel level sensor to unlock it from the fuel pump reservoir housing, and simultaneously pull up on the fuel level sensor to remove it.



1. *Fuel level sensor release tabs*
2. *Locking pins*

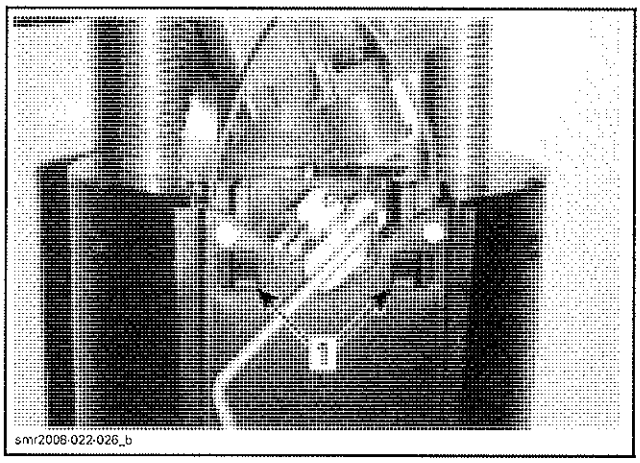


1. *Pull up on fuel level sensor*

Fuel Level Sensor Installation

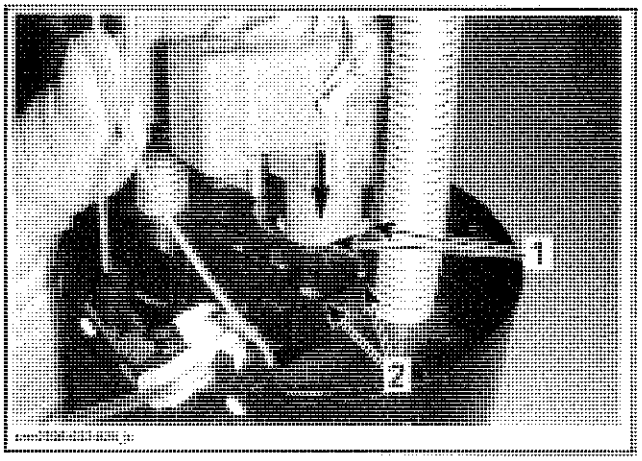
Installation is the reverse of the removal procedure however, pay attention to the following.

Ensure fuel level sensor locking pins are properly engaged into the fuel pump reservoir.

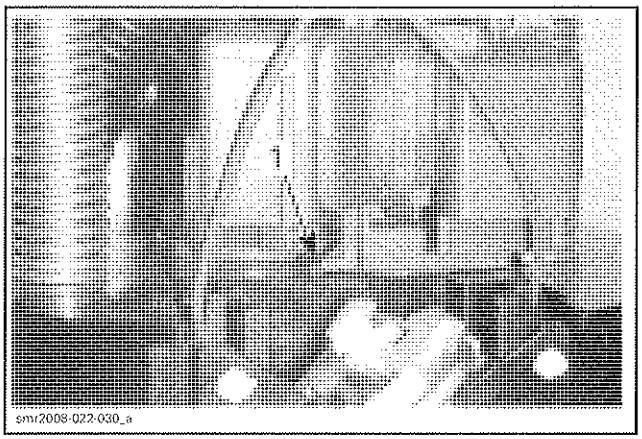


1. *Ensure engagement of sensor locking pins*

Align the fuel pressure regulator tabs into the pump reservoir cover and turn it counterclockwise until it locks properly.

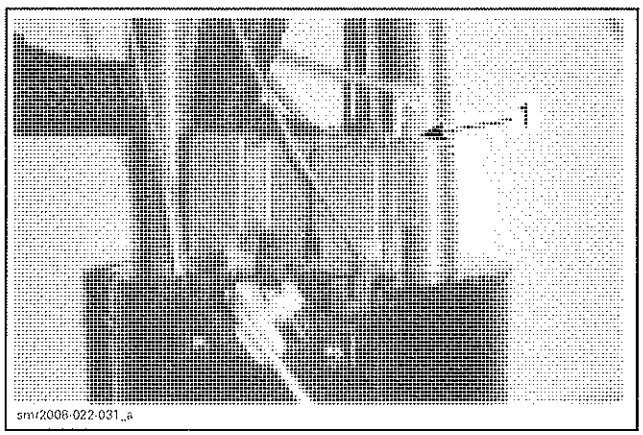


PRESSURE REGULATOR INSERTION INTO PUMP RESERVOIR COVER
1. *Pressure regulator alignment tabs*
2. *Fuel pump reservoir alignment tabs*



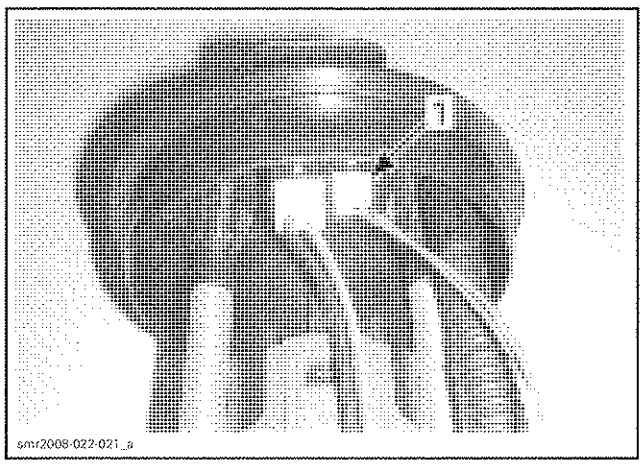
TAB UP WHEN PRESSURE REGULATOR PROPERLY LOCKED
1. Pressure regulator locking tab

Reconnect the ground wire onto the pressure regulator.



1. Pressure regulator ground wire installed

Ensure fuel level sensor connector is locked into the module flange connector.



1. Fuel level sensor connector

Carry out a *FUEL LEVEL SENSOR RESISTANCE TEST* as described in the *GAUGE/FUSE* section.

Reinstall the fuel pump module following the *FUEL PUMP INSTALLATION* procedure in this section.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	280
Fluke 115 multimeter	529 035 868	279

SERVICE PRODUCTS

Description	Part Number	Page
Dow Corning 111	413 707 000	281

GENERAL

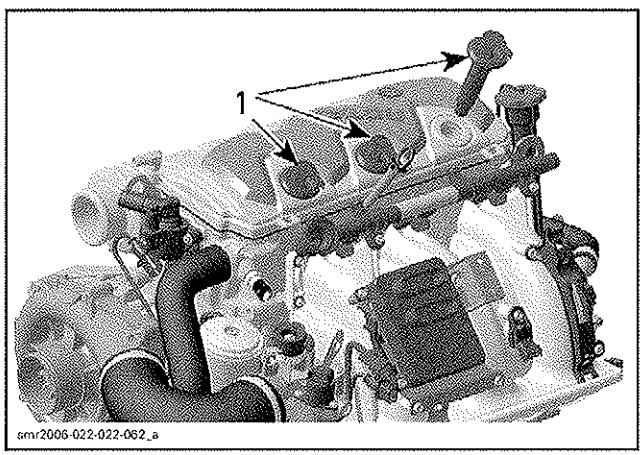
IGNITION SYSTEM DESCRIPTION

The ignition system is a digital inductive type system.

Ignition system parameters such as ignition timing, spark duration, and firing order, are controlled by the ECM in order to meet engine operational requirements.

Three separate ignition coils receive power from three separate fuses.

When a ground signal is provide by the ECM to an ignition coil primary winding, a high voltage is induced in the coil secondary winding that is used to produce a spark at the spark plug electrode.



TYPICAL
1. Ignition coils

Ignition Timing

Ignition timing is not adjustable.

The ECM is programmed with data (ignition mappings), which it uses along with data it receives from a variety of sensors to establish optimum ignition timing under all engine operating conditions.

The firing of each spark plug is independent of the others.

Knock Sensor

A knock sensor is mounted on the cylinder block behind the intake manifold. It detects specific vibrations that would typically be generated by engine detonation.

If detonation occurs, the knock sensor detects it and the ECM goes into a specific operating mode whereby it temporarily retards the ignition advance until detonation stops.

The ECM is able to identify in which cylinder the knocking occurs and modifies the ignition advance on that cylinder only.

Refer to the *ELECTRONIC FUEL INJECTION* section for testing and replacement procedures.

TROUBLESHOOTING

IGNITION SYSTEM TESTING

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

The ECM controls the ignition system and can detect an open or short circuit in the ignition coil primary winding. However, it does not monitor the secondary winding.

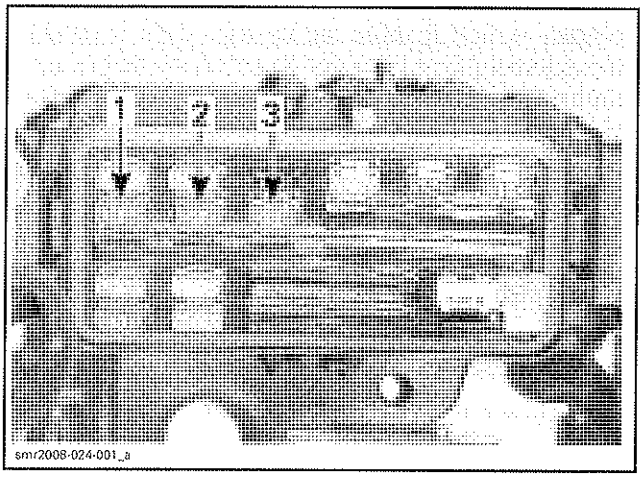
If a primary winding or circuit is at fault, a check engine light, check engine message, and fault code will be displayed. A beep code will also be heard. Refer to *ENGINE MANAGEMENT SYSTEM* section for details.

Ignition System Testing Sequence

Ensure fuses 7, 8 and 9 are good. If a fuse is burnt, test for a short circuit or faulty component on that fuse circuit before replacing the fuse.

⚠ WARNING

Due to the possibility of flammable vapors accumulating in the lower areas of the hull (the bilge), you should always test for a short circuit which may produce a spark and ignite the vapors before replacing a burnt fuse.



1. *Fuse 7 (# 1 CYL)*
2. *Fuse 8 (# 2 CYL)*
3. *Fuse 9 (# 3 CYL)*

If one cylinder is not firing and there is no fault message displayed in the information center, replace each spark plug with a known good spark plug until the faulty plug is located.

If the fault is not found, carry out an *IGNITION COIL QUICK TEST USING B.U.D.S.*

PROCEDURES

IGNITION COILS

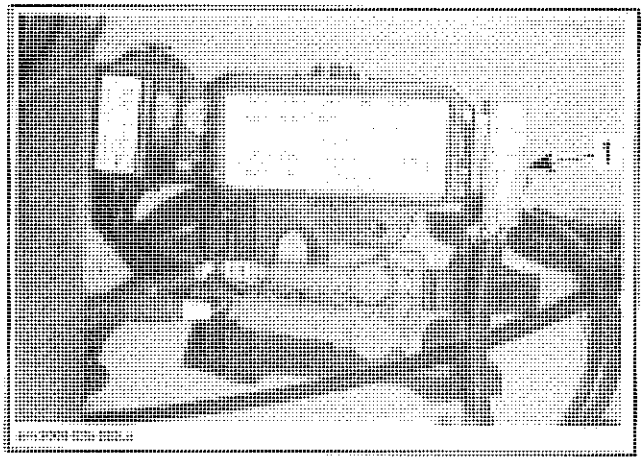
⚠ WARNING

Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as a spark may cause fuel vapors which may have accumulated in the low areas of the hull to ignite.

Ignition Coil Quick Test using B.U.D.S.

Remove seat, refer to *BODY* section.

Remove the diagnostic connector from its storage cap located next to the main fuse box.



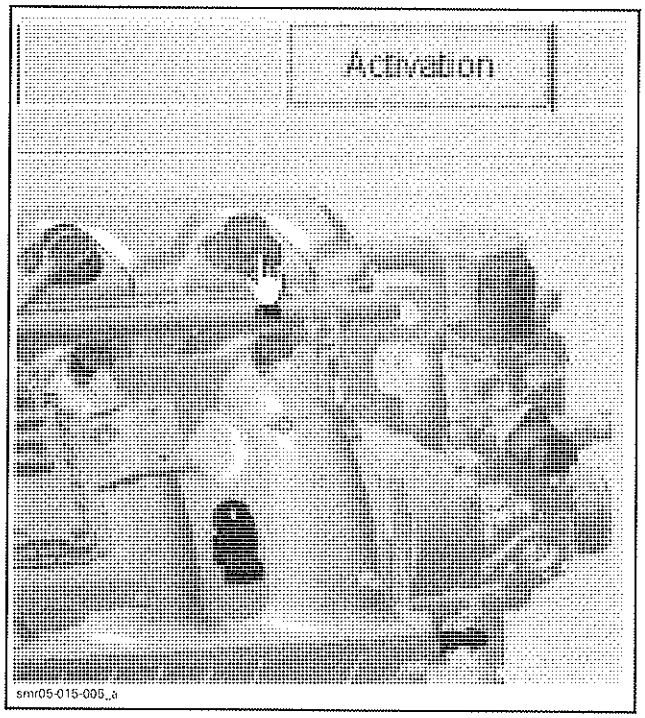
1. *Diagnostic connector*

Connect to the latest applicable B.U.D.S. software, refer to *COMMUNICATION TOOLS/ B.U.D.S. SOFTWARE* section.

In B.U.D.S., select **Read Data**.

Select the **Activation** tab.

Energize the ignition coil by selecting it on the engine illustration.



IGNITION COIL ACTIVATION

You should hear the spark occurring. If in doubt, use a sealed **vapor proof** spark tester – available from tool suppliers, to prevent a spark from occurring in the bilge. If there is no spark, carry out the following checks.

NOTE: Keep in mind that even if the tester indicates that there is a spark during this static test, the voltage required to produce a spark in the combustion chamber is higher when the engine is running. The ignition coil or spark plug may not be functioning properly during actual engine operation. Replacing the ignition coil or spark plug may be necessary as a test.

If there is no ignition at one or more coils, carry out a *PRIMARY WINDING INPUT VOLTAGE TEST*.

Ignition Coil Input Voltage Test (Primary Winding)

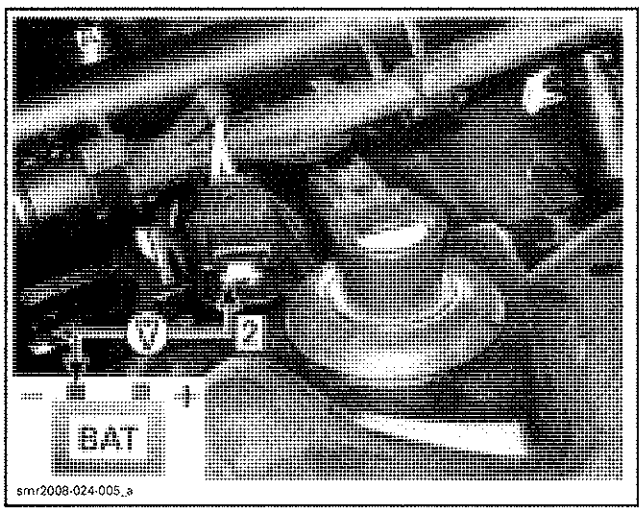
Disconnect the ignition coil connector.

Install safety lanyard on the DESS post.

Use a Fluke 115 multimeter (P/N 529 035 868) set to Vdc.

Test for the primary winding input voltage at the ignition coil connector as per following table.

IGNITION COIL INPUT VOLTAGE TEST		
TEST PROBES		VOLTAGE
Coil 1 connector pin 2 (PURPLE/BLUE)	Battery ground	Battery voltage
Coil 2 connector pin 2 (PURPLE/GREEN)		
Coil 3 connector pin 2 (PURPLE/ORANGE)		



IGNITION COIL INPUT VOLTAGE TEST (PIN 2)

If battery voltage is read, test coil ground wire continuity to ECM. Refer to *IGNITION COIL CIRCUIT CONTINUITY TEST* below.

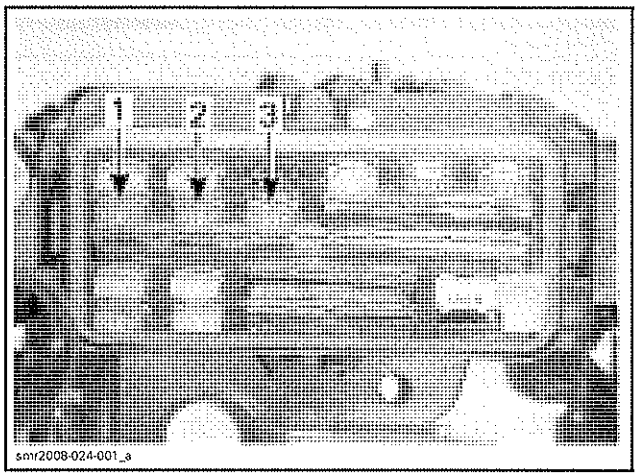
If battery voltage is NOT read, test ignition coil power input wire continuity. Refer to *IGNITION COIL CIRCUIT CONTINUITY TEST* below.

Remove safety lanyard from DESS post.

Ignition Coil Circuit Continuity Test

Power Input Wire Continuity Test (Coil)

Remove the applicable ignition/injector fuse located in main fuse box.

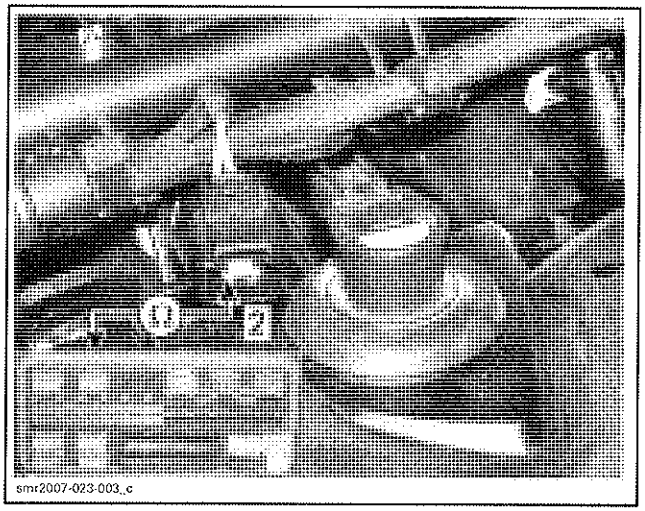


1. *Fuse 7 (# 1 CYL)*
2. *Fuse 8 (# 2 CYL)*
3. *Fuse 9 (# 3 CYL)*

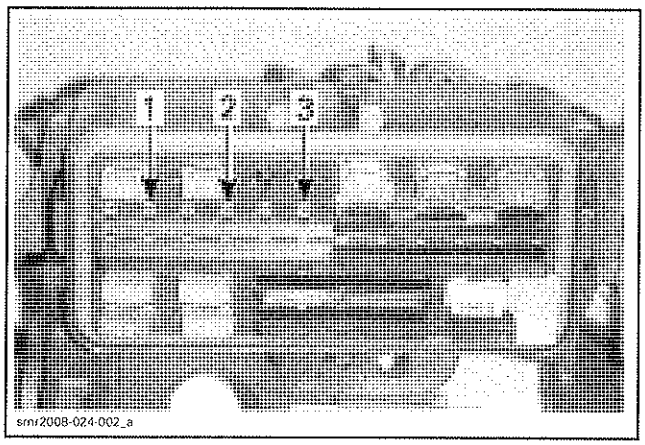
Disconnect ignition coil connector.

Test for continuity of circuit as per following table.

POWER INPUT WIRE CONTINUITY TEST (COIL)			
COIL	COIL CONNECTOR	RELAY FUSE BOX CONTACT	RESISTANCE
Cylinder 1 (rear)	Pin 2 (PURPLE/BLUE)	B11	Close to 0 Ω (continuity)
Cylinder 2	Pin 2 (PURPLE/GREEN)	B9	
Cylinder 3	Pin 2 (PURPLE/ORANGE)	B7	

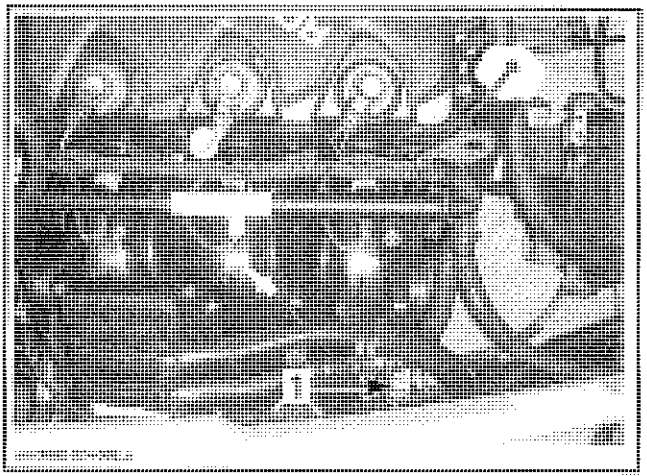


POWER INPUT WIRE CONTINUITY TEST (COIL)



1. *Contact B11*
2. *Contact B9*
3. *Contact B7*

If continuity is not measured as specified, disconnect the engine harness from the vehicle harness as per following illustration and carry out a continuity test of each harness.



1. *Ignition/injection systems engine harness connector*

Carry out a continuity test of each harness as per following tables.

POWER INPUT WIRE CONTINUITY TEST (ENGINE HARNESS)			
COIL	COIL CONNECTOR	ENGINE HARNESS CONNECTOR	RESISTANCE
Cylinder 1 (rear)	Pin 2 (PURPLE/BLUE)	Pin1 (PURPLE/BLUE)	Close to 0 Ω (continuity)
Cylinder 2	Pin 2 (PURPLE/GREEN)	Pin 2 (PURPLE/GREEN)	
Cylinder 3	Pin 2 (PURPLE/ORANGE)	Pin 3 (PURPLE/ORANGE)	

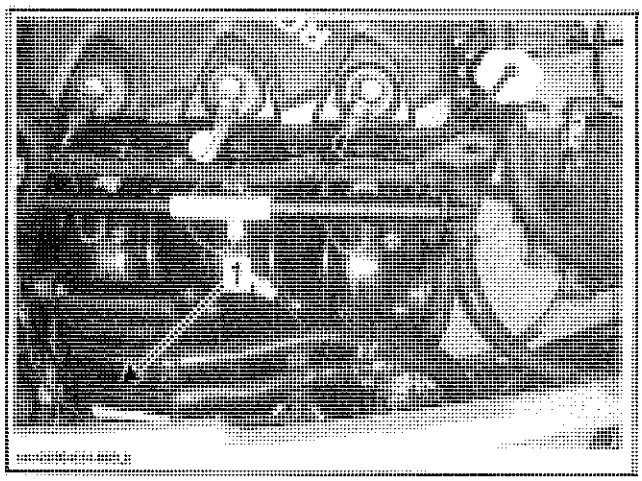
POWER INPUT WIRE CONTINUITY (VEHICLE HARNESS)			
COIL	VEHICLE HARNESS CONNECTOR	RELAY FUSE BOX CONTACT	RESISTANCE
Cylinder 1 (rear)	Pin1 (PURPLE/BLUE)	B11	Close to 0 Ω (continuity)
Cylinder 2	Pin 2 (PURPLE/GREEN)	B9	
Cylinder 3	Pin 3 (PURPLE/ORANGE)	B7	

Repair or replace wiring/connector as required.

Reinstall removed fuses.

Coil Ground Wire Continuity Test

Disconnect ECM connector A and install it on the ECM adapter (P/N 420 277 010).

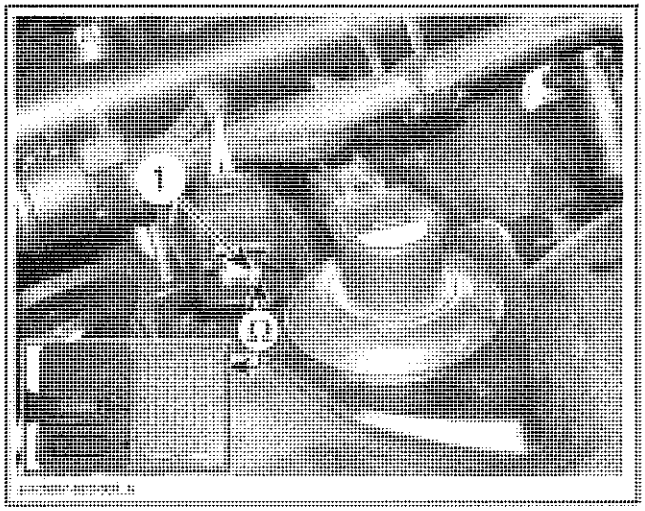


ECM CONNECTORS IDENTIFICATION
1. *Connector A*

Disconnect ignition coil connector.

Test for continuity of coil ground circuit as per following table.

COIL GROUND WIRE CONTINUITY TEST			
COIL	COIL CONNECTOR	ECM PIN	RESISTANCE
Cylinder 1 (rear)	Pin 1 (BROWN/BLACK)	A-41	Close to 0 Ω (continuity)
Cylinder 2	Pin 1 (BROWN/ORANGE)	A-1	
Cylinder 3	Pin 1 (BROWN/YELLOW)	A-29	



TYPICAL — COIL GROUND WIRE CONTINUITY TEST (PIN 1)

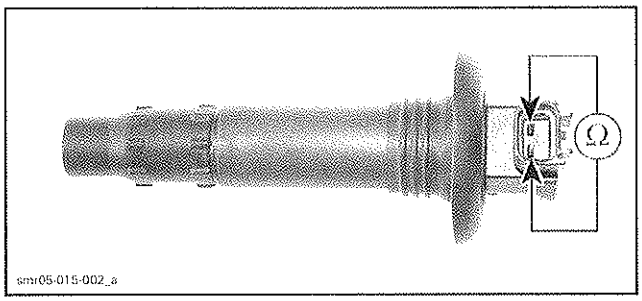
If continuity is not measured as specified, repair the connector or replace the engine wiring harness.

Ignition Coil Resistance Test

An ignition coil with a good resistance measurement can still be faulty. Current leakage can occur at high voltage levels which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

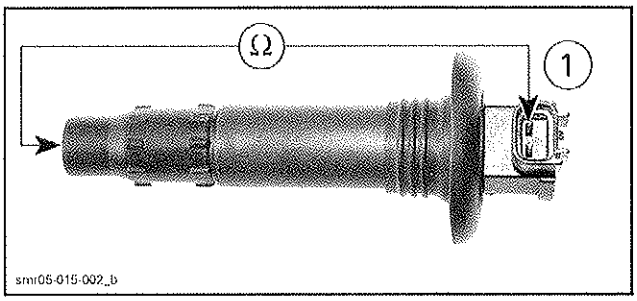
Remove ignition coil. Refer to *IGNITION COIL REMOVAL* below.

Using a multimeter, test the resistance in both primary and secondary windings.



PRIMARY COIL

CIRCUIT	TERMINAL	RESISTANCE @ 20°C (68°F)
Primary	1 and 2	0.85 - 1.15 Ω



SECONDARY COIL

CIRCUIT	TERMINAL	RESISTANCE @ 20°C (68°F)
Secondary	1 and spark plug terminal	9.5 - 13.5 kΩ

If any resistance value measured is not within specification, replace ignition coil.

Ignition Coil Removal

Remove engine cover (as applicable to model).

Disconnect ignition coil connector.

CAUTION: Do not remove the ignition coil before disconnecting the input connector or the wires may be damaged. Do not pry up ignition coil with a screwdriver to avoid damage.

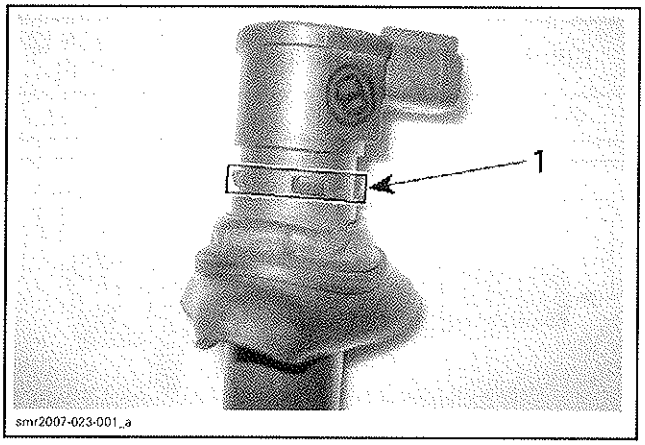
NOTE: Rotate coil side to side as you pull up on it to ease removal.

Remove ignition coil from spark plug.

Ignition Coil Installation

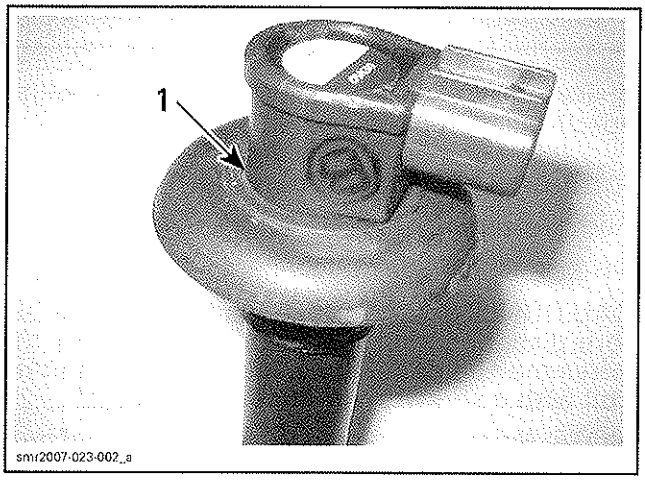
Prior to inserting the ignition coil on its spark plug, apply Dow Corning 111 (P/N 413 707 000) as described in following procedure:

– Roll down rubber seal and apply sealant on seal contact area.



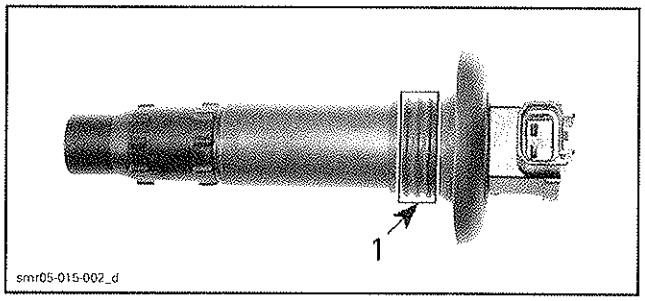
1. Sealant here

– Put up rubber seal ensuring it is properly seated against top of ignition coil. Wipe off any excess sealant.



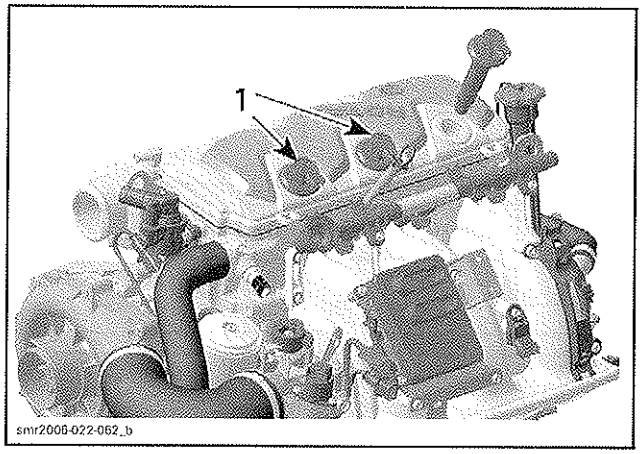
1. Properly seated here

– Apply sealant on seal contact area as per following illustration.



1. Sealant here

– After installation, ensure the seal seats properly with top surface of engine valve cover.



1. Seal properly seated

SPARK PLUGS

Spark Plug Removal

Remove engine cover (as applicable to model).

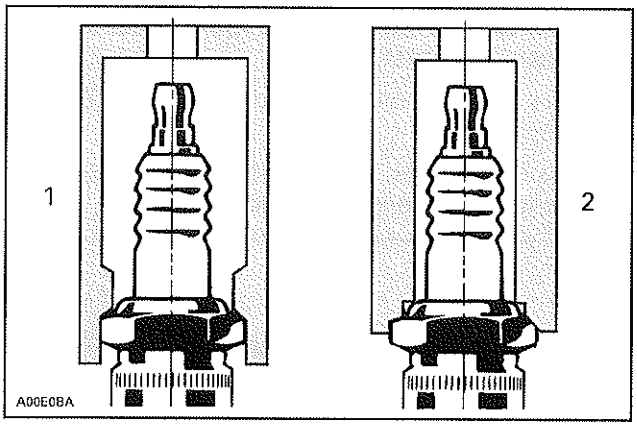
Disconnect the ignition coil input connector.

Remove ignition coil as per previous procedure.

⚠ WARNING

Never remove an ignition coil from a spark plug without disconnecting it from the wiring harness. Flammable vapors may be present in the bilge. Should the safety lanyard be installed on the DESS post, a spark could be generated at the coil spark plug end which could cause an explosion.

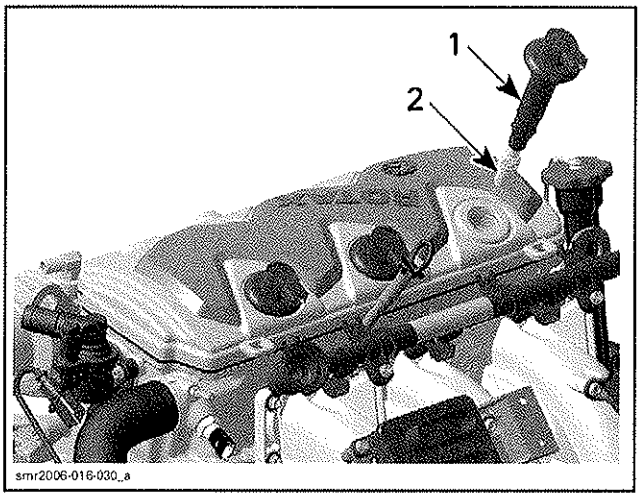
Using an approved spark plug socket, release the torque applied to the spark plug.



1. Aproved socket
2. Improper socket

Clean the spark plug and cylinder head with pressurize air.

Unscrew spark plug then use the ignition coil to take spark plug out of spark plug hole.



1. *Ignition coil*
2. *Spark plug*

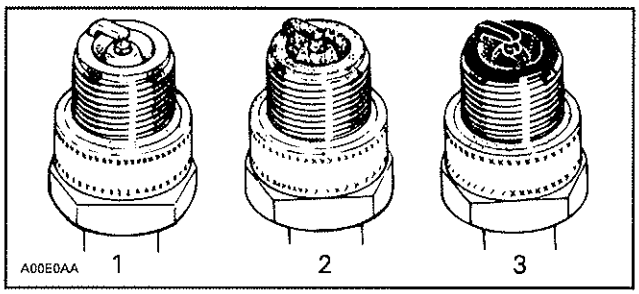
Troubleshooting a Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running or misfiring of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption.

Other possible causes are: a incorrect or bad fuel, defective ignition system, incorrect spark plug gap, loss of compression, or lubricating oil entering the combustion chamber.

The plug face of a fouled spark plug has either a wet or dry black carbon deposit. Such coatings form a conductive connection between the center electrode and the ground electrode.

Spark Plug Analysis



TYPICAL
1. *Overheated (light grey, white)*
2. *Normal (light brown, brown)*
3. *Fouled (black, wet or dry, dark deposits, grey, melted coating)*

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at prescribed intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

Spark Plug Installation

Prior to installation, ensure the contact surfaces of the cylinder head and spark plug are free of grime.

1. Using a wire feeler gauge, set electrode gap as specified in the following chart.

ENGINE	SPARK PLUG	TORQUE	GAP mm (in)
All 4-TEC	NGK DCPR8E	Hand tighten + 1/4 turn with a socket	0.75 (.030)

2. Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
3. Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise an additional 1/4 turn with an approved spark plug socket.

Follow ignition coil installation procedures.

Complete the installation in the reverse order of the removal.

CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
engine leak test kit	295 500 352	290

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Extech inductive ammeter	380941	287
Electro Specialties battery load tester	710	292

GENERAL

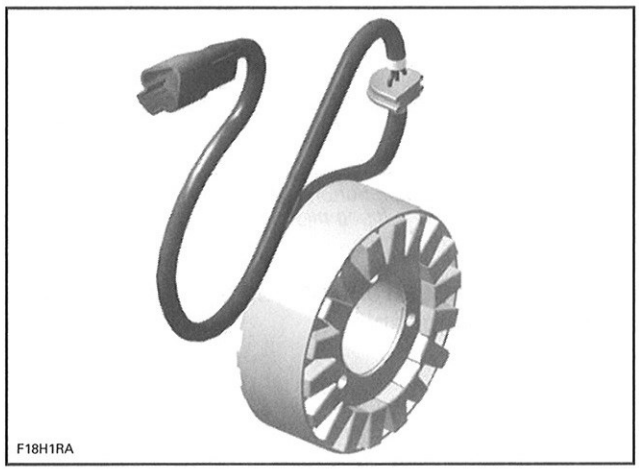
SYSTEM DESCRIPTION

The purpose of the charging system is to maintain the battery at a full state of charge and to provide the electrical system with the required electrical power for normal vehicle operation.

Magneto

The magneto is the primary source of electrical energy. It transforms a magnetic field into an electric current (AC).

The magneto has a 3 phase, delta wound, 18 pole stator that is rated at 380 watts.

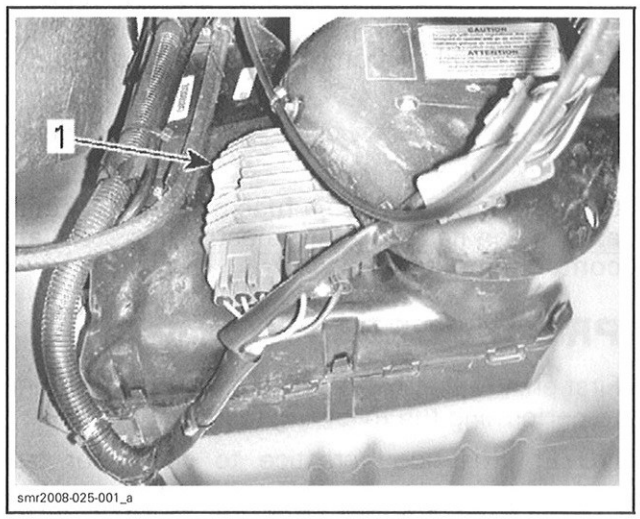


TYPICAL

Voltage Regulator/Rectifier

The rectifier receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator included in the same unit, limits voltage to a maximum level of 14.5 ± 0.5 volts to prevent any damage to electrical components.



1. Voltage regulator/rectifier unit

Battery

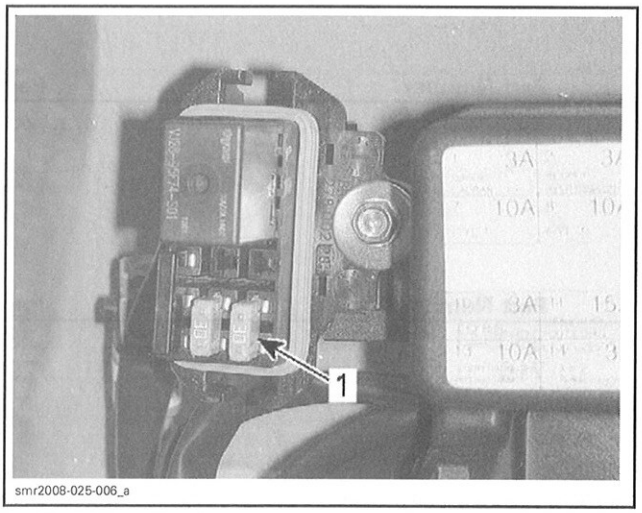
The battery supplies DC power to the electric starter for cranking the engine. During engine starting, it also supplies DC power to every electrical and electronic system in the vehicle as well as all accessories.

At low engine RPM operation and high current load conditions, it supplements the magneto's output and helps to maintain a steady system voltage.

Charging System Fuse

The charging/electrical system is protected by a 30 A fuse. Insert pist of fuse.

If the battery becomes discharged, check the charging system fuse condition, located in relay fuse box.



1. Charging system fuse

The voltage regulator/rectifier could be the culprit of a blown charging system fuse. To test for this possibility, simply disconnect the voltage regulator/rectifier from the circuit and install a new fuse.

If the fuse still burns, check for a shorted wire or connector pins.

CAUTION: Do not use a fuse of a higher rating as this can cause severe electrical system and component damage.

PROCEDURES

First ensure that battery is in good condition prior to performing the following tests.

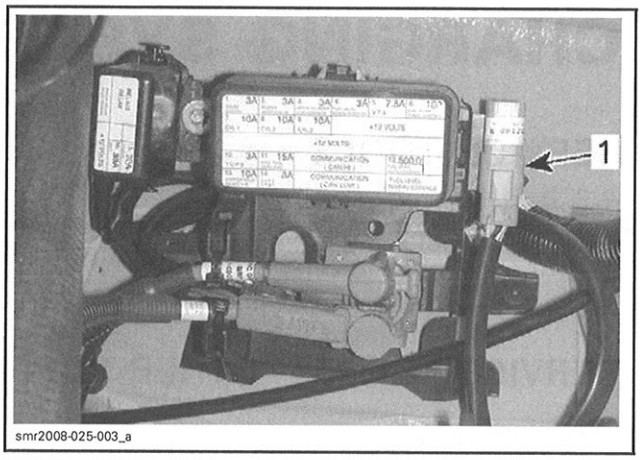
NOTE: It is good practice to check for fault codes using the B.U.D.S. software as a first troubleshooting step. Refer to *MONITORING SYSTEM/FAULT CODES* section.

VOLTAGE REGULATOR/RECTIFIER

Charging System Voltage Test Using B.U.D.S.

Remove seat, refer to *BODY* section.

Remove the diagnostic connector from its storage cap located near the front LH side of the engine.



1. Diagnostic connector

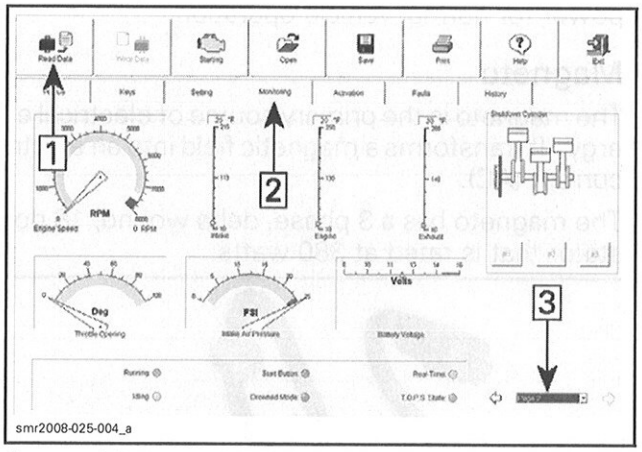
Connect to the latest applicable B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Start engine.

In B.U.D.S., select **Read Data**.

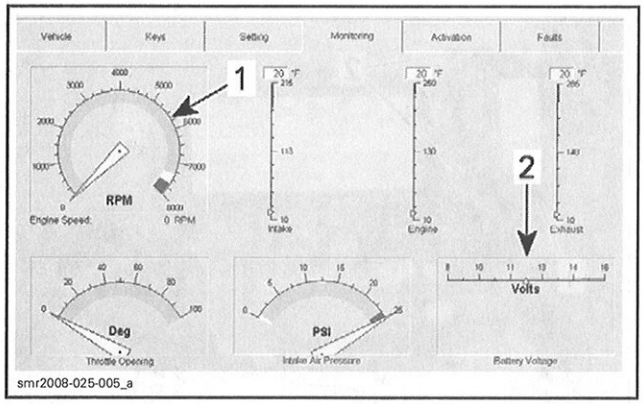
Select the **Monitoring** tab.

On the bottom RH corner of the monitoring page, select page 2.



Step 1: Select Read Data button
Step 2: Select the Monitoring page tab
Step 3: Select page 2

Read engine speed and battery voltage in B.U.D.S. as per following table.



1. *RPM indication*
2. *Battery voltage indication*

CHARGING SYSTEM VOLTAGE TEST USING B.U.D.S.	
TEST ENGINE SPEED	VOLTAGE (DC)
5500 RPM	14.5 ± .5 Vdc

NOTE: Indicated battery voltage is charging system voltage when engine is running.

If voltage is above specification, replace voltage regulator/rectifier.

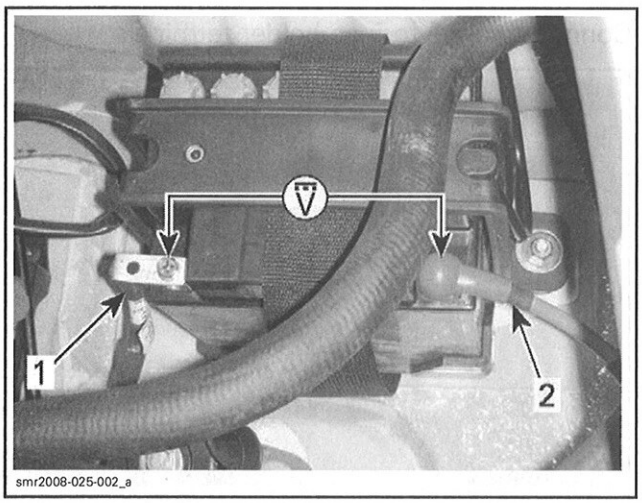
If voltage is below specification, check stator output prior to concluding that voltage regulator/rectifier is defective. Refer to *PTO HOUSING/MAGNETO* section.

Charging System Voltage Test Using a Multimeter

Remove seat, refer to *BODY* section.

Set multimeter to Vdc scale.

Connect multimeter to battery posts.



CHARGING SYSTEM VOLTAGE TEST AT BATTERY TERMINALS
1. *Negative battery cable*
2. *Positive battery cable*

Start engine.

Read voltage.

CHARGING SYSTEM VOLTAGE TEST USING A MULTIMETER	
TEST ENGINE SPEED	VOLTAGE (DC)
5500 RPM	14.5 ± .5 Vdc

If voltage is above specification, replace voltage regulator/rectifier.

If voltage is below specification, check stator output prior to concluding that voltage regulator/rectifier is defective. Refer to PTO HOUSING/MAGNETO section.

Voltage Regulator Continuity Test

Due to internal circuitry, there is no static test available to check continuity.

Charging System Current Test

Move vehicle to a well ventilated area where it can be safely run and connected to a water hose for exhaust system cooling. Refer to *EXHAUST SYSTEM FLUSHING* section for detailed procedures.

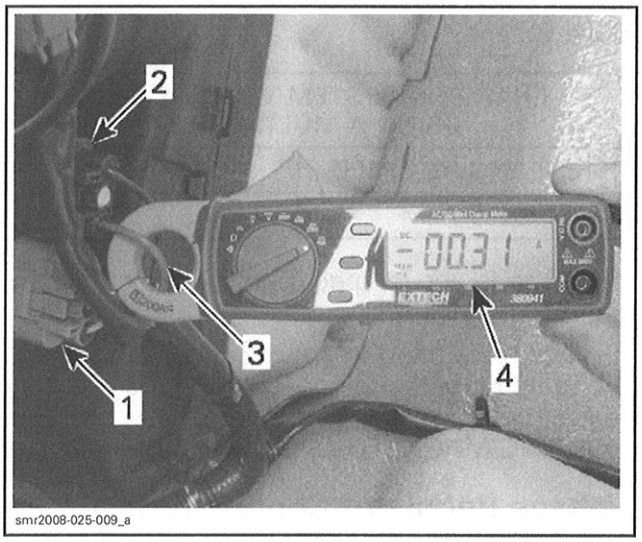
Charging System Current Test with an Inductive Ammeter

Use an inductive ammeter such as the Extech inductive ammeter (P/N 380941) or equivalent.

Turn on the ammeter and select 40 Adc.

NOTE: Zero set the ammeter before installing it for the test or reading will be erroneous.

Locate the RED wire of the voltage regulator/rectifier (voltage output) and clamp the ammeter over it.



CHARGING SYSTEM CURRENT TEST WITH AN INDUCTIVE AMMETER
1. *Voltage regulator/rectifier input connector*
2. *Voltage regulator/rectifier output connector*
3. *Red output wire*
4. *Ammeter reading before zero setting*

NOTE: Initial current reading will be higher than specified due to the battery drain from the engine start. Current load will come down as the battery recovers its charge.

Start engine.

Read current.

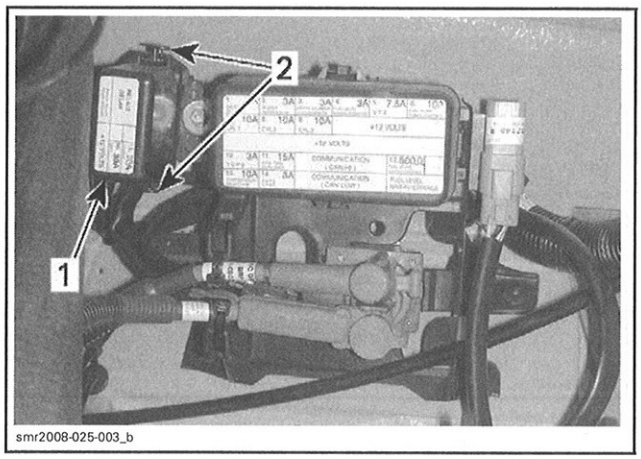
TEST ENGINE SPEED	CURRENT
4000 RPM	Approx. 8 A

If current reading is far below specification, test stator output prior to concluding that voltage regulator/rectifier is faulty.

NOTE: If battery is in poor condition or is not at a full state of charge, current reading will be above specification. Refer to *BATTERY* in this section for battery testing.

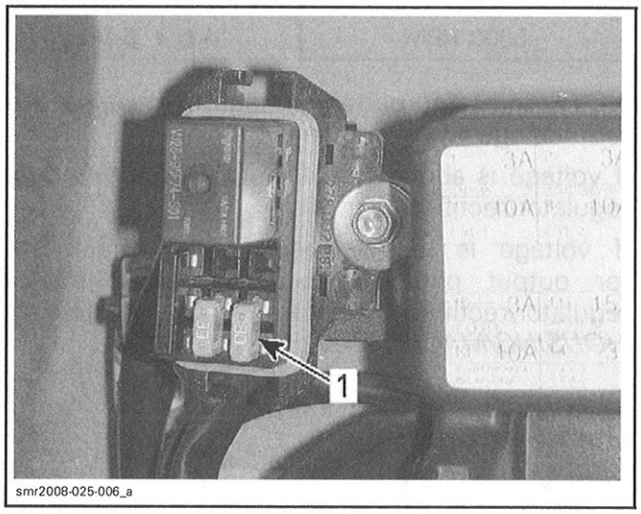
Charging System Current Test with a Multimeter

Remove the cover from relay fuse box, by pressing in on and holding the release tabs at each end as you pull the cover off the fuse box.



1. *Relay fuse box*
2. *Cover release tabs*

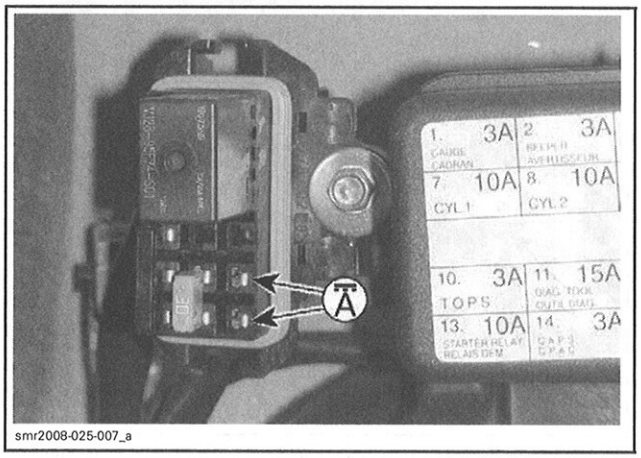
Remove charging system fuse.



1. *Charging system fuse*

Set multimeter to Adc.

Connect probes to fuse holder terminals.



CHARGING SYSTEM CURRENT TEST

Start engine.

Read current.

CAUTION: Charging current may rise over multimeter current reading capacity (10 A) possibly causing testing equipment damage. It is preferable to use an inductive ammeter to test the charging system current.

CHARGING SYSTEM CURRENT TEST	
TEST ENGINE SPEED	CURRENT (DC)
6000 RPM	5 A min.

If current is below specification, carry out a magneto stator output voltage test prior to concluding that rectifier is faulty.

BATTERY

Troubleshooting

SYMPTOM: DISCHARGED OR WEAK BATTERY	
CAUSE	REMEDY
Battery posts and/or cable terminal oxidized.	Clean battery terminals, posts, and coat with dielectric grease.
Loose or bad connections.	Check for wiring and connector tightness, frayed or broken wires. Repair or replace cables or connectors.
Faulty battery (sulfated, fretting, shorted plates or cell, damaged casing, loose post).	Replace battery.
Burnt fuse(s) or faulty rectifier.	First check fuse(s). If in good condition, check rectifier/regulator.
Faulty battery charging coil (or stator).	Test stator and replace as required.
Parasitic or "Key Off" current loads.	Isolate, reduce or eliminate such loads, recharge battery as recommended if vehicle is not used for extended periods of time.

NOTE: "Key Off" or parasitic loads may be loads due to installed accessories. Parasitic loads may also be due to water ingress in connectors, or partial short circuits that slowly drain a battery without causing a fuse to burn.

NOTE: A battery that continually necessitates the addition of distilled water indicates an over voltage situation. Carry out a *CHARGING SYSTEM VOLTAGE TEST*.

Battery Removal

⚠ WARNING

The BLACK negative battery cable must always be disconnected first and reconnected last. Never charge or boost battery while installed in watercraft.

Proceed as follows:
- Disconnect the BLACK negative cable first.
- Disconnect the RED positive cable last.
- Remove the vent line from the battery.
- Remove the upper battery support.
- Withdraw battery from watercraft being careful not to lean it so that electrolyte flows out of battery vent fitting.

⚠ WARNING

Electrolyte is poisonous and corrosive. Avoid contact with eyes, skin and clothing. Wear a suitable pair of non-absorbent gloves when removing the battery by hand. Rinse any affected area with clear running water for at least 15 minutes, then seek professional medical attention.

CAUTION: Should any electrolyte spillage occur, immediately wash off area with a solution of baking soda and water, then rinse thoroughly.

Battery Cleaning

Clean the battery casing, caps, cables and battery posts using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water then dry well.

Battery Inspection

Visually inspect battery casing for cracks or other possible damages. If casing is damaged or shows signs of acid leaking, replace battery and thoroughly clean battery tray and surrounding area with a solution of water and baking soda.

Inspect battery posts for corrosion and security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

NOTE: Hand tighten caps then tighten an additional 1/4 turn using a 20 mm (3/4 in) socket. Using any other tool could damage the plastic battery caps.

⚠ WARNING

Battery electrolyte is caustic. To prevent spillage, ensure battery cell caps are sufficiently tight to properly seal each cell.

Battery Electrolyte Level

Check electrolyte level in each cell, add distilled water up to the upper fill level line.

CAUTION: Add only distilled water in an activated battery.

Battery Vent and Check Valve

⚠ WARNING

Battery caps do not have vent holes. Ensure vent line is not obstructed and check valve is functioning properly.

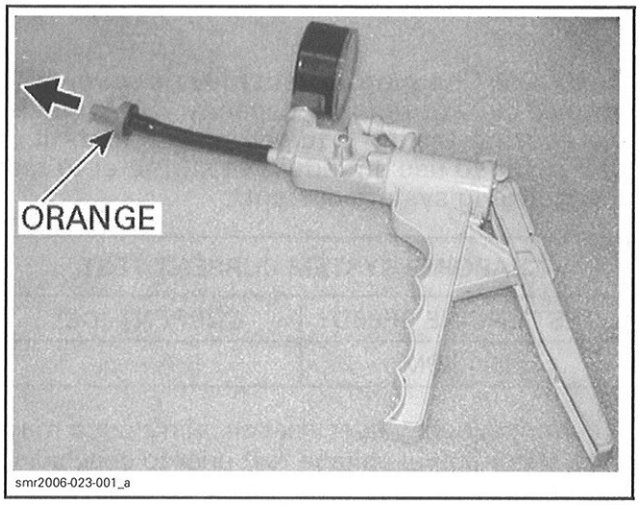
Check vent line condition.

Remove the vent system check valve and test it using the vacuum/pressure pump in the engine leak test kit (P/N 295 500 352).

529 021 800

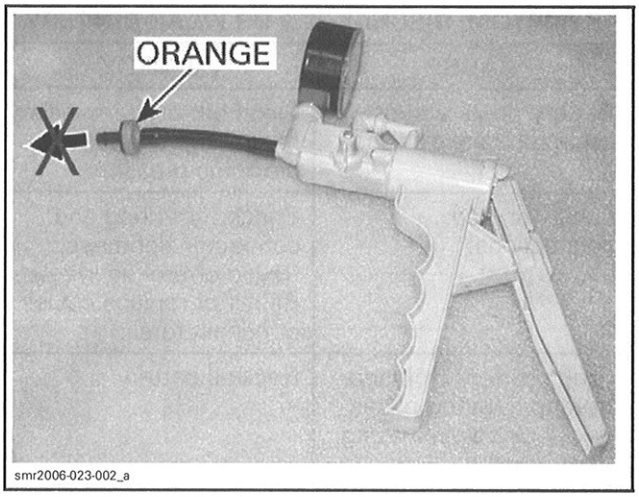
Set pump to PRESSURE and verify check valve operation as follows.

Check valve must let air flow out when ORANGE side is open to atmosphere.



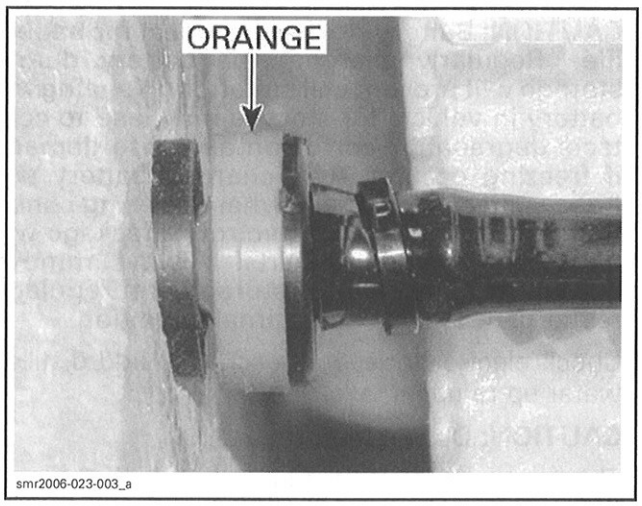
AIR MUST FLOW OUT IN THIS POSITION

Check valve must hold air with 34 kPa (5 PSI) pressure without leaking when ORANGE side is connected to pump.



MUST HOLD AIR IN THIS POSITION

At installation, ensure to position check valve with black side connected to vent line and ORANGE side inserted in the grommet protruding through the hull as shown in following illustration.



Battery Testing

There are 3 types of battery tests: electrolyte reading, static voltage test with a multimeter (no load), and a voltage test with a load applied.

A static voltage test is carried out on a battery without discharging current. It is the simplest and most commonly used. A battery voltage test with load applied gives a more accurate indication of the condition of the battery.

An electrolyte reading gives a more accurate indication of the charge condition of each cell.

Battery Electrolyte Reading

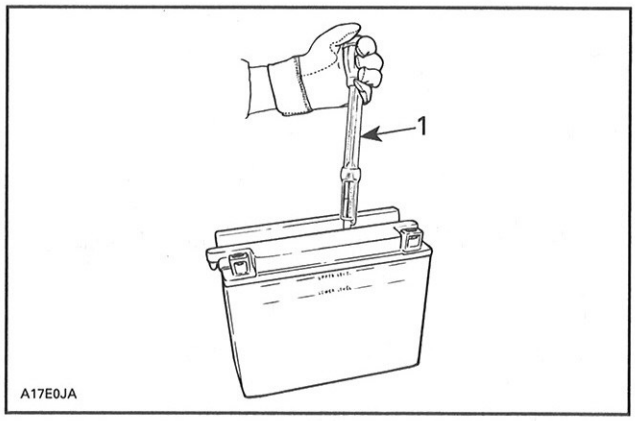
NOTE: Do not top up cell electrolyte level with distilled water prior to taking an electrolyte reading.

Check charge condition of each cell using a hydrometer.

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte.

BATTERY ELECTROLYTE READING	
BATTERY CONDITION	SPECIFIC GRAVITY
Fully charged	1.265 - 1.280

Most hydrometers give a true reading at 21°C (70°F).



1. Specific gravity 1.265

In order to obtain correct readings, adjust the initial reading by adding .004 points to the hydrometer readings for each 5.5°C (10°F) above 21°C (70°F) and by subtracting .004 point for every 5.5°C (10°F) below 21°C (70°F).

This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM	
°C	°F		
38	100	.012	Add to the reading
32	90	.008	
27	80	.004	
21	**70**	CORRECT READING	
16	60	.004	Subtract from the reading
10	50	.008	
4	40	.012	
- 1	30	.016	

EXAMPLE NO. 1

TEMPERATURE ABOVE 21°C (70°F):
Hydrometer reading: 1.250
Electrolyte temperature: - 1°C (30°F)
Subtract .016 Sp. Gr.
Corrected Sp. Gr. is 1.234

EXAMPLE NO. 2

TEMPERATURE ABOVE 21°C (70°F):
Hydrometer reading: 1.235
Electrolyte temperature: 38°C (100°F)
Add .012 Sp. Gr.
Corrected Sp. Gr. is 1.247

SPECIFIC GRAVITY READING USING A HYDROMETER		
STATE OF CHARGE	ELECTROLYTE TEMPERATURE	
	27°C (80°F)	4°C (40°F)
100%	1.26/1.27	1.27/1.28
75%	1.21/1.22	1.22/1.23
50%	1.16/1.17	1.17/1.18
25%	1.12/1.13	1.13/1.14
0%	1.10 or less	1.11 or less

NOTE: Cell voltage with specific gravity is obtained by adding 0.84 to the specific gravity reading (eg. 1.265 + 0.84 = 2.105 Vdc).

Battery Voltage Test (No Load)

A battery voltage test without a load applied is carried out on a battery without discharging current. It is the simplest and most commonly used.

With a multimeter, voltage readings appear instantly to show the state of charge.

NOTE: Be aware that the voltage test can indicate that the battery is in good condition even though the battery does not have enough stored energy to crank the engine. A load test gives a more accurate indication of the condition of the battery.

If the battery has just received a charge, allow it to rest for 1-2 hours before taking a voltage reading.

Set multimeter to Vdc and measure voltage at battery terminals.

FULLY CHARGED BATTERY VOLTAGE (NO LOAD)
12.6 Vdc minimum

Battery Voltage Test (Load Applied)

This is the best test used to determine the condition of a battery. Use a load testing device such as the Electro Specialties battery load tester (P/N 710). It has a 500 A carbon pile adjustable load.

Follow battery load tester instructions.

Apply a load of 3 times the ampere-hour rating of the battery for 14 seconds, then check battery voltage.

BATTERY VOLTAGE TEST (LOAD APPLIED)	
TIME TO MEASURE INTO TEST	VOLTAGE
14 seconds	10.5 Vdc min.

If battery voltage has dropped below 10.5 Vdc, the battery storage capacity has decreased appreciably and the battery should be replaced.

Battery Storage

Disconnect and remove battery from watercraft as explained in *BATTERY REMOVAL*.

CAUTION: Battery storage is critical for battery life. Regularly charging the battery during storage will prevent cell sulfation. Keeping the battery in vehicle for storage may lead to contacts degradation/corrosion and case damage if freezing occurs. A discharged battery will freeze and crack in areas where freezing conditions are experienced. Electrolyte leakage will damage surrounding parts. Always remove battery from vehicle for storage and regularly recharge it to keep an optimal condition.

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Do not overfill.

The battery must always be stored fully charged. If required, recharge until specific gravity of 1.265 is obtained prior to storage.

CAUTION: Battery electrolyte temperature must not exceed 50°C (122°F) during charging. The battery casing should not feel hot to the touch.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of dielectric grease on terminals.

Clean battery casing and caps using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery.

Rinse battery with clear water and dry well using a clean cloth.

Store battery in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum. Keep battery away from dew, high moisture and direct sunlight.

During the storage period, recheck electrolyte level and specific gravity readings at least every month. If necessary, top up the electrolyte level with distilled water, then recharge (trickle charge). Recharge frequency depends on battery condition and storage temperature. Maintain battery as per following table.

AMBIENT TEMPERATURE	CHARGING FREQUENCY
Below 16°C (60°F)	Every month
Above 16°C (60°F)	Every 2 weeks

⚠ WARNING

Batteries must always be stored out of reach of children.

Activation of a New Battery

⚠ WARNING

Never charge or boost battery while installed in watercraft.

Perform the following operations anytime a new battery is to be installed.

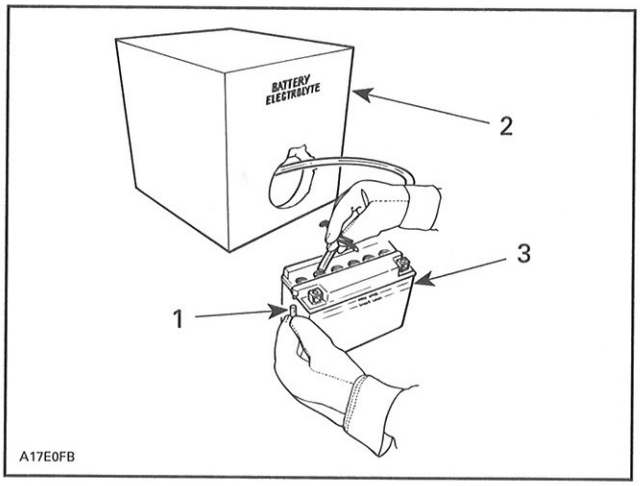
– Remove the sealing tube from the vent fitting.

⚠ WARNING

Failure to remove the sealing tube could result in an explosion.

– Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity: 1.265 at 21°C (70°F)).

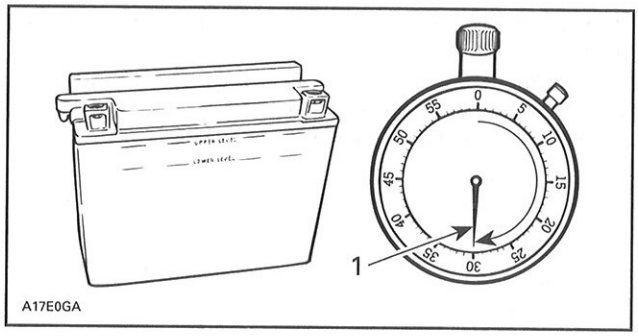
NOTE: This battery may fill slower than others due to the anti-spill check ball design.



1. *Sealing tube removed*
2. *Battery electrolyte*
3. *Upper level line*

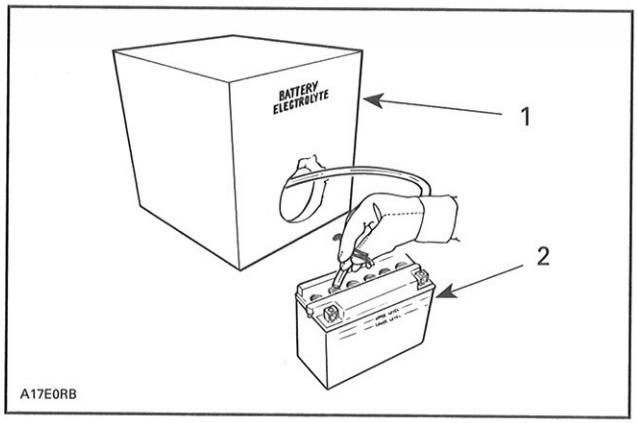
NOTE: Place the cell caps over the cell openings **engaging only the first thread** to prevent cell contamination and acid splatter during charging. **Do not screw caps on tightly**.

– Allow the battery to stand for 30 minutes MINIMUM to allow the electrolyte time to soak through the battery cells plates.



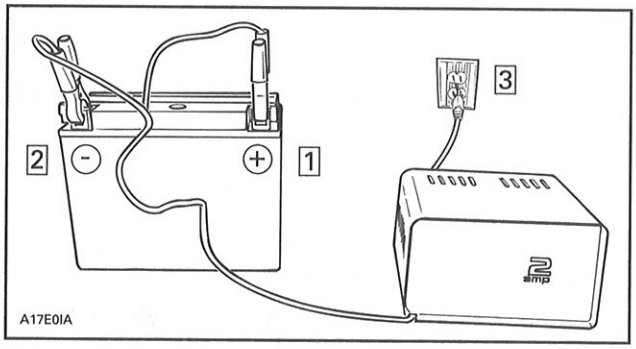
1. *30 minutes*

– Readjust the electrolyte level to the UPPER LEVEL line.



1. *Battery electrolyte*
2. *Upper level line*

– Connect a 2 A battery charger for 3 to 5 hours.



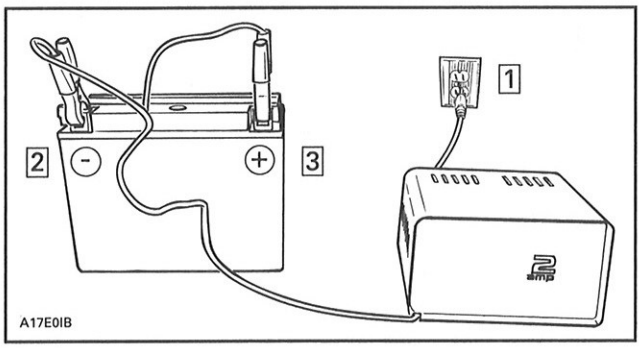
Step 1: Connect + lead to battery + post
Step 2: Connect - lead to battery - post
Step 3: Connect battery charger to AC outlet

⚠ WARNING

Gases given off by a battery being charged are highly explosive. Always charge in a well ventilated area. Keep battery away from cigarettes, open flames, welding operations and any other types of ignition. Always turn battery charger off prior to disconnecting cables. Otherwise a spark will occur possibly causing the battery to explode.

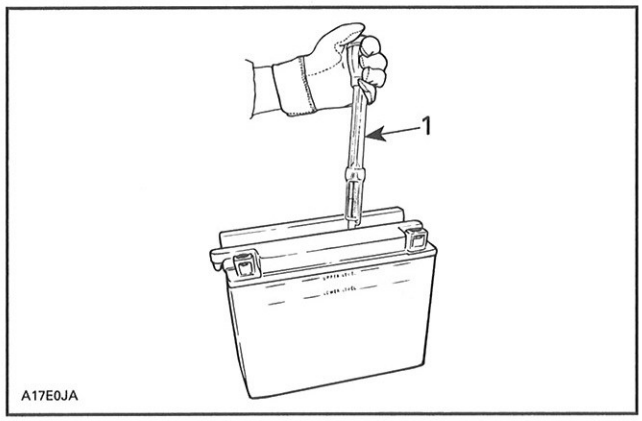
CAUTION: If charging rate increases above 2.4 A reduce it immediately. If cell temperature rises above 50°C (122°F) or if the casing feels hot, discontinue charging temporarily or reduce the charging rate.

– Disconnect battery charger.



Step 1: Disconnect battery charger from AC outlet
Step 2: Disconnect - lead
Step 3: Disconnect + lead

– Test battery state of charge. Use a hydrometer.



1. Specific gravity 1.265

– If electrolyte level has dropped after charging, fill with distilled water to UPPER LEVEL line. After water is added, continue charging for 1 to 2 hours to mix water with electrolyte.
– Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.

NOTE: Hand tighten caps then tighten an additional 1/4 turn using a 20 mm (3/4 in) socket. Using an other tool could damage the plastic battery caps.

⚠ WARNING

Battery electrolyte is caustic. To prevent spillage, battery cell cap should be sufficiently tight to properly seal.

Charging a Used Battery

⚠ WARNING

Never charge battery while installed in watercraft.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging has begun.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If you suspect the battery to be frozen, move it to a heated area for about 2 hours (or more if required) to let it thaw out before charging.

⚠ WARNING

Always charge a battery in a well ventilated area.

The time required to charge a battery will vary depending on several factors, such as:

– Battery temperature: The charging time is increased for a cold battery as charging current accepted by a cold battery will be lower than for a warm battery. As the battery warms up, it will accept a higher rate of charge.
– State of charge: As a battery discharges, it gives up its stored energy. The greater the discharge, the longer it will take to fully recharge it.
– Type of charger: Battery chargers vary in the amount of voltage and current that they can supply.

Charging a Very Flat or Completely Discharged Battery

The battery charger used should have an adjustable charging rate. A unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than 1 ampere.

Unless this procedure is properly followed, a good battery may be needlessly replaced.

– Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will not seem to accept the charge.
– Exceptionally for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

- Since battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept a measurable charger current may be up to 10 hours or more.
- If the charging current is not up to a measurable amount after 10 hours, the battery should be replaced.
- If the charging current is measurable before the end of the 10 hour period, the battery is good and charging should be completed at a lower rate as specified in *ACTIVATION OF A NEW BATTERY*.
- It is recommended that any battery recharged using this procedure be tested under load prior to returning it to service.

Battery Installation

⚠ WARNING

Always connect battery cables in the specified order, RED positive cable first, BLACK negative cable last.

Proceed as follows:

- Install battery in its support.
- Secure vent line to the battery and support. Ensure vent line is not kinked or obstructed.

⚠ WARNING

Vent line must be free and open. Avoid skin contact with electrolyte.

- First connect RED positive cable.
- Connect BLACK negative cable last.
- Apply dielectric grease on battery posts.
- Verify cable routing and attachments.

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	299
Fluke 115 multimeter	529 035 868	299, 301

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	290 897 651	307
dielectric grease	293 550 004	307
Isoflex grease Topas NB 52	293 550 021	306

GENERAL

Engine Cranking Conditions

The following conditions must be met to allow engine cranking:

- Safety lanyard (DESS key) must be on its post and recognized by the ECM as valid (2 short beeps)
- START/STOP button pressed and held.

Starting System Operation

If the ECM recognizes a valid safety lanyard (DESS key), it allows engine starting by providing the ground to the starter solenoid when the start/stop button is pressed.

If the start/stop button is held after engine has started, the ECM automatically stops the starter when the engine speed reaches 1600 RPM.

If the start button is activated while the throttle lever is depressed more than 65%, the engine will not be allowed to start (engine drowned mode).

⚠ WARNING

When carrying out any kind of maintenance on the starting system, always disconnect the battery ground cable. This will eliminate the possibility of shorting out a power cable, and generating a spark which could result in a fire or and explosion. Do not place tools on the battery.

Electrical Cables or Connections

Check all connections, cables and wires. Tighten any loose cables. Replace any chafed wire.

TROUBLESHOOTING

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *MONITORING SYSTEM/FAULT CODES* section.

Starting system failures are not necessarily related to the starter but may be due to one the following:

- Starter solenoid fuse 13
- Battery, refer to *CHARGING SYSTEM*
- Start/stop switch
- Starter solenoid
- DESS post
- ECM
- Wiring/connections.

Check these components before removing the starter.

NOTE: This section assumes the problem is related to the electrical starting system. If starting system tests good, ensure engine and jet pump integrity. Refer to applicable section.

PROCEDURES

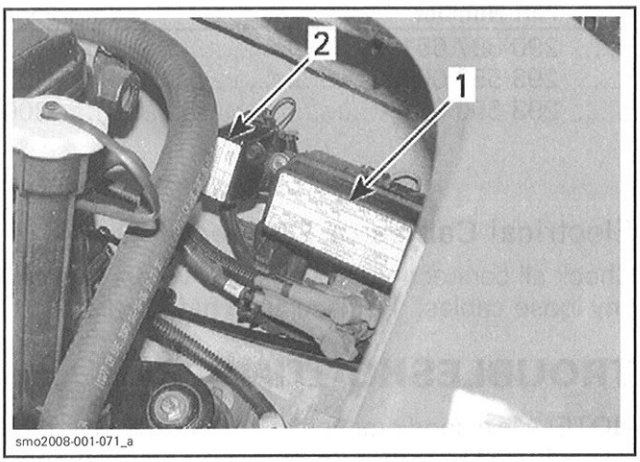
STARTER SOLENOID FUSE

Fuse Inspection GTI and RXP Models

To access fuse boxes, open the front storage cover and remove the storage bin. The fuse boxes are located in the front LH side of the bow.

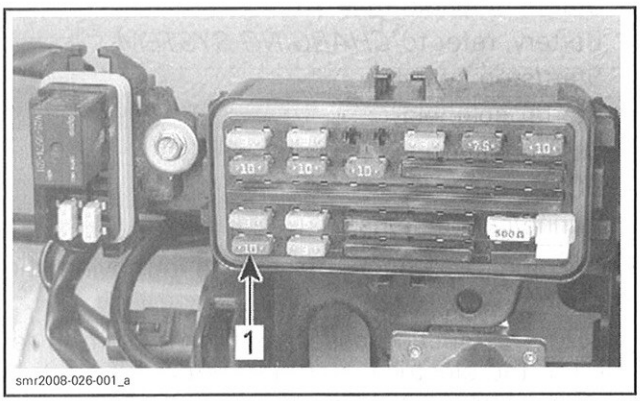
Fuse Inspection GTX and RXT Models

To access fuse boxes, remove the seat. The fuse boxes are located next to the front LH side of the engine.



RXT MODEL ILLUSTRATED
1. *Main fuse box (system fuses)*
2. *Relay fuse box (main power fuses and main relay)*

Make sure fuse 13 in main fuse box is in good condition.



1. *Fuse 13 (starter solenoid fuse)*

If the starter solenoid fuse (13) is burnt, it can be quickly identified by the following symptoms:
- The information center will come on
- A beep code should be heard
- There will not be any input voltage at the starter solenoid coil.

The solenoid may be the cause of a burnt fuse (13 or 16).

If the solenoid and solenoid coil circuit wiring tests good, one of the other systems may be at fault.

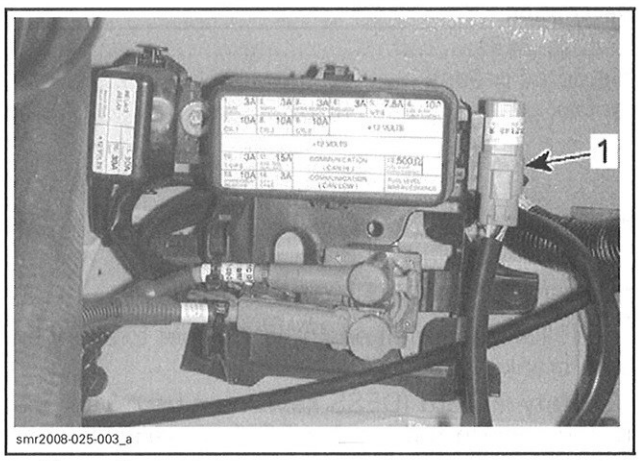
If fuse is good, proceed with the *STARTER QUICK TEST*.

ENGINE START/STOP SWITCH

Engine Start/Stop SwitchTest using B.U.D.S.

Remove seat, refer to *BODY* section.

Remove the diagnostic connector from its storage cap located next to main fuse box.



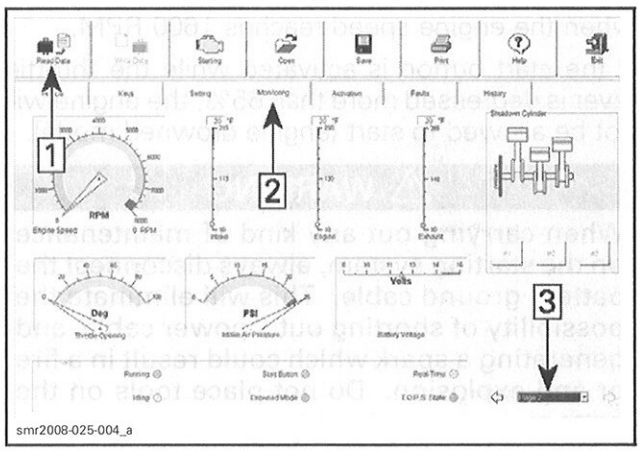
1. *Diagnostic connector*

Connect to the latest applicable B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

In B.U.D.S., select **Read Data**.

Select the **Monitoring** tab.

On the bottom RH corner of the monitoring page, select page 2.



Step 1: Select Read Data button
Step 2: Select the Monitoring page tab
Step 3: Select page 2

Press the vehicle start button and look for the **Start Button** LED to come "ON" in the lower center portion of the page.

lmr2005-056-005_en

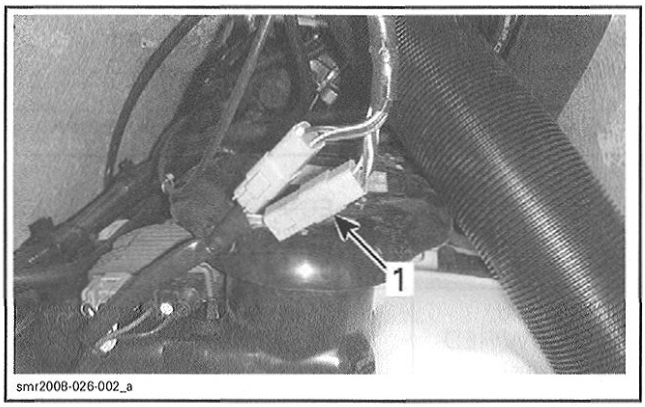
The start button LED should turn ON, indicating the starting system control circuits are functioning normally on the input side (start button, ECM and wiring). Test for a problem on the output side of the starting system (ECM ground signal to the starter solenoid, starter solenoid, wiring harness to the solenoid and the starter motor).

If the start button LED did not come ON, test the Start/Stop switch and its wiring circuits.

Start/Stop Switch Continuity Test

Open the front storage cover and remove the storage bin.

Disconnect the start/stop switch connector.



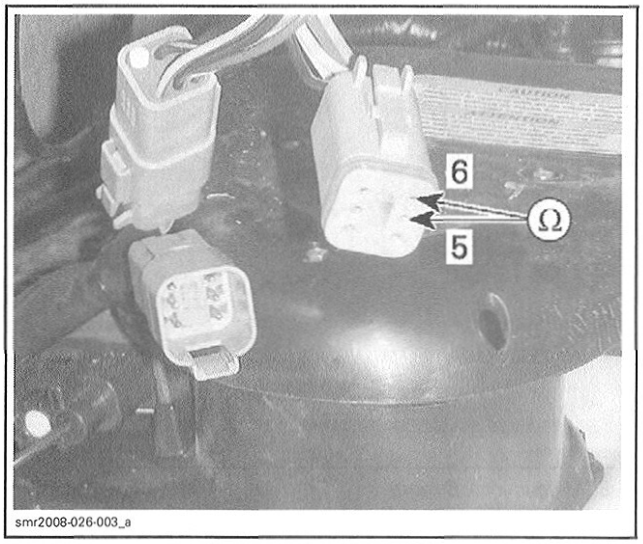
smr2008-026-002_a

1. Start/stop switch connector

Set a Fluke 115 multimeter (P/N 529 035 868) to Ω setting.

Measure resistance through switch as per following table.

START/STOP SWITCH CONTINUITY TEST		
SWITCH POSITION	TEST PROBES	RESISTANCE
Released	Pin 6 (YELLOW/RED) and Pin 5 (PURPLE)	Infinite (OL)
Pressed and held		Close to 0 Ω



smr2008-026-003_a

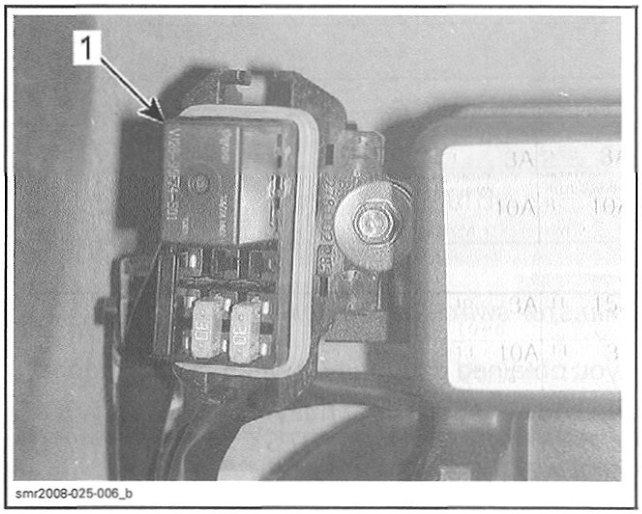
START/STOP SWITCH CONTINUITY TEST (PINS 5 AND 6)

If switch does not test as specified, replace the engine start/stop switch.

If switch tests as specified, reconnect switch connector and carry out a *START/STOP SWITCH CIRCUIT CONTINUITY TEST* as follows.

Start/Stop Switch Circuit Continuity Test

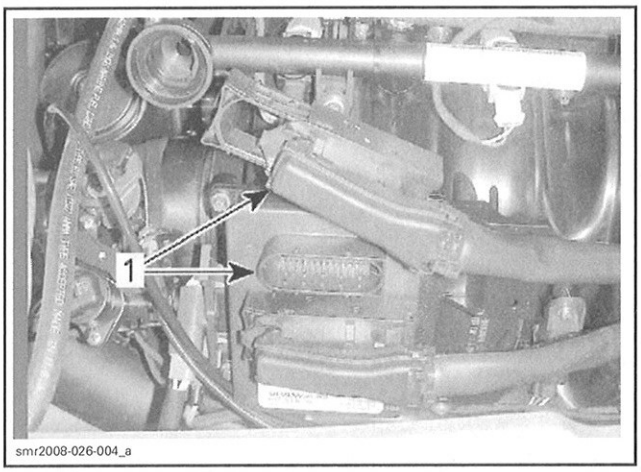
Remove main relay in relay fuse box.



smr2008-025-006_b

1. Main relay

Disconnect ECM connector B and install it on the ECM adapter (P/N 420 277 010).

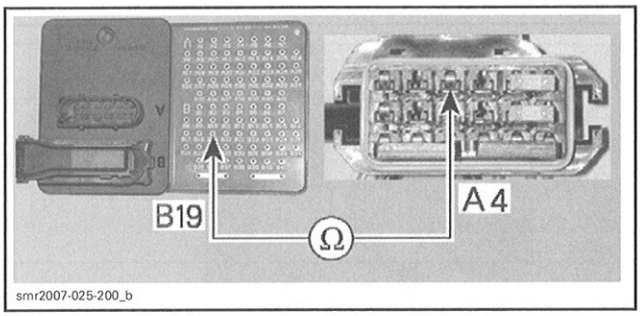


smr2008-026-004_a

1. ECM connector B removed

Carry out a continuity test of the start/stop switch circuit as per following table.

START/STOP SWITCH CIRCUIT CONTINUITY TEST			
SWITCH POSITION	ECM CONNECTOR B	RELAY FUSE BOX TERMINAL	RESISTANCE
Released	B-19	A4	Infinite (OL)
Pressed and held			Close to 0 Ω



smr2007-025-200_b

START/STOP SWITCH CIRCUIT CONTINUITY TEST

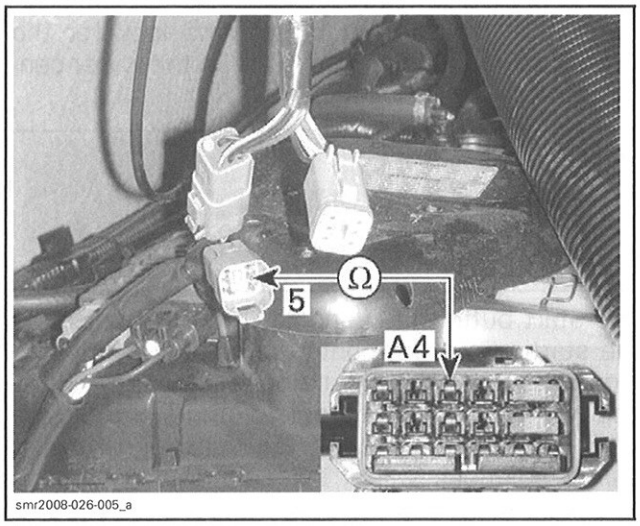
If you obtained continuity, switch circuit is good.

If you do not obtain continuity, carry out a *SWITCH POWER INPUT WIRE TEST* and a *SWITCH GROUND WIRE TEST.*

Switch Power Input Wire Test

Test continuity of the start/stop switch power input wire as per following table.

SWITCH POWER INPUT WIRE TEST		
SWITCH CONNECTOR (VEHICLE HARNESS SIDE)	RELAY FUSE BOX	RESISTANCE
Pin 5 (PURPLE wire)	Pin A4	Close to 0 Ω (continuity)



smr2008-026-005_a

SWITCH POWER INPUT WIRE TEST

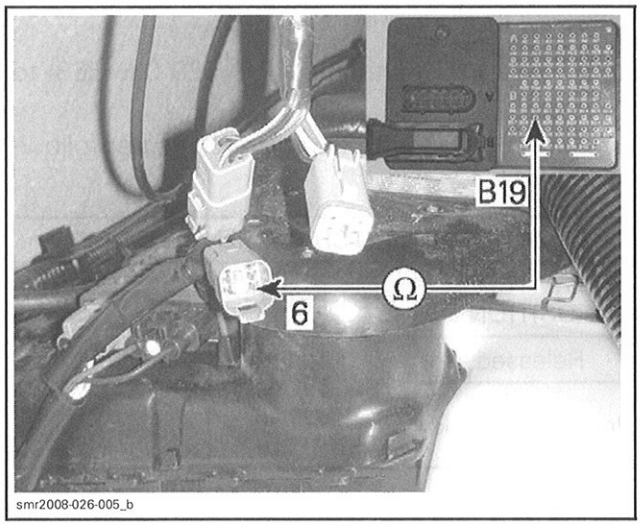
If resistance is not as specified, repair wiring/connectors.

If the power input wire continuity tested good, carry out the *SWITCH GROUND WIRE CONTINUITY TEST.*

Switch Ground Wire Continuity Test

Test continuity of start/stop switch ground wire as per following table.

SWITCH GROUND WIRE CONTINUITY TEST		
SWITCH CONNECTOR (VEHICLE HARNESS SIDE)	ECM CONNECTOR B	RESISTANCE
Pin 6 (YELLOW/RED wire)	B-19	Close to 0 Ω (continuity)



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SWITCH GROUND WIRE CONTINUITY TEST

If continuity is not obtained, repair harness/ connectors.

If continuity was obtained, the problem could be ECM related. Refer to *ENGINE MANAGEMENT* section.

STARTER SOLENOID

Solenoid is located below main fuse box.

GTI and RXP Models

To access starter solenoid, open the front storage cover and remove the storage bin. The solenoid is in the front LH side of the bow, at the bottom of the fuse box support.

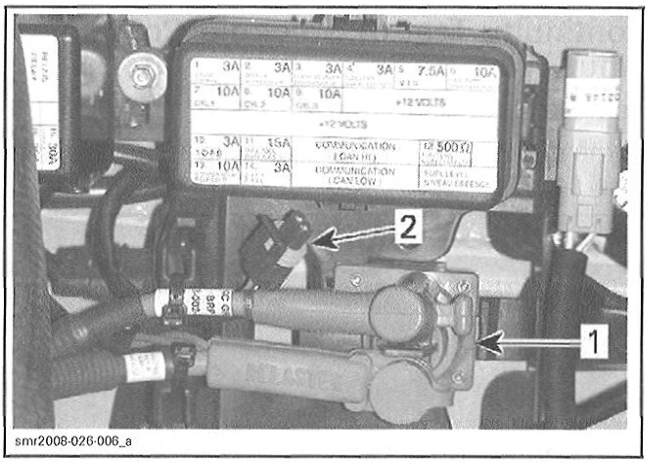
GTX and RXT Models

To access starter solenoid, remove the seat. The solenoid is located at the front LH side of the engine, at the bottom of the fuse box support.

TYPICAL – STARTER SOLENOID

Solenoid Input Voltage Test (at Coil)

Disconnect solenoid connector.



1. *Starter solenoid*
2. *Solenoid connector disconnected*

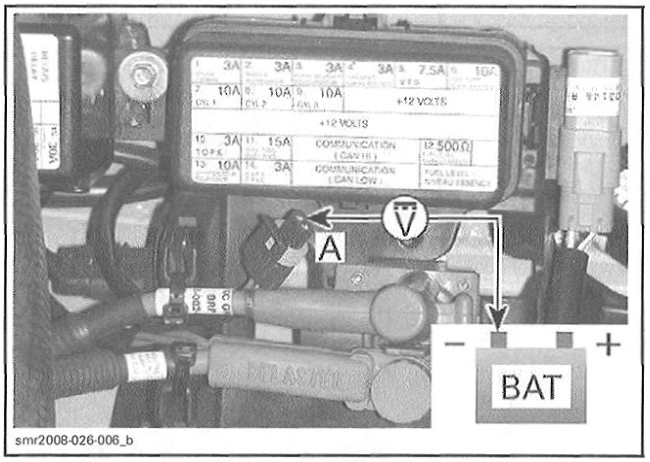
Install safety lanyard (DESS key).

Set Fluke 115 multimeter (P/N 529 035 868) to Vdc.

Measure for coil input voltage as per following table.

NOTE: Do not press the START/STOP button.

SOLENOID INPUT VOLTAGE TEST (COIL)		
TEST PROBES		VOLTAGE READING
Pin A (PURPLE wire) solenoid connector	Battery ground	Battery voltage



SOLENOID COIL INPUT VOLTAGE TEST

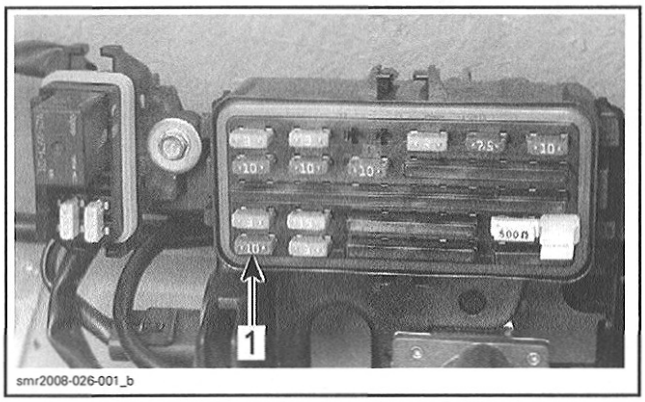
If battery voltage is obtained, carry out a *SOLENOID GROUND WIRE CONTINUITY TEST.*

If battery voltage is not obtained, carry out a *CONTINUITY TEST OF SOLENOID COIL INPUT WIRE* as follows.

Continuity Test of Solenoid Coil Input Wire

Remove safety lanyard (DESS key).

Remove fuse 13 (starter solenoid fuse) in main fuse box.

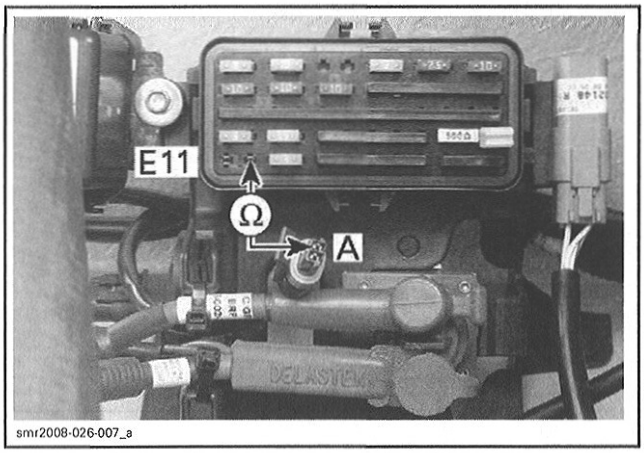


1. Fuse 13 (starter solenoid fuse)

Set multimeter to Ω setting.

Test continuity of the coil input wire as per following table.

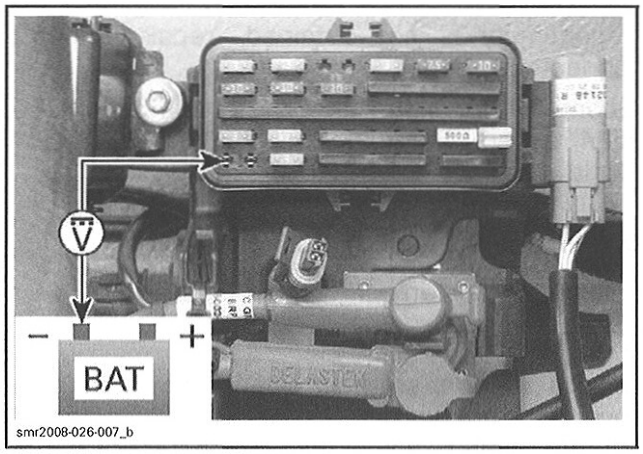
CONTINUITY TEST OF SOLENOID COIL INPUT WIRE		
SOLENOID CONNECTOR	MAIN FUSE BOX TERMINAL	RESISTANCE
Pin A	E11	Close to 0 Ω (continuity)



CONTINUITY TEST OF SOLENOID COIL INPUT CIRCUIT

If you do not obtain close to 0 Ω, repair or replace wiring/connectors.

If the power signal to the solenoid coil was not measured but continuity of the coil input circuit and fuse 13 are good, test for power between fuse box contact E12 and battery ground.



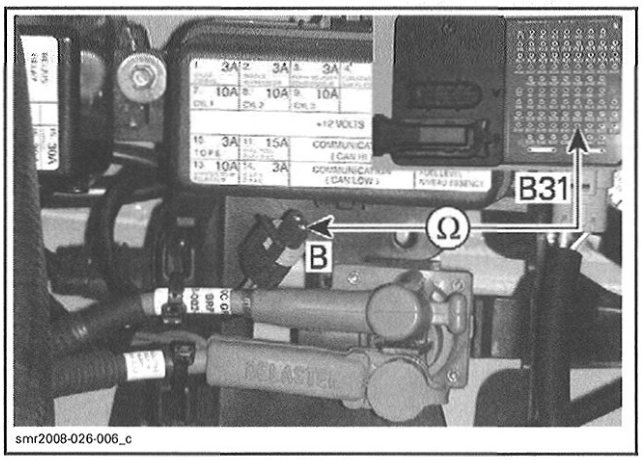
FUSE 13 INPUT VOLTAGE TEST

If battery voltage is not measured at contact E12, repair or replace fuse box wiring jumpers or connectors as required.

Solenoid Ground Wire Continuity Test

Test continuity of solenoid coil ground wire to ECM as per following table.

CONTINUITY TEST OF SOLENOID COIL GROUND WIRE		
SOLENOID CONNECTOR	ECM CONNECTOR B	RESISTANCE
Pin B	B-31	Close to 0 Ω (continuity)



SOLENOID GROUND WIRE CONTINUITY TEST

If you do not obtain close to 0 Ω, repair or replace wiring/connectors.

If wire continuity is good, carry out a *SOLENOID RESISTANCE TEST*

Solenoid Resistance Test

Remove solenoid from fuse box support, refer to *SOLENOID REMOVAL* in this section.

NOTE: Solenoid may be removed without disconnecting starter power cables for this test.

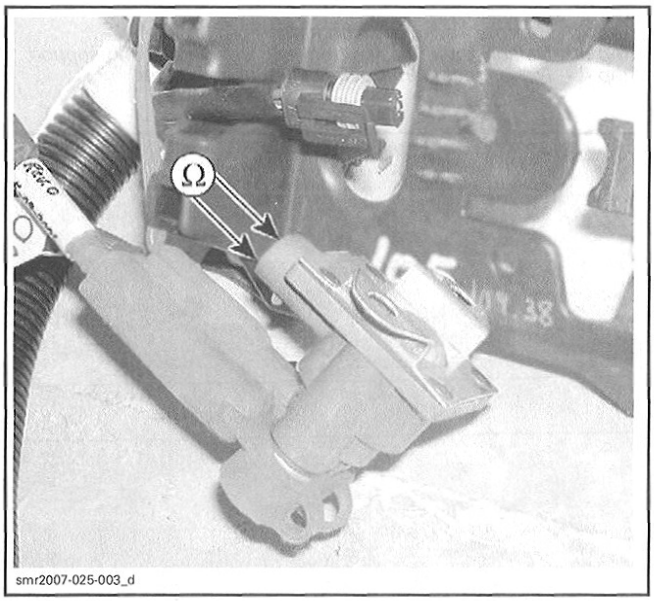
⚠ WARNING

Ensure the negative (-) battery cable is disconnected before removing starter solenoid and carrying out this test.

Set multimeter to Ω setting.

Measure solenoid coil resistance, as per following table.

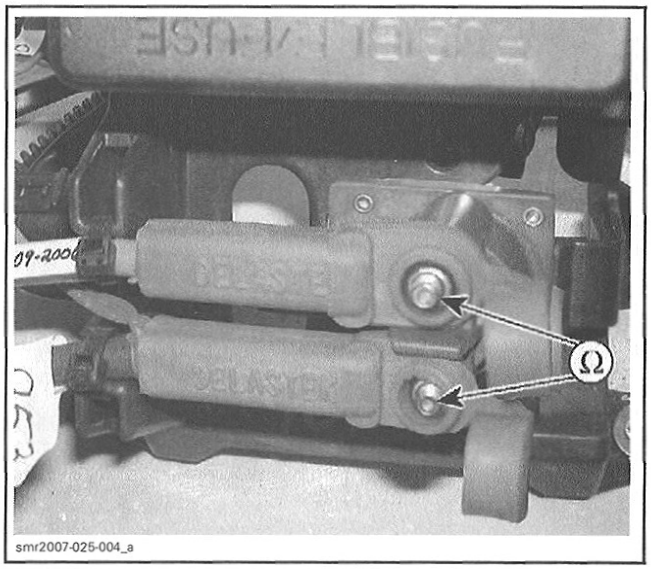
SOLENOID COIL RESISTANCE TEST	
PIN	RESISTANCE
A and B	Approximately 5 Ω



SOLENOID COIL RESISTANCE TEST

Test solenoid main contacts as per following table.

SOLENOID MAIN CONTACTS TEST		
SOLENOID POSTS		RESISTANCE
Post coming from battery	Post going to starter	OL (open circuit)



SOLENOID MAIN CONTACTS TEST (BATTERY DISCONNECTED)

If you do not measure an open circuit across the starter solenoid main contacts when the solenoid coil is not energized, the solenoid may be hung up or the contacts may be partially fused or shorted together. Replace the solenoid.

If an open circuit is read, carry out a *SOLENOID DYNAMIC TEST*.

Solenoid Dynamic Test

Ensure battery and starter solenoid are properly reconnected.

Set ECM in engine drowned mode as follows:

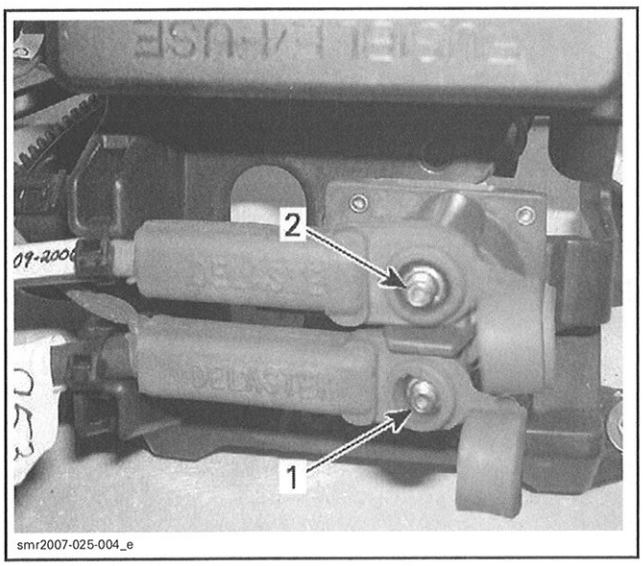
Depress throttle lever and install a rubber band to hold lever in full throttle position.

Set multimeter to Vdc.

Install the safety lanyard (DESS key).

Depress START/STOP button. As engine is cranking, measure the voltage at the large solenoid posts as per following table.

SOLENOID DYNAMIC TEST		
PROBES		VOLTAGE (DC)
Solenoid battery post	Battery ground	Battery voltage
Solenoid starter post		
Solenoid battery post	Solenoid starter post	0.2 V max.



1. *Solenoid battery post*
2. *Solenoid starter post*

If voltage at starter post or across solenoid contacts is out of specification, replace solenoid.

If voltage is not as specified at solenoid battery post, check battery and cable from battery to solenoid.

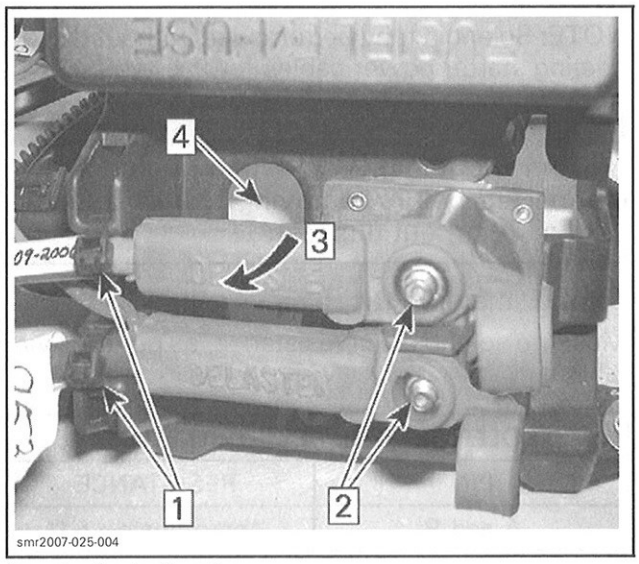
If solenoid dynamic test is a specified, carry out a *STARTER QUICK TEST*.

NOTE: Remove rubber band from throttle lever when tests are complete.

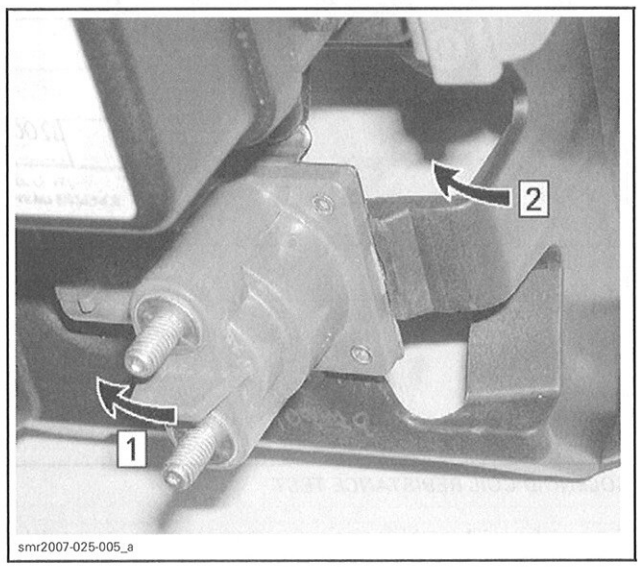
Solenoid Removal

Disconnect battery, refer to *CHARGING SYSTEM* section.

Disconnect starter solenoid as per following steps.

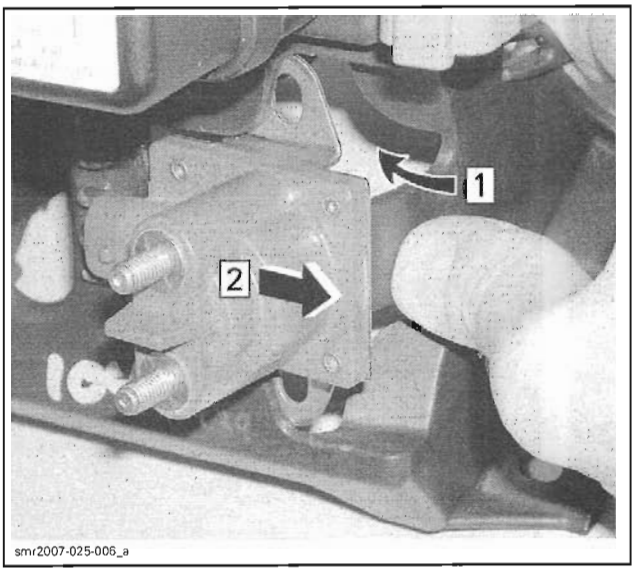


Step 1: Cut locking ties
Step 2: Remove cable retaining nuts
Step 3: Detach power cables from starter solenoid and support
Step 4: Disconnect starter solenoid input connector



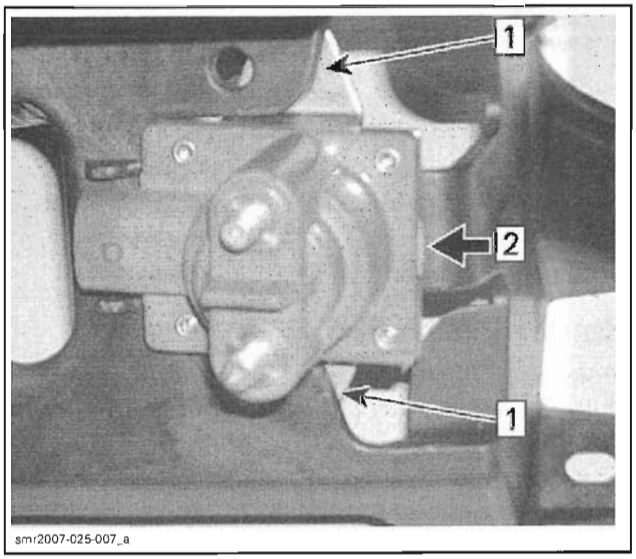
Step 1: Force top of solenoid and hold towards rear of support
Step 2: Push retaining tab under solenoid to release

NOTE: A screwdriver can be used to carefully pry solenoid.



Step 1: Maintain pressure on retaining tab
Step 2: Slide solenoid out

Solenoid Installation



Step 1: Insert solenoid mounting tabs under support
Step 2: Firmly push solenoid to lock position

Ensure to push solenoid until a "click" is heard (retaining tab engagement).

NOTE: It may be necessary to pull retaining tab to ensure proper locking.

Reinstall cables and secure with locking ties.

Reconnect battery and test starter solenoid operation.

STARTER

Starter Quick Test

To easily bypass the starter solenoid and the start control circuits, carry out the following procedure.

NOTE: This procedure tests the electric starter, the starter power cable from the starter solenoid, and the battery to engine ground cable.

Use a fully charged external 12 volt battery (similar in capacity to the battery installed in the vehicle), and a set of booster cables to power the starter at the starter post on the solenoid.

⚠ WARNING

Fuel, oil, or electrolyte vapors are flammable and may become explosive if certain conditions are met. These vapors may collect near the bottom of the hull when present. All types of ignition including electrical sparks are to be avoided when maintaining or testing vehicle.

⚠ WARNING

Always use an external battery for the starter quick test. Always connect the last BLACK booster cable clip to the external battery negative (-) terminal. Do not short starter solenoid contacts across the main power connections on the relay with a tool which may cause a spark. Failure to follow this procedure may result in an explosion.

⚠ WARNING

Always wear safety glasses when working with or around batteries.

Connect the first RED booster cable clip to the starter cable post on the starter solenoid.

Connect the second RED booster cable clip to the positive (+) terminal on the external battery.

Connect the first BLACK cable clip to the negative (-) battery terminal in the vehicle.

Momentarily apply the second BLACK cable clip to the negative (-) terminal of the external battery.

If engine does not crank (or slowly cranks), check the following:

- Booster cable connections
- Vehicle battery ground cable connections to engine
- Starter power cable/connections from solenoid to starter.

If the above items all test good, replace the starter.

If a new starter cannot rotate the engine, the problem may be engine or jet pump related. Refer to the applicable sections for testing procedures.

Starter Removal

Disconnect battery, refer to *CHARGING SYSTEM* section.

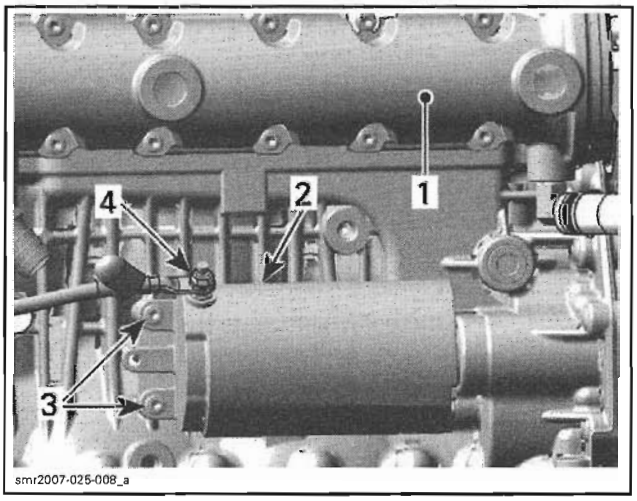
⚠ WARNING

Always disconnect the BLACK (-) battery cable first and reconnect last.

NOTE: To facilitate starter removal, remove engine cover and/or upper bridge as required. Refer to *BODY* section.

Disconnect starter power cable.

Remove starter retaining screws.

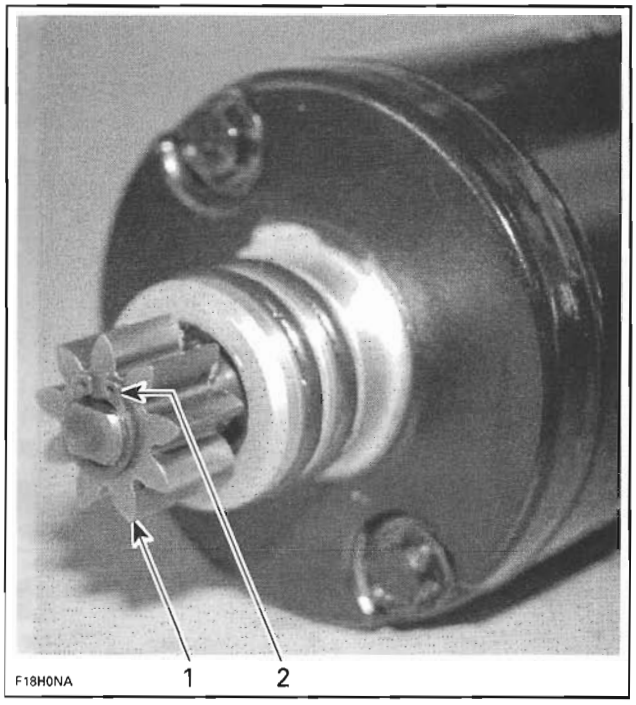


1. *Exhaust manifold*
2. *Starter*
3. *Starter retaining screws*
4. *Starter power cable retaining nut*

Starter Gear Removal

Remove starter.

Remove gear retaining circlip and pull out starter gear.



1. *Retaining circlip*
2. *Starter gear*

Starter Gear Installation

Installation is essentially the reverse of removal procedure. However, pay particular attention to the following.

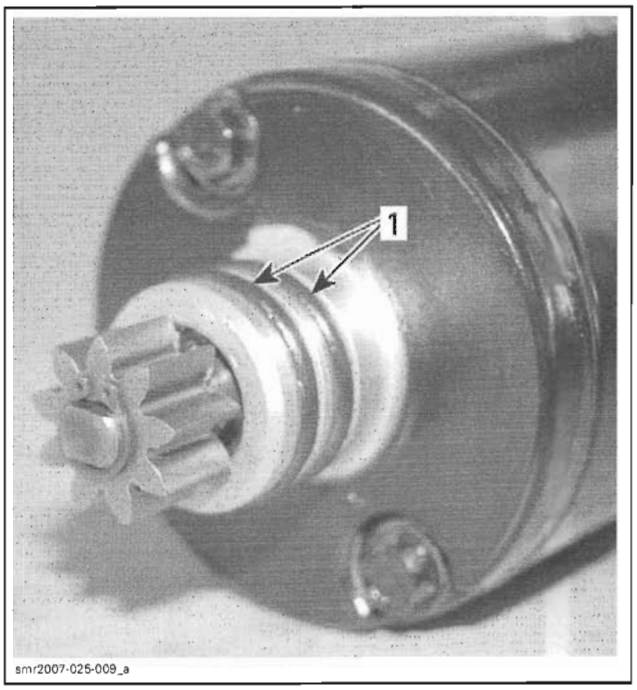
It is recommended to use a new circlip.

Starter Installation

Installation is the reverse of the removal procedure. However, pay particular attention to the following.

Ensure starter and engine mating surfaces are free of debris. Serious problems may arise if starter is not properly aligned.

Apply Isoflex grease Topas NB 52 (P/N 293 550 021) on starter O-rings.



1. Apply Isoflex grease Topas NB 52

Install starter.

NOTE: If starter does not mesh properly with intermediate gear, pull starter out, slightly rotate the starter gear; then reinstall the starter. Temporarily removing both O-rings makes it easier to align both gears. Once gears are aligned, remove starter to install O-rings being careful not to rotate starter gear out of position, then reinstall the starter.

Apply Loctite 243 (P/N 290 897 651) on retaining screws and torque to 10 N•m (89 lbf•**in**).

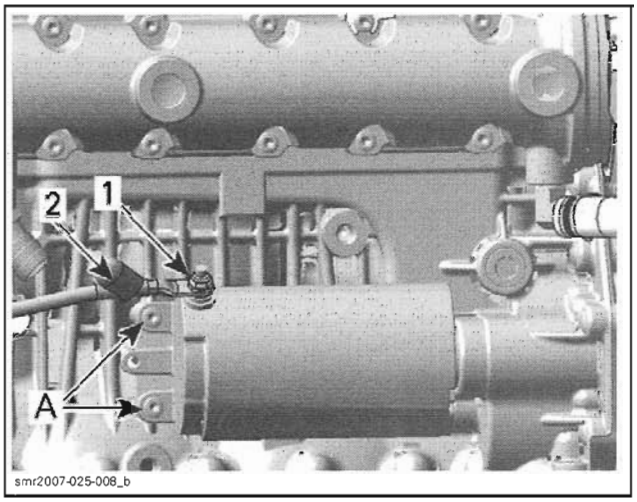
Connect the RED positive cable to the starter and torque retaining nut to 7 N•m (62 lbf•**in**).

⚠ WARNING

To prevent electric shock whenever connecting the RED power cable to the starter motor, ensure the BLACK (-) battery cable is disconnected.

Apply dielectric grease (P/N 293 550 004) on terminal and nut.

Ensure to install rubber protector over starter power cable retaining nut.



*1. Torque power cable retaining nut to 7 N•m (62 lbf•**in**) and apply dielectric grease*
2. Install rubber protector
*A. 10 N•m (89 lbf•**in**)*

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	314
Fluke 115 multimeter	529 035 868	311

GENERAL

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE*.

This system allows starting the engine only with safety lanyard(s) that has been programmed to operate a specific watercraft. This functionality is the DESS system.

NOTE: If desired, a DESS key can be used on other watercraft equipped with the DESS. It only needs to be programmed for that watercraft.

The following components are specially designed for this system: ECM, DESS key and DESS post.

The DESS key cap contains a magnet and a ROM chip. The magnet actually closes the reed switches inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code which is the equivalent of the notch pattern on a conventional key.

The system is quite flexible. Up to 8 different keys may be programmed in the memory of the ECM. They can also be erased individually.

The memory of the ECM is programmed to recognize the digital code of the DESS key. This is achieved with the B.U.D.S. software.

DESS Key Types

In addition to the standard DESS key, the ECM also offers special keys that can be programmed so that the vehicle can be run only at a limited speed. Such feature is ideal for first time riders or renters.

The following table indicates the approximate maximum engine rpm's given the type of key used.

DESS KEY TYPE	COLOR	MAXIMUM ENGINE RPM
Standard key	YELLOW	Approximately 8220 to prevent engine overspeed
Learning key	WHITE	Approximately 5500
R key	ORANGE	Approximately 6500

⚠ WARNING

The 3 key types differ only in color and can be programmed to any of the 3 options proposed in B.U.D.S. It is important to program each key type to the adequate engine RPM restriction. Only program WHITE key for learning mode, ORANGE key for rental or reduced speed mode and YELLOW key for no restriction mode. Failure to do so can result in severe injury or death for the operator of the vehicle.

NOTE: Depending on riding and environment conditions, the given values can vary of at least ± 500 RPM's. At high altitude, variations could be greater if impeller is not replaced.

The restrictor plate for the air intake system is an option to use solely on GTI Rental models when using the R key, it does not apply to any other models. The restrictor plate does not affect the RPM restriction.

Beeps

When connecting a key on the post, the DESS is activated and will emit audible signals:

BEEP	SIGNIFICATION
2 short	Indicate a working DESS key. Engine starting can take place.
1 long	Indicates a wrong DESS key is being used or something is defective. Engine starting is not allowed.

Other beeps can be heard. The ECM features a self-diagnostic mode. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* for more information.

When ordering a new ECM from the regular parts channel, the DESS circuitry will be activated.

Key Reminder

If engine is not started within 10 seconds after installing the DESS key on its post, 4 very short beeps will sound every 5 minutes for 2 cycles. Then, 4 very short beeps will sound every 3 second interval to remind you to start the engine or to remove the key. The same will occur when the key is left on its post 10 seconds after engine is stopped.

The beeps stops only when safety lanyard is removed or after 4 hours elapsed.

Always ensure DESS key is not left on its post after engine is stopped.

IMPORTANT: Leaving the DESS key on its post when engine is not running will slowly discharge the battery.

PROCEDURES

DESS KEY

KEY PROGRAMMING

Perform the required connections for B.U.D.S. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* for proper connection instructions.

Use the latest B.U.D.S. software available from BOSSWeb.

IMPORTANT: Ensure all connections have been made **before starting B.U.D.S.** to allow proper operation.

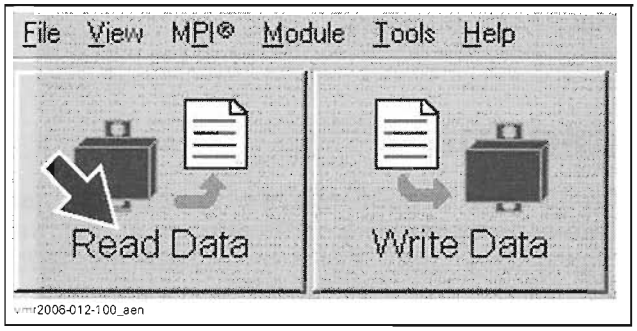
Start B.U.D.S. and logon.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

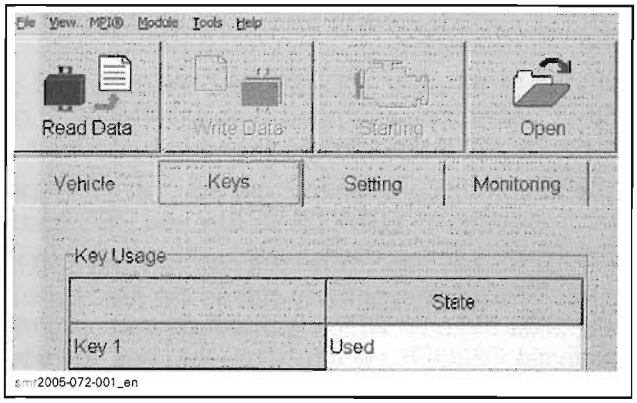
⚠ WARNING

If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

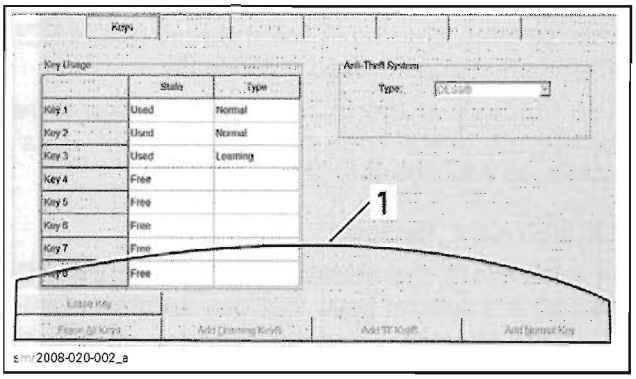
Read ECM using **Read Data** button.



Click on **Keys** tab.



If all all buttons are greyout out in **Keys** tab:



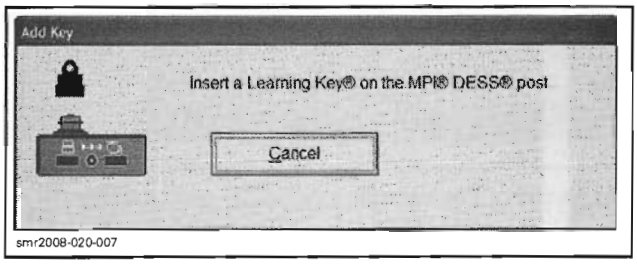
1. *All buttons greyed out*

- The batteries in the DESS post interface are leak or are not installed. Install new batteries.
- The DESS post interface was connected after B.U.D.S. has been started.

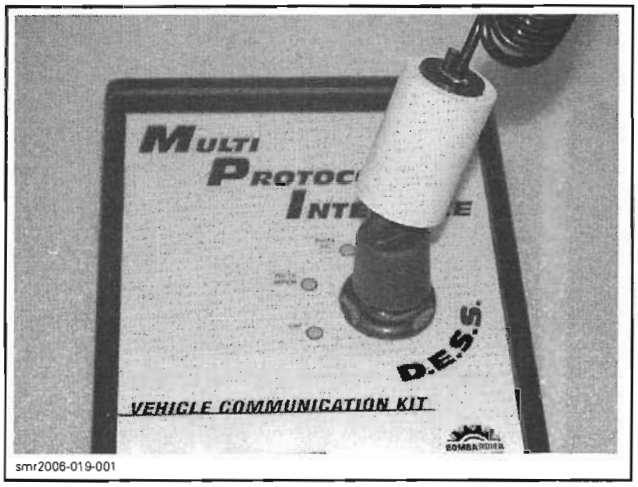
– In all cases, exit B.U.D.S., ensure the DESS post interface is properly connected then restart B.U.D.S.

Click on the desired **Add Key** button on bottom of screen according to the type of key you want to program.

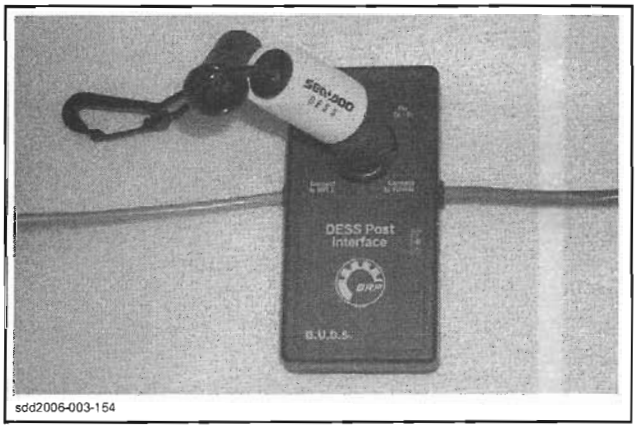
When the following window pops up, install the new key to be programmed on MPI or DESS post interface tool.



NOTE: Ensure to use the DESS key color that matches the key usage.

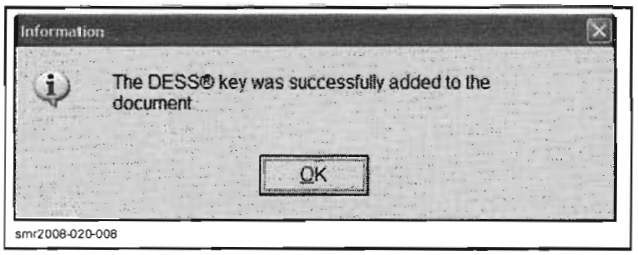


MPI



MPI-2

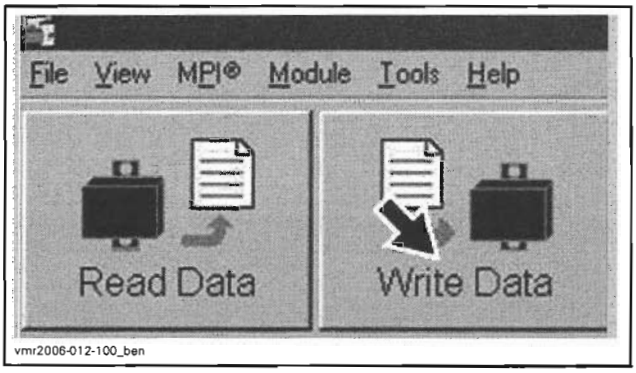
When this window pops up, a new key has been saved in the computer.



Remove key from MPI and install on vehicle DESS post.

NOTE: To program other key(s), click again on the desired **Add Key** button.

When finished ensure to save new data in ECM using **Write Data** button so that the programming becomes effective.



BEEPER

Beeper Troubleshooting

If no beep is heard when installing the DESS key on the post and engine can be started, refer to *GAUGE/FUSES* to check the beeper operation.

If no beep is heard when installing the DESS key on the post and engine can NOT be started, refer to *ELECTRONIC FUEL INJECTION*.

DESS POST

DESS Post Continuity Test

NOTE: The DESS post with 4 wires contains 2 reed switches working in parallel.

The following continuity tests can be performed using an ohmmeter.

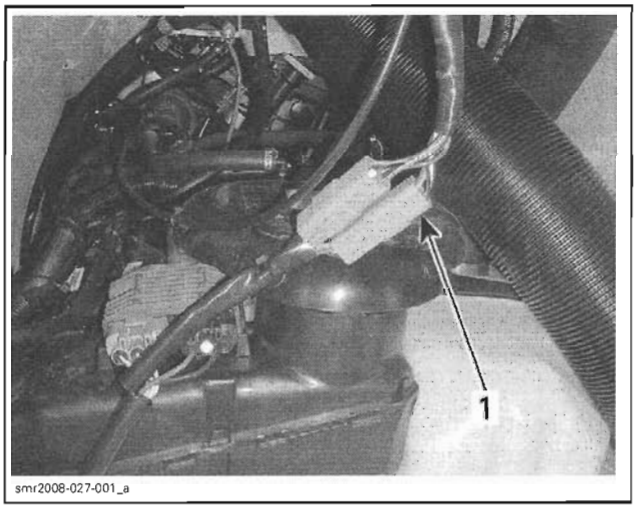
For best results, use the Fluke 115 multimeter (P/N 529 035 868).

Open front storage cover.

Remove storage tray if so equipped.

DESS Key Removed from Post

Disconnect the male connector attached to the DESS post harness.

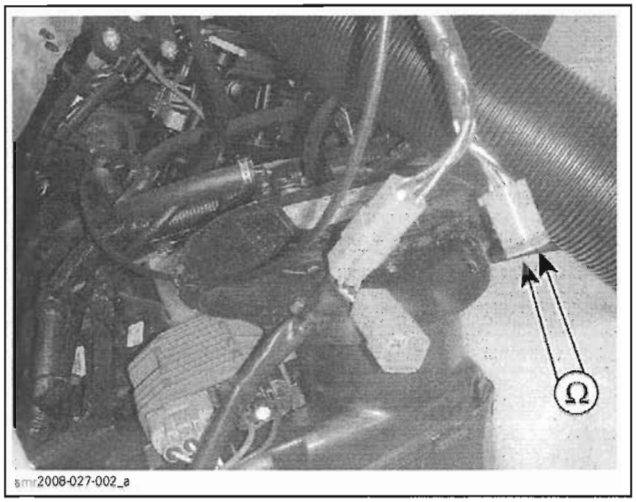


1. Male connector here

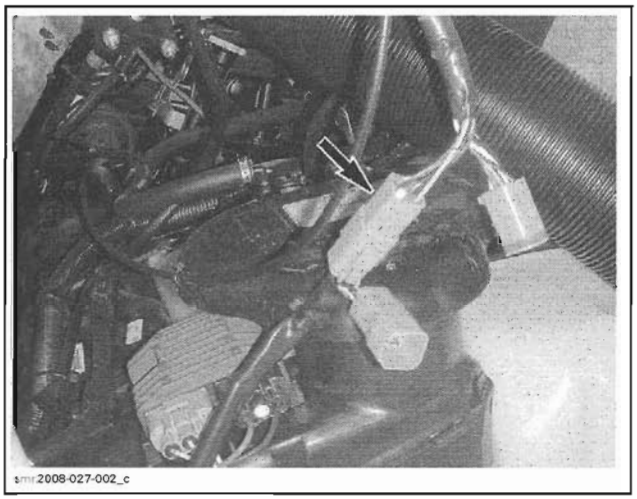
Set multimeter to Ω.

Probe DESS post terminals to check continuity as follows.

DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
BLACK (male connector)	BLACK/YELLOW (male connector)	Open circuit

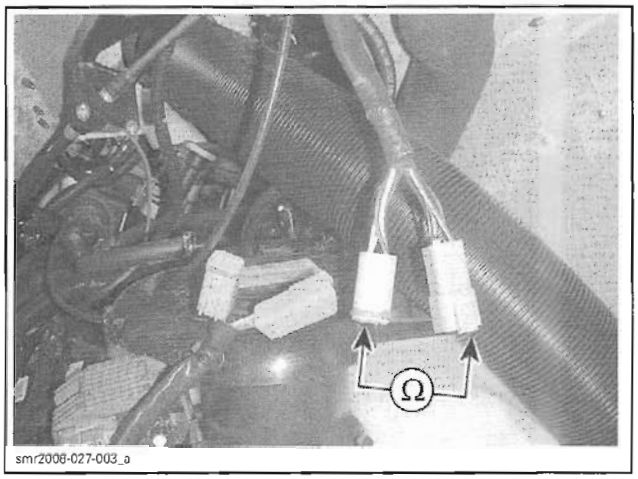


Disconnect the remaining DESS connector.

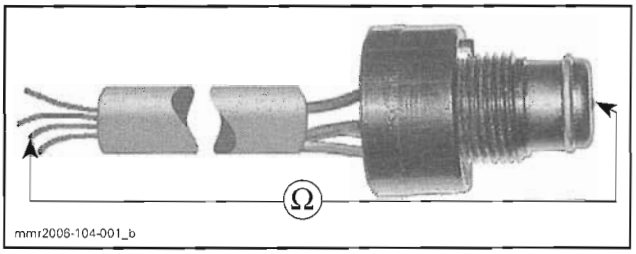


Probe DESS post terminals to check continuity as follows.

DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
BLACK (male connector)	BLACK/PURPLE (female connector)	Open circuit

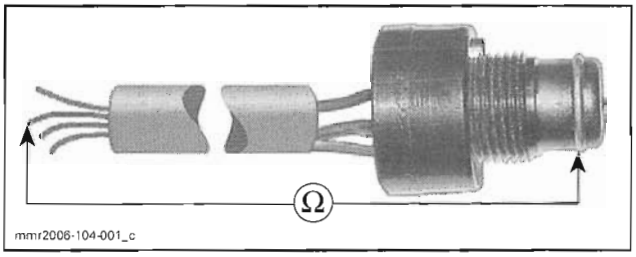


DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
WHITE/GREY (male connector)	Post terminal	Close to 0 Ω



TYPICAL

DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
BLACK (male connector)	Post ring	Close to 0 Ω

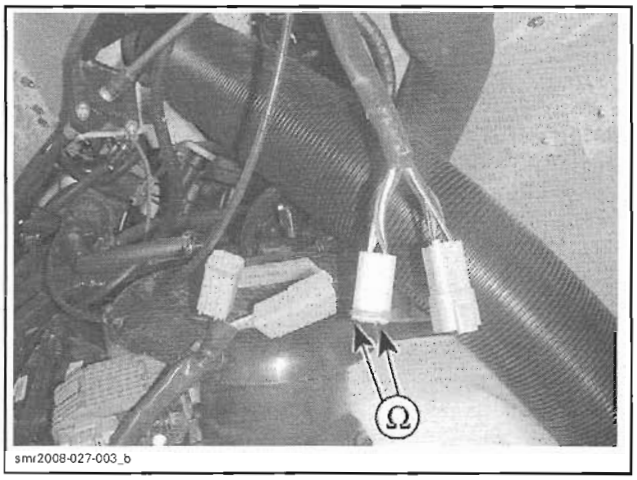


TYPICAL

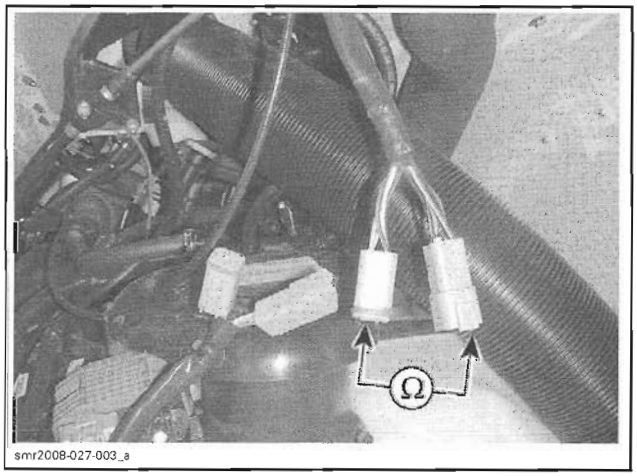
DESS Key on Post

Probe DESS post terminals to check continuity as follows.

DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
BLACK (male connector)	BLACK/YELLOW (male connector)	Close to 0 Ω



DESS POST HARNESS		RESISTANCE @ 20°C (68°F)
BLACK (male connector)	BLACK/PURPLE (female connector)	Close to 0 Ω

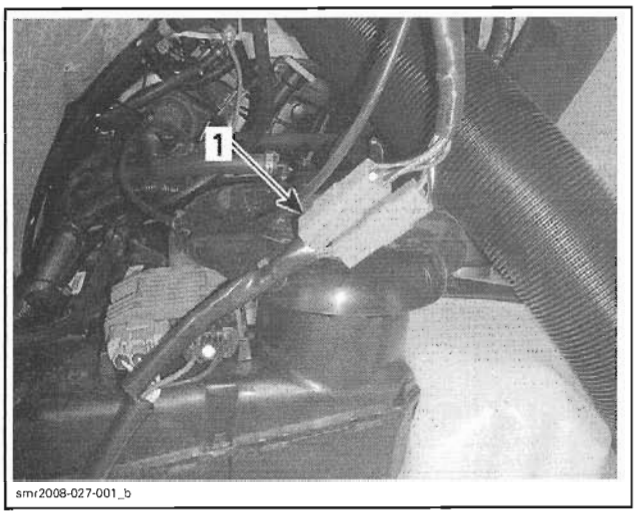


Reconnect DESS post connectors.

If any continuity test fails, replace DESS post.

DESS Post Vehicle Harness Continuity Test

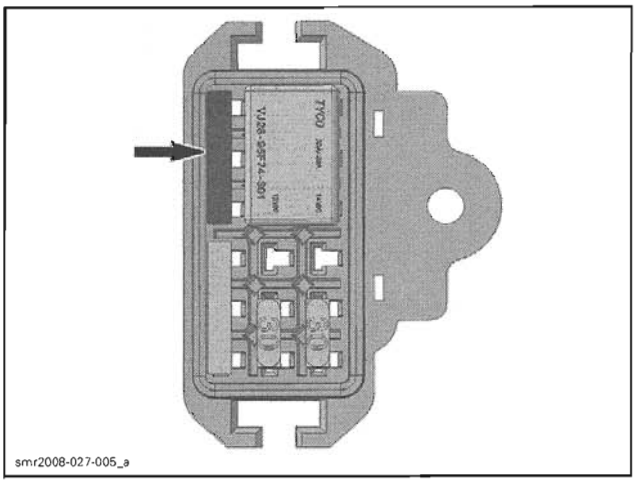
Disconnect the male connector attached to the vehicle harness of the DESS post.



1. Male connector here

Remove cover from relay fuse box.

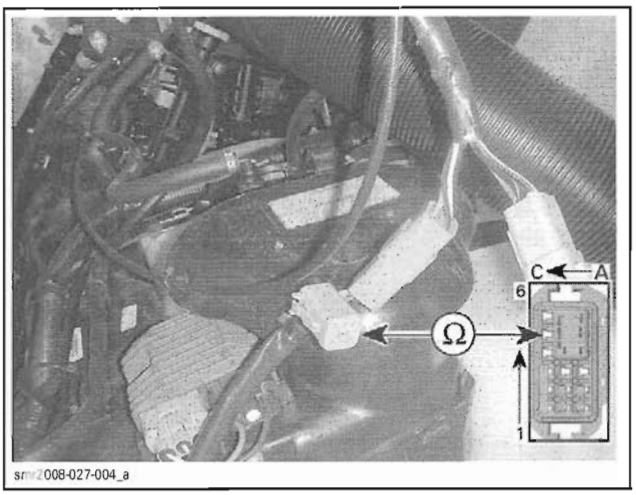
Remove the ground bus bar.



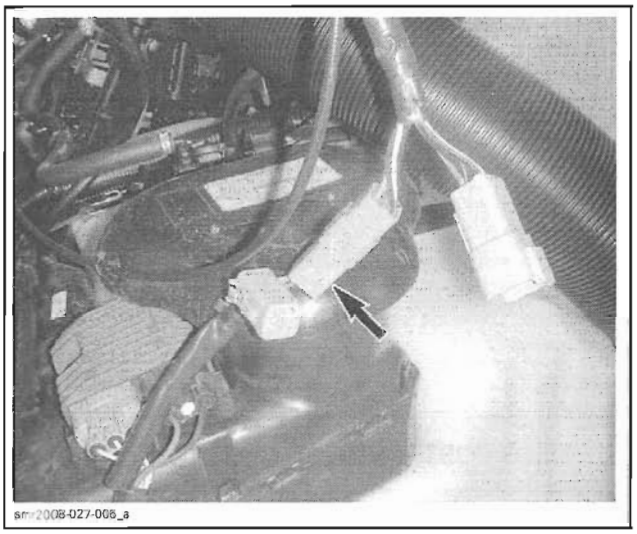
Set multimeter to Ω.

Probe vehicle harness terminals to check continuity as follows.

DESS POST VEHICLE HARNESS	RELAY FUSE BOX	RESISTANCE @ 20°C (68°F)
BLACK/PURPLE (male connector)	C5 (crossing of column C and row 5)	Close to 0 Ω

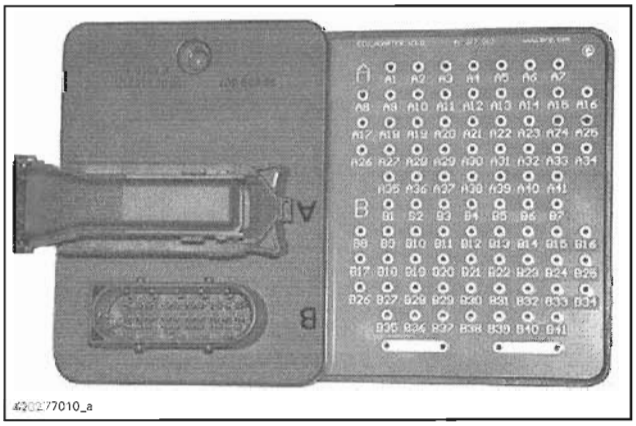


Disconnect the remaining DESS connector.



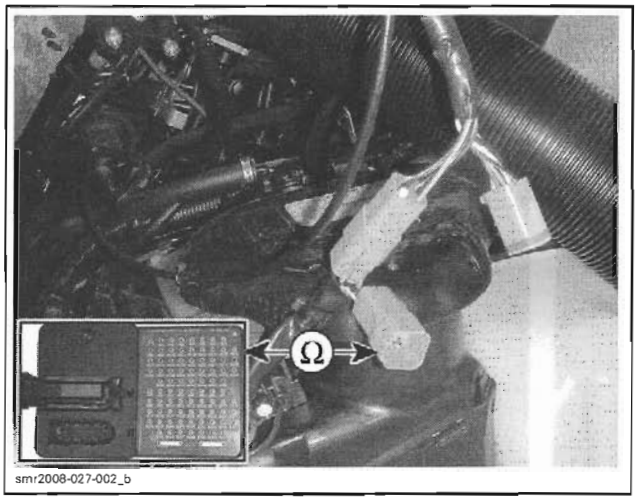
Disconnect the A connector from ECM.

Install the ECM adapter (P/N 420 277 010) on ECM connector.



Probe vehicle harness terminals to check continuity as follows.

DESS POST VEHICLE HARNESS (FEMALE CONNECTOR)	ECM CONNECTOR	RESISTANCE @ 20°C (68°F)
BLACK/YELLOW	B-26	Close to 0 Ω
WHITE/GREY	B-38	
BLACK	B-39	



Reinstall removed components.

If any continuity test failed, replace DESS post. Refer to *STEERING SYSTEM.*

If problem persists and all tests have been performed, try a new ECM. Refer to *FUEL INJECTION* section.

GAUGE/FUSES

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	331, 337, 343
Fluke 115 multimeter	529 035 868	321

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on terminal remover	TT600-4	340

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	317
Locktite 425 threadlocker	293 800 040	344

GENERAL

NOTE: For a complete overview of the vehicle electrical system, refer to *ENGINE MANAGEMENT*.

NOTE: It is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

It is highly recommended to disconnect the battery when replacing any electric or electronic component.

⚠ WARNING

Always disconnect battery exactly in the specified order, BLACK (-) cable first, RED (+) cable last. Always reconnect BLACK (-) cable last. Do not place tools on battery.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones.

IMPORTANT: When troubleshooting an electrical system fault, check battery condition, cables and connections first.

Install safety lanyard (DESS key) to activate ECM and Information Center when testing procedures require the device or system to be supplied with electrical power.

Check the related-circuit fuse condition with a fuse tester or ohmmeter (a visual inspection could lead to a wrong conclusion).

Pay particular attention to ensure that pins are not bent or pushed out of their connectors.

Ensure all wire terminals are properly crimped on wires, and connector housings are properly fastened.

When replacing an electric or electronic component, always check electrical connections. Make sure they are tight, make good contact, and are corrosion-free. Dirty, loose or corroded contacts are poor conductors and are often the source of a system or component malfunction.

Check for signs of moisture, corrosion or dullness. Clean pins properly and coat them with dielectric grease (P/N 293 550 004) or other appropriate lubricant (except if otherwise specified) when reassembling them.

Pay attention to ground wires.

Checking for Shorts Between 2 Wires

When checking continuity of a wire in a circuit, wires should be checked for a short circuit between them as follows.

Isolate the circuit by disconnecting its connectors.

Let's suppose that the circuit to be checked is composed of a RED and a BLACK wire. Using an ohmmeter, measure the resistance between the RED and the BLACK wire. The resistance should be infinite (OL). Otherwise, a short circuit exits between the two wires must be identified and corrected.

Addition of Electrical Accessories

When an electrical accessory is added such as a VTS, Depth Sounder or Lake Water Temp/Speed Sensor, it must be activated in the ECM using B.U.D.S.

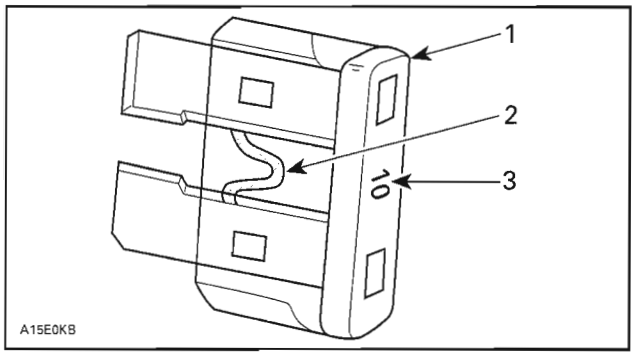
If an option is installed but not activated in B.U.D.S., the information center will not display that option. If an option is activated in B.U.D.S. but not installed in the vehicle, SENSOR will be displayed in the Information Center.

Select the applicable accessory in the **Options** area of the **Setting** page in B.U.D.S. to activate or deactivate the function.

PROCEDURES

FUSES

If an electrical system fault occurs, check the fuses. If a fuse is burnt, replace it with a fuse of the same rating.



1. *Fuse*
2. *Check if melted*
3. *Ampere rating*

⚠ WARNING

Do not use a higher rated fuse than recommended. Use of a higher rated fuse can lead to severe component or circuit damage, and overheat condition, and possibly and electrical fire. If a fuse has burnt out, the source of the malfunction should be identified and corrected before applying power to the vehicle.

Fuses can be found in 2 fuse boxes mounted on a support with the diagnostic connector, starter solenoid and T.O.P.S. switch.

All RXP and GTI Models

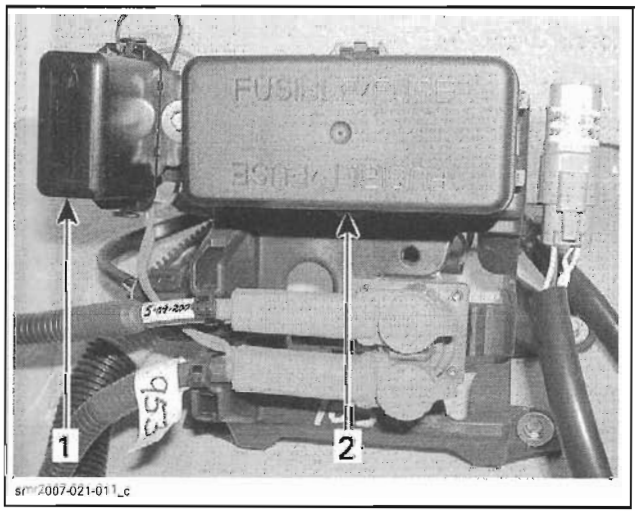
For these models, the fuse boxes are located in the bow area.

To access them, open the front storage compartment cover and remove the storage bin.

All GTX and RXT Models

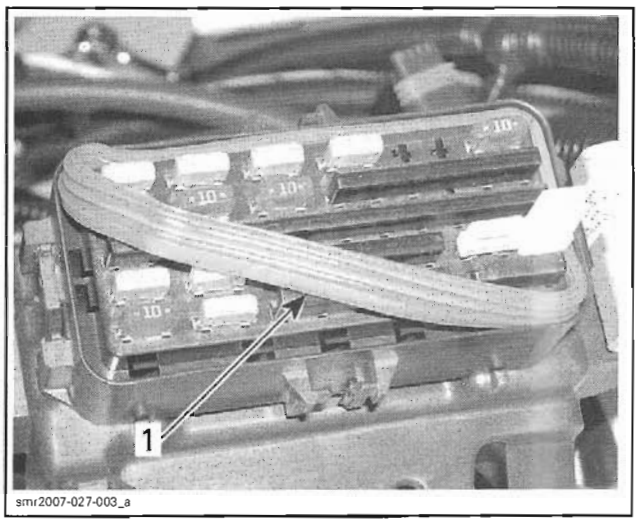
For these models, the fuse boxes are located in the engine compartment, just forward and to the left of the engine.

To access them, simply remove the seat.



1. *Relay fuse box*
2. *Main fuse box*

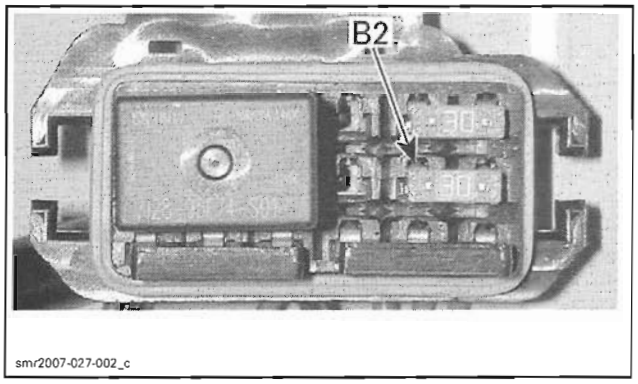
When installing main fuse box cover, ensure the seal is properly seated. If the seal has been removed, ensure to reinstall it as illustrated.



TYPICAL
1. Wider lip here

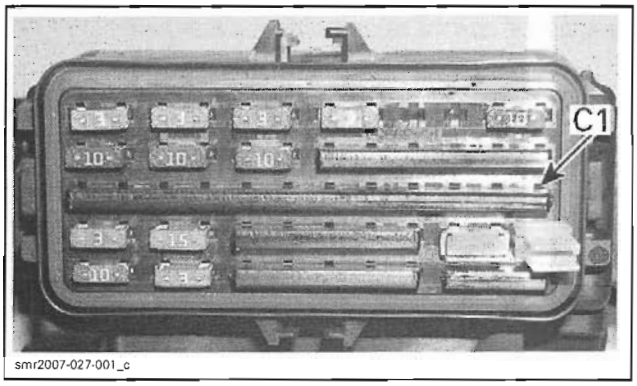
Fuse Box Power Input

The relay fuse box receives power at pin B2 from the battery. Refer to *FUSE BOX PIN-OUT IDENTIFICATION* further in this section.



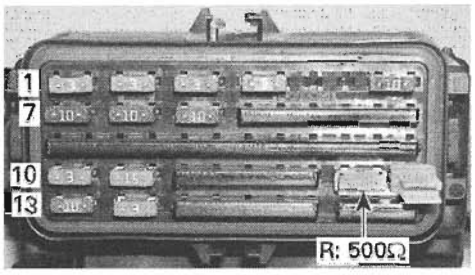
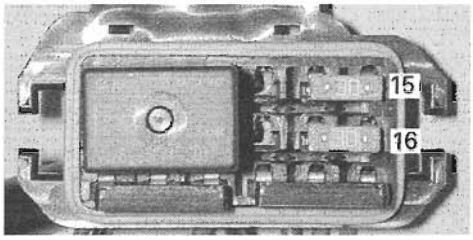
TYPICAL – POWER IN

Main fuse box receives its power at pin C1 from the main relay. It then distributes power through plug-in bus bars (seen in illustration) and jumper wires to the system fuses (connected in back of fuse box).



TYPICAL – POWER IN

Fuses Identification

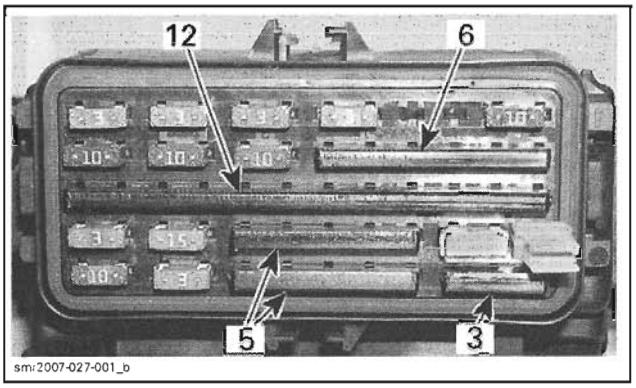
FUSE NO.	FUSE	DESCRIPTION	LOCATION
1	3 A	Information center gauge	
2	3 A	Beeper	
3	3 A	Depth sounder (if so equipped)	
4	3 A	Fuel level sensor and ECM	
5	7.5 A	VTS (if so equipped)	
6	10 A	Fuel pump	
7	10 A	Cylinder 1 (ignition coil and injection)	
8	10 A	Cylinder 2 (ignition coil and injection)	
9	10 A	Cylinder 3 (ignition coil and injection)	
10	3 A	TOPS sensor	
11	15 A	Diagnostic connector	
12	500 Ω resistor	Fuel level sensor	
13	10 A	Starter solenoid	
14	3 A	CAPS	
15	30 A	Charging system	
16	30 A	Main (battery)	

NOTE: The contact numbers on either side of the fuses on the electrical schematic do not necessarily identify the fuse contact numbers. They identify the bus-bar contact from which the fuse receives power (through a wire jumper), and the contact through which the fuse powers the system.

NOTE: The 500 Ω resistor in the main fuse box is counted as if it was fuse 12.

If a system is not receiving input voltage, ensure the bus-bars and wire jumpers are making good contact.

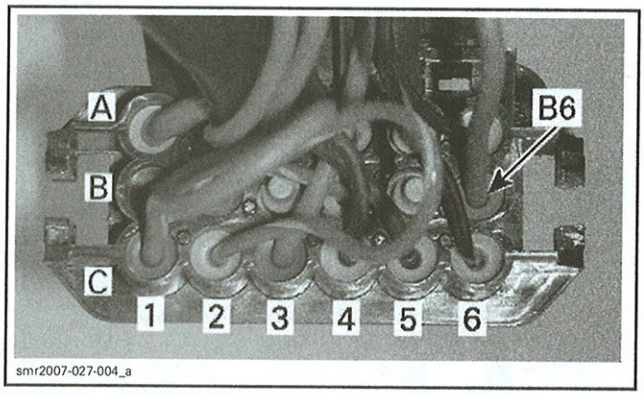
CAUTION: Never interchange a bus-bar with one of a different length as it will cause short circuits. See following illustration for bus bar locations and the number of contacts it groups together.



NUMBER OF CONTACTS GROUPED PER BUS BAR

Fuse Box Pin-Out Identification

Fuse box contacts are identified as seen from the back of the fuse box (wire side) with letters to identify rows and numbers to identify columns. The combined letter and number identify the coordinate of a contact that is used in the wiring diagram (B6 for instance in the illustration).



TYPICAL — RELAY FUSE BOX ILLUSTRATED

NOTE: Although the contacts in the fuse boxes are in reality sockets, they will be referred to as pin numbers (pin B6) in the procedures.

MAIN RELAY

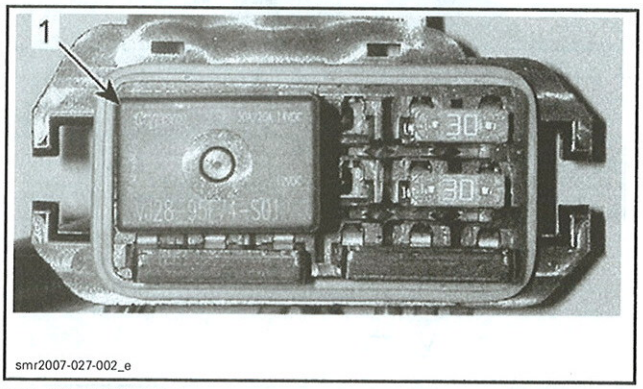
The main relay routes power from the battery and the voltage regulator/rectifier to the main fuse box for power distribution to most of the vehicle systems.

For a description of its function, refer to the *OVERVIEW* sub section in the in engine management section.

NOTE: The main relay is a plug-in type that may be inverted by 180° at installation and still function correctly.

Main Relay Continuity Test

Remove the main relay from relay fuse box.

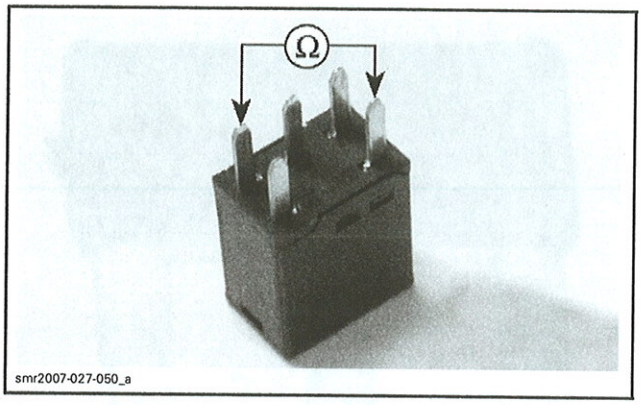


RELAY FUSE BOX
1. Main relay

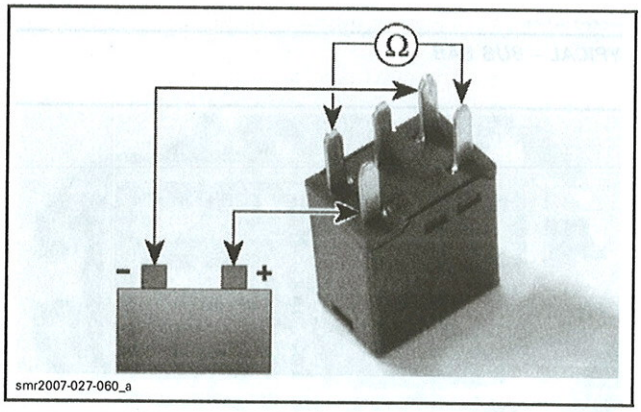
Use the Fluke 115 multimeter (P/N 529 035 868), and select the Ω position.

Probe relay as per following table.

TERMINAL		RESISTANCE
30	87	Open circuit (OL)



Connect a 12 Vdc battery as in following illustration and probe relay again.



TERMINAL		RESISTANCE
30	87	0.5 Ω max. (continuity)

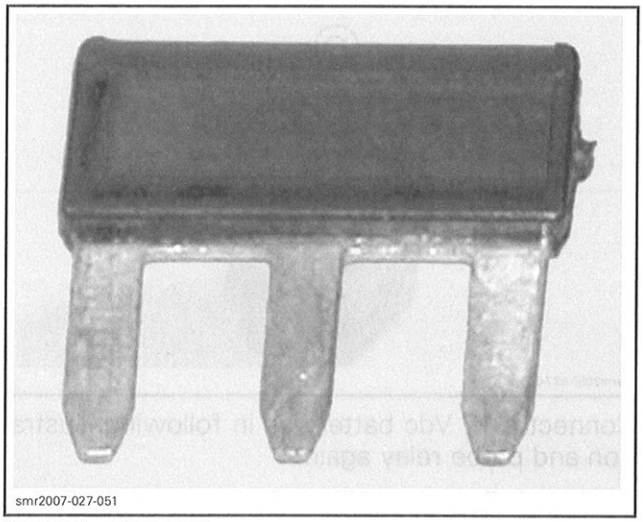
If the relay failed a test, replace it.

If relay is good, carry out the voltage test below.

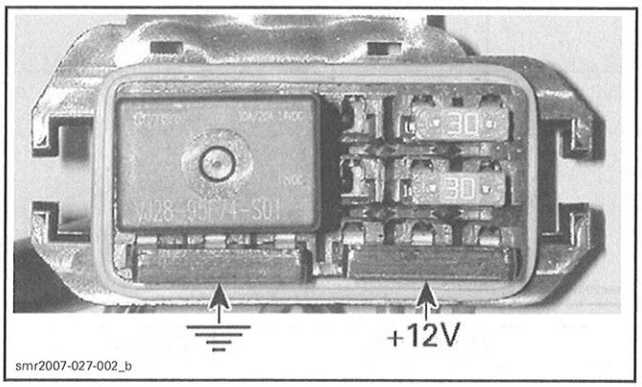
Main Relay Voltage Test

First test fuse 16.

Ensure bus bar terminals are clean and in good condition.



TYPICAL – BUS BAR



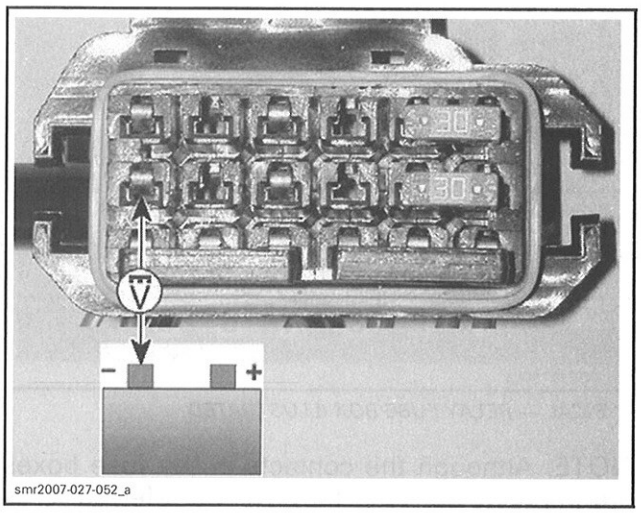
RELAY FUSE BOX BUS BAR LOCATIONS AND THEIR FUNCTION

Remove main relay.

Set multimeter to Vdc.

Probe fuse box as per following tables.

MAIN RELAY INPUT VOLTAGE TEST (POWER CONTACT)	
FUSE BOX PIN	VOLTAGE
B6 to battery ground	Battery voltage



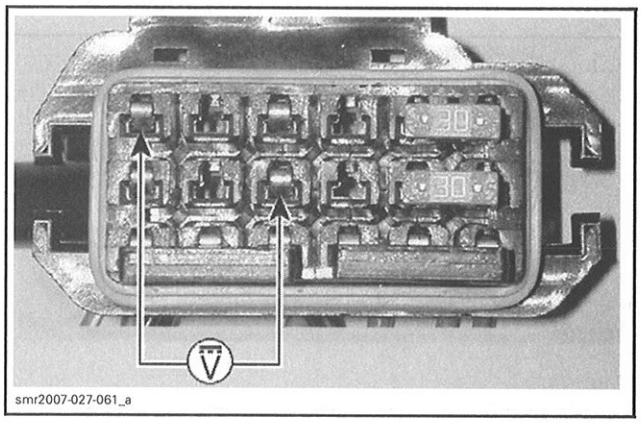
If battery voltage is not read, check the following items:

- Wiring/ connectors from battery
- Bus bar connecting C1, C2 and C3 for proper contact
- Wire jumper B1 to C1 behind fuse box
- Wire jumper C3 to B6.

Install safety lanyard on DESS post.

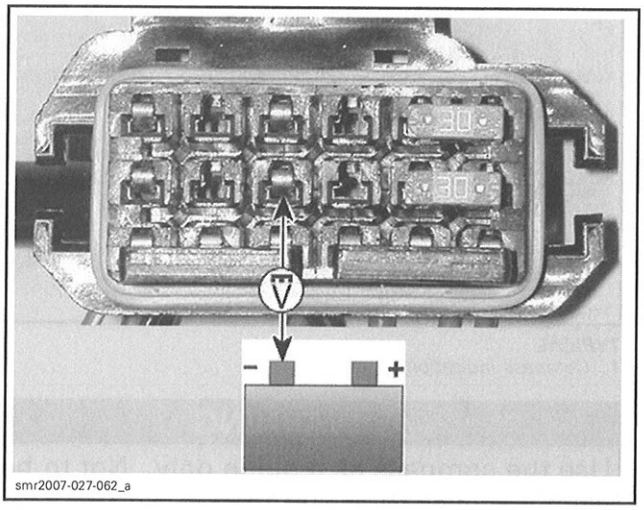
If battery voltage was read in previous test, check relay coil circuit as per following table.

MAIN RELAY INPUT VOLTAGE TEST TO ECM (COIL)	
FUSE BOX PIN	VOLTAGE
B4 to A6	Battery voltage



If battery voltage is not read, probe as follows.

MAIN RELAY INPUT VOLTAGE TEST TO BATTERY (COIL)	
FUSE BOX PIN	VOLTAGE
B4 to battery ground	Battery voltage



If battery voltage is not read, check wire jumper from C2 to B4.

If battery voltage is read between B4 and battery ground, test the following:

- Continuity of the main relay ground circuit wiring
- DESS key and DESS post, refer to *DESS SYSTEM*.

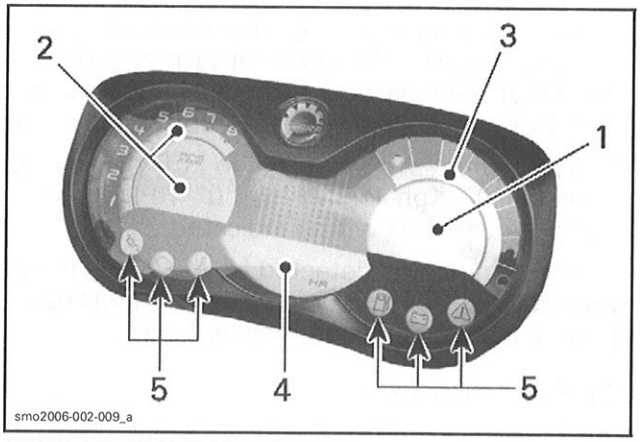
If DESS post and main relay ground circuit tested good, the ECM may be at fault. Refer to the *ENGINE MANAGEMENT* section.

INFORMATION CENTER

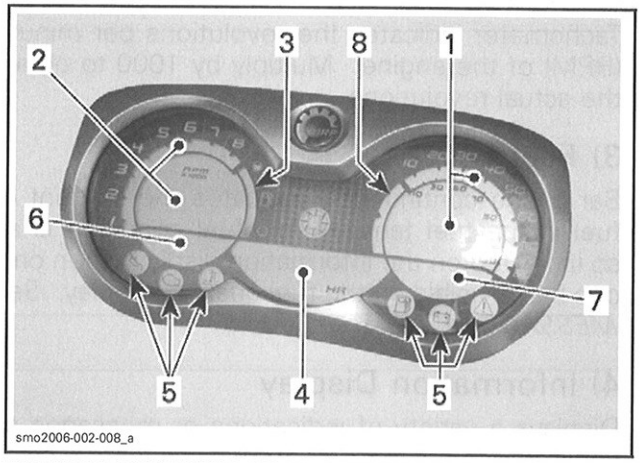
Information Center Overview

The information center (cluster) is a multifunction gauge that supplies several real time useful informations to the driver.

There are two models of multifunction gauges used, a standard model (used on GTI models) and the premium model (used on all other models).



STANDARD GAUGE (GTI MODELS)
1. *Speedometer (optional)*
2. *Tachometer*
3. *Fuel level*
4. *Information display*
5. *Indicator lights*



PREMIUM GAUGE (ALL MODELS EXCEPT GTI)
1. *Speedometer*
2. *Tachometer*
3. *Fuel level*
4. *Information display*
5. *Indicator lights*
6. *Water depth display (optional)*
7. *Water temperature display*
8. *VTS position indicator (optional)*

Both models can display the information in one of three languages, English, French, or Spanish. Units of measurement can be displayed either in SAE system or in the metric system. Use B.U.D.S. to change the language and units of measurement settings.

When the safety lanyard is installed and the vehicle powers up, all LCD segments and indicator lights in the information center will turn **ON for 3 seconds** (self test function). This self test function allows the driver time to ensure that all indications are functioning properly.

It also validates the information centers internal circuits, however, this does not validate proper operation of the individual external circuits and sensors that provide inputs to the information center.

With the self test complete, the LCD displays will indicate "0" Kph (or MPH), "0" RPM, and the compass direction will be indicated.

If a system fault is detected by the ECM, the applicable message and/or indicator light will be displayed, and a beep code may be heard.

1) Speedometer

All Models except GTI

Speedometer indicates the speed of the watercraft in miles per hour (MPH) or kilometers per hour (km/h).

2) Tachometer

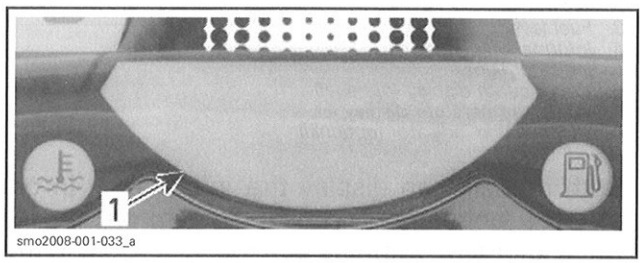
Tachometer indicates the revolutions per minute (RPM) of the engine. Multiply by 1000 to obtain the actual revolutions.

3) Fuel Level

Bar gauge continuously indicates the amount of fuel in the fuel tank. A low-fuel condition is also indicated on the information display when only one bar is visible on the fuel quantity display. See *MESSAGE DISPLAY*.

4) Information Display

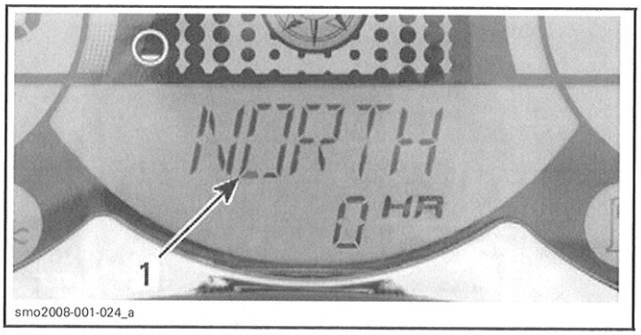
Displays a variety of indications or messages as applicable to standard or premium gauge, vehicle model or installed accessories.



TYPICAL
1. Information display

Compass Indication (Premium Gauge Only)

Displays the cardinal points to indicate the orientation of the watercraft.



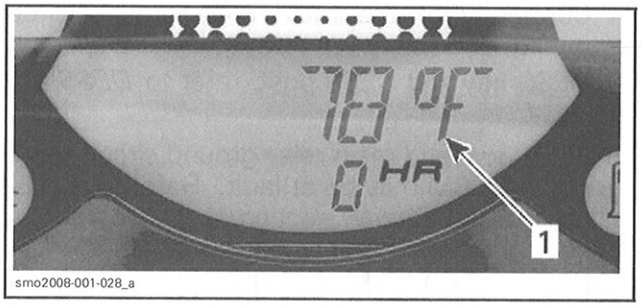
TYPICAL
1. Compass indication

⚠ WARNING

Use the compass as a guide only. Not to be used for navigation purposes.

Water Temperature Indication (Standard Gauge)

GTI SE Model



STANDARD GAUGE INFORMATION DISPLAY
1. Water temperature indication

Displays the water temperature at the surface in degrees Celsius (°C) or Fahrenheit (°F).

NOTE: Water temperature and depth gauge will be displayed alternately on standard gauge information display if both sensors are installed and activated.

Hourmeter (HR)

Displays the accumulated time of the watercraft usage in hours.

TYPICAL
1. Hourmeter display

Message Display (Standard and Premium Gauges)

TYPICAL
1. Message display

Displays a message for each of the following occurrences. The abbreviations in the following parenthesis are the codes that may be displayed:

- Engine or exhaust system overheating (EXHAUST or ENGINE)
- Low oil pressure (OIL)
- Low battery voltage (12 V LOW)
- High battery voltage (12 V HI)
- Low fuel level (FUEL-LO)
- Maintenance reminder (MAINT)
- Check engine (CHK ENG)
- Sensor failure (vehicle electronic equipment) (SENSOR)
- Invalid safety lanyard (KEY)
- Safety lanyard, learning key active (L KEY) (includes the Rental key as well).

NOTE: When the watercraft is due for a maintenance inspection, the message **MAINT** will blink. After servicing, the code must be cleared using B.U.D.S.

NOTE: If a fault occurs, the monitoring system generates numbered fault codes (P-XXXX) that are displayed through the information center. Use B.U.D.S. to help in troubleshooting the fault.

When necessary, a beeper will sound and an indicator light will blink to attract the drivers attention depending on the importance of the fault or indication occurring. Use B.U.D.S. as a troubleshooting tool when such a message is displayed.

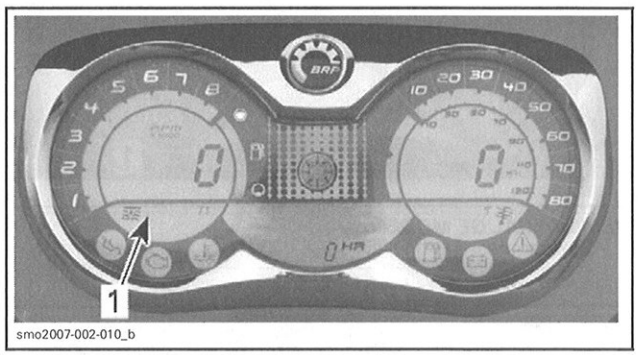
5) Indicator Lights

NOTE: Refer to *INFORMATION DISPLAY* for additional information regarding messages which may accompany an indicator light.

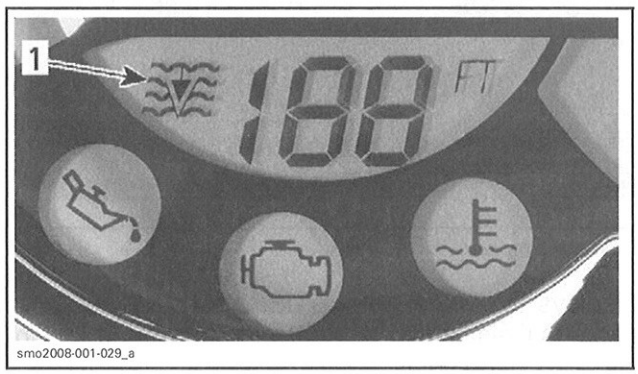
	Low oil pressure (OIL)
	Check engine (CHK ENG)
	Engine or exhaust system overheating (H-TEMP)
	Low fuel level (FUEL-LOW)
	Low/high battery voltage (12 V LOW/HI)
	Maintenance reminder (MAINT)

6) Water Depth Display (Premium Gauge Only)

GTX Limited Model



PREMIUM GAUGE MODELS
1. Water depth display



TYPICAL
1. Water depth indication

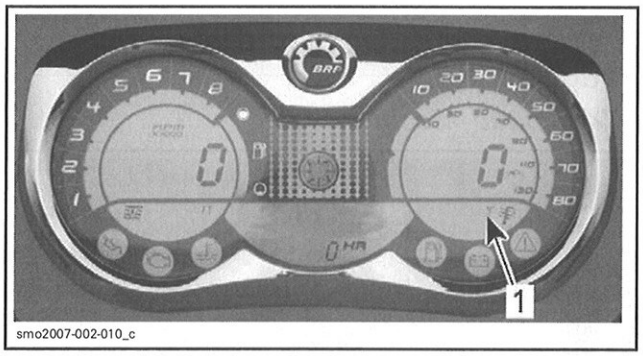
Displays the water depth under the hull within 0 to 50 meters (0 to 170 feet) in the LH LCD display.

NOTE: Under certain conditions, the gauge may stop displaying. The gauges ability to display the depth depends on the conditions of use. When carrying out summerization procedures, if vehicle is run out of water with an active depth sounder, a SENSOR warning will appear in the message display.

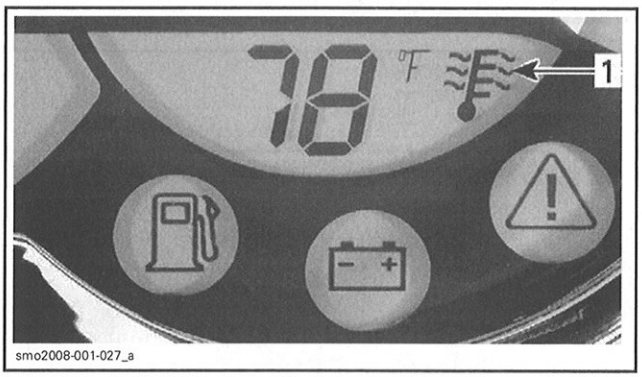
⚠ WARNING

Never use the depth gauge as a warning device to ride in shallow water. Use it as a navigation guide only. Not to be used for navigation purposes.

7) Water Temperature Display (Premium Gauge Only)



PREMIUM GAUGE MODELS
1. *Water temperature display*



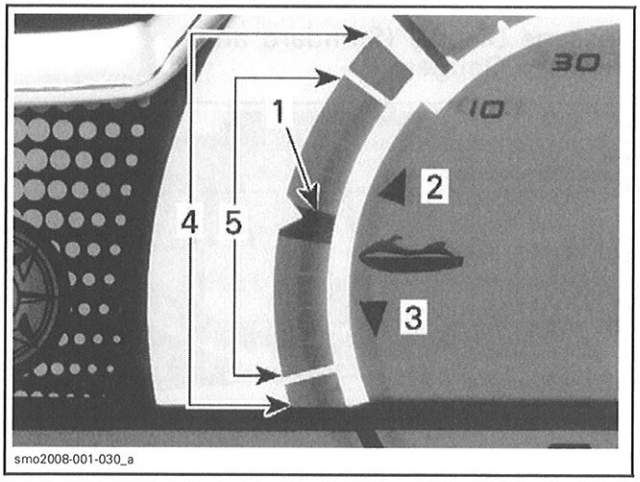
1. *Water temperature indication*

Displays the water temperature at the surface in degrees Celsius (°C) or degrees Fahrenheit (°F) in the RH LCD display.

8) VTS Position Indicator (Premium Gauge Only)

RXT–X 255, RXP 215, RXP–X 255 and WAKE Models Only

The VTS position indicator displays the riding attitude of the watercraft.



1. *Position indicator*
2. *Bow up*
3. *Bow down*
4. *Operating range (RXP models)*
5. *Operating range (other models)*

PROCEDURES

INFORMATION CENTER

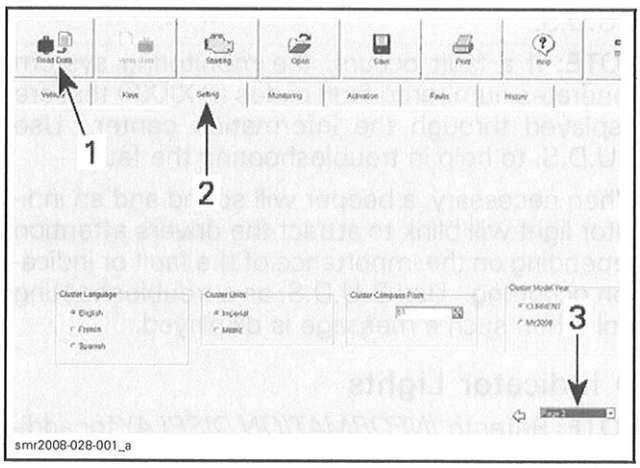
Setting Language and Units of Measurement

Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Select the **Read Data** button.

Choose the **Setting** tab at the top of the page.

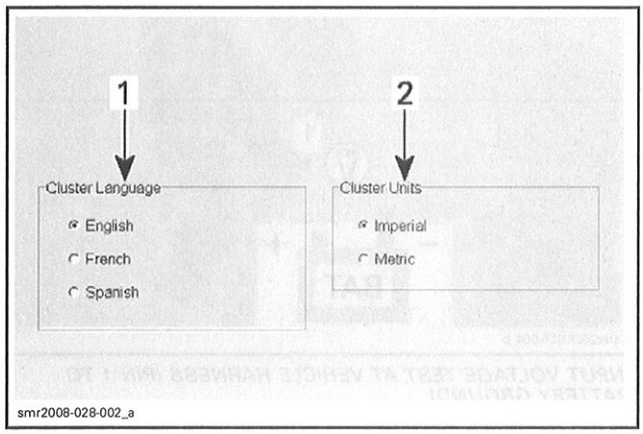
At the bottom RH side of the setting page, select the arrow to the right of page 1 and choose **page 2**.



1. *Read Data*
2. *Setting tab*
3. *Page 2*

In the **Cluster Language** field, choose the desired unit of language, **English**, **French** or **Spanish**.

In the **Cluster Scale** field, choose the desired unit of measurement, **Imperial** or **Metric**.



1. Cluster Language field
2. Cluster Units field

Clearing the Maintenance Reminder Indicators

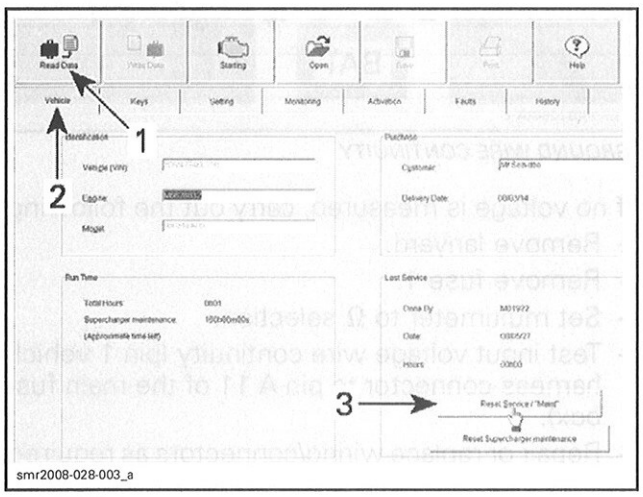
When the vehicle is due for maintenance, the Check engine light and the **Maint** message will appear. These must be cleared using B.U.D.S.

Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Select the **Read Data** button.

Choose the **Vehicle** tab at the top of the page.

At the bottom RH side of the setting page in the **Last Service** field, choose **Reset Service/"Maint"**.



1. Read Data
2. Vehicle tab
3. Reset Service/"Maint" button

Information Center Troubleshooting

Install the safety lanyard on the DESS post.

Information Center "Does Not Turn ON"

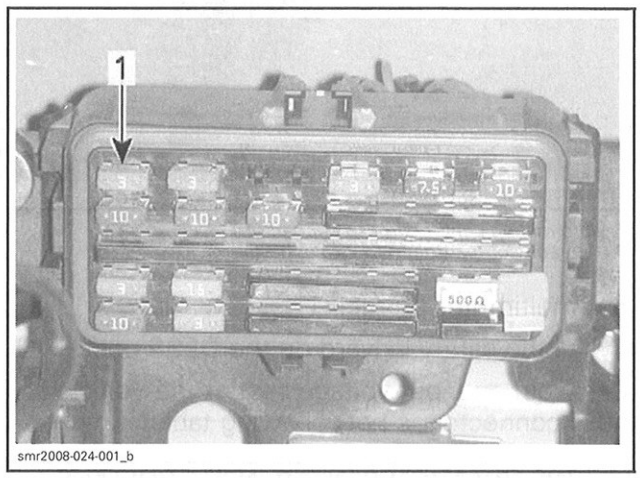
When the information center does not turn ON, the power or ground circuit to the information center is open. Remove safety lanyard and carry out the following procedure:

NOTE: If you do not hear a beep code, check battery and fuse 16 (battery fuse). If a beep code is heard, the main fuse box and ECM are powered.

Obtain access to the main fuse box:

- RXP and GTI models through front storage compartment
- RXT and GTX models by removing seat.

Test the 3 A information center fuse in the main fuse box (fuse 1).



MAIN FUSE BOX
1. Information center 3 A fuse (fuse 1)

If fuse 1 tests good, carry out an *INFORMATION CENTER HARNESS INPUT VOLTAGE TEST.*

NOTE: On GTI models, refer directly to *INFORMATION CENTER INPUT VOLTAGE TEST.*

Information Center Turns ON but "Displays No Indications" except Compass

If the information center turns ON when the lanyard is installed, goes through the self test function, then goes blank (except for the compass indication), there is no communication between the information center and the ECM.

Connect to the latest applicable B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Read the fault codes related to a communication problem then carry out a *CAN BUS CONTINUITY TEST* relating to that component.

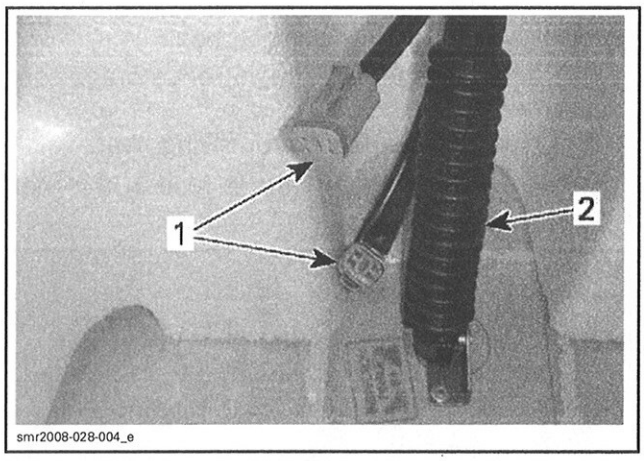
NOTE: The information center, ECM and the diagnostic connector are linked together through busbars in the main fuse box.

Information Center Input Voltage Test (at Vehicle Harness Connector)

GTX, RXP and RXT Models

Open front storage compartment and remove storage bin.

Disconnect the information center harness connector from the vehicle harness.



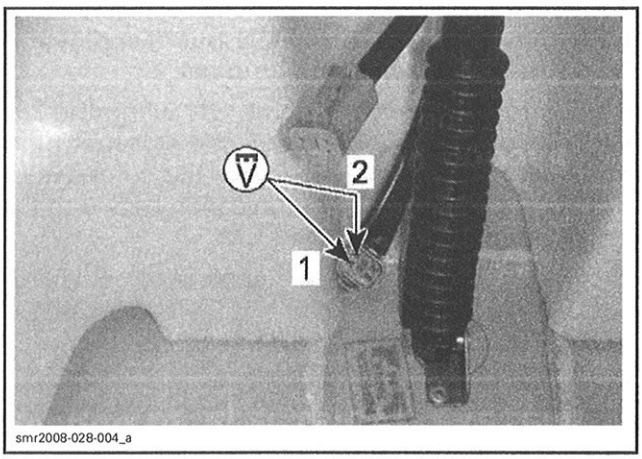
1. *Information center harness connector*
2. *Storage compartment shock support*

Set multimeter to Vdc.

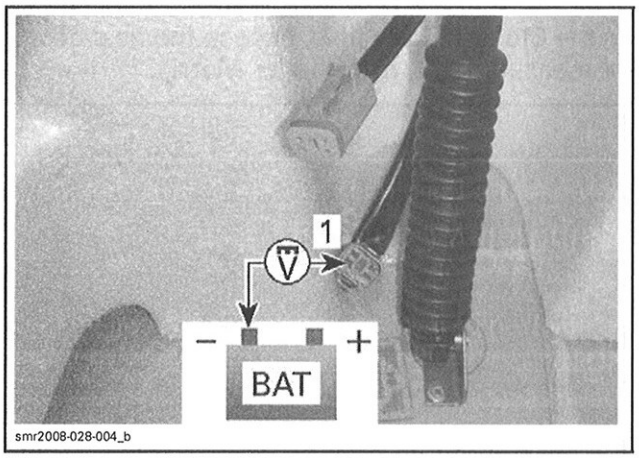
Install the safety lanyard on the DESS post.

Carry out an input voltage test at the vehicle harness connector as per following table.

INFORMATION CENTER INPUT VOLTAGE TEST (HARNESS CONNECTOR)		
INFORMATION CENTER HARNESS CONNECTOR		VOLTAGE
Pin 1	Pin 2	Battery voltage
Pin 1	Battery ground	



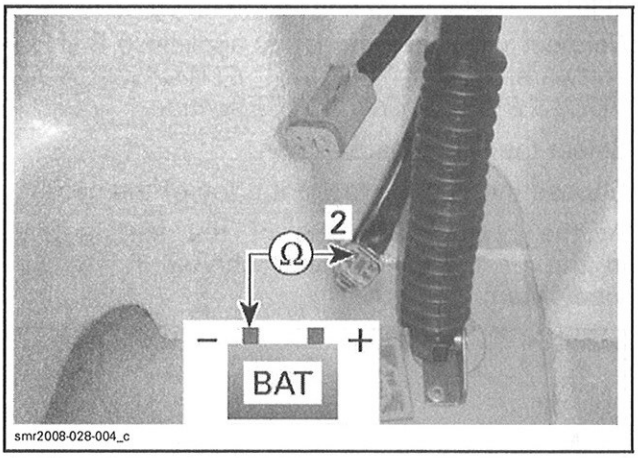
INPUT VOLTAGE TEST AT VEHICLE HARNESS (PIN 1 TO PIN 2)



INPUT VOLTAGE TEST AT VEHICLE HARNESS (PIN 1 TO BATTERY GROUND)

If battery voltage is measured to battery ground but not to pin 2, carry out the following:

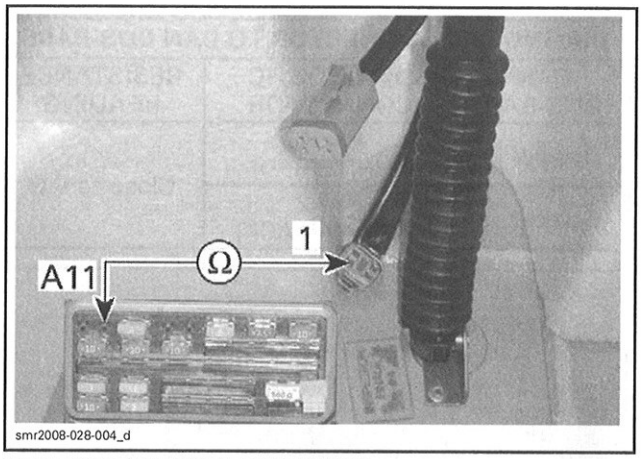
- Remove lanyard.
- Set multimeter to Ω selection.
- Test ground wire continuity (pin 2 vehicle harness connector to battery ground).
- Repair or replace wiring/connectors as required.



GROUND WIRE CONTINUITY

If no voltage is measured, carry out the following:

- Remove lanyard.
- Remove fuse 1.
- Set multimeter to Ω selection.
- Test input voltage wire continuity (pin 1 vehicle harness connector to pin A 11 of the main fuse box).
- Repair or replace wiring/connectors as required.



INPUT VOLTAGE WIRE CONTINUITY

If battery voltage is measured between pin 1 and pin 2, refer to *INFORMATION CENTER INPUT VOLTAGE TEST*.

Information Center Input Voltage Test (at Gauge Connector)

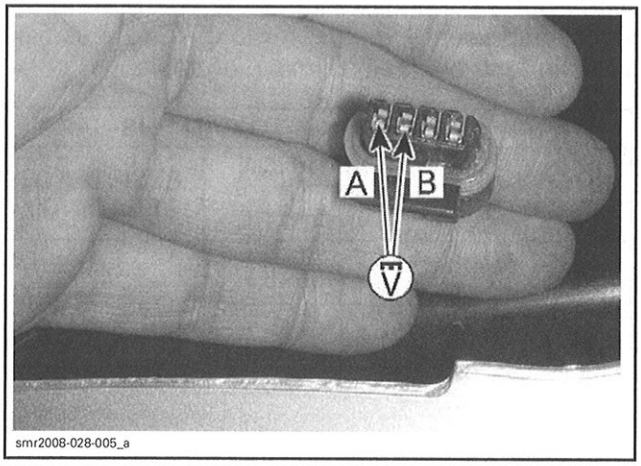
All Models

Remove the information center, refer to *INFORMATION CENTER REMOVAL* in this section.

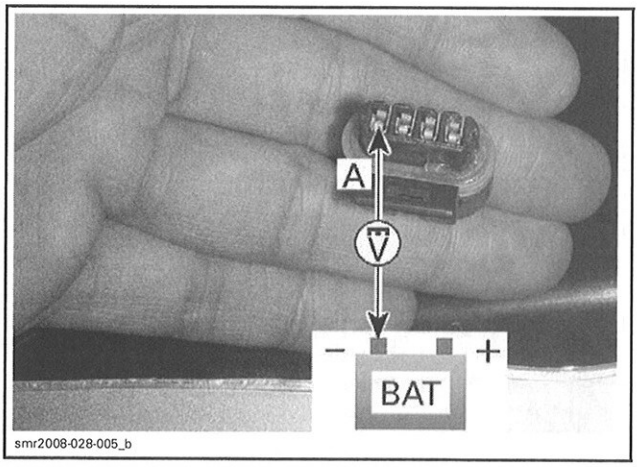
Install the safety lanyard on the DESS post.

Measure the information center input voltage as per following table.

INFORMATION CENTER INPUT VOLTAGE TEST		
INFORMATION CENTER CONNECTOR		VOLTAGE
Pin A	Pin B	Battery voltage
Pin A	Battery ground	



INPUT VOLTAGE TEST AT GAUGE CONNECTOR (A TO B)

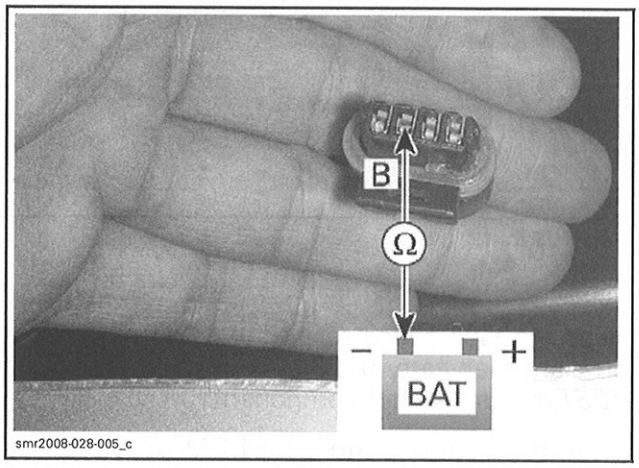


INPUT VOLTAGE TEST AT GAUGE CONNECTOR (A TO BATTERY GROUND)

If battery voltage is measured to pin B, replace information center.

If battery voltage is measured to battery ground but not to pin B, carry out the following continuity test:

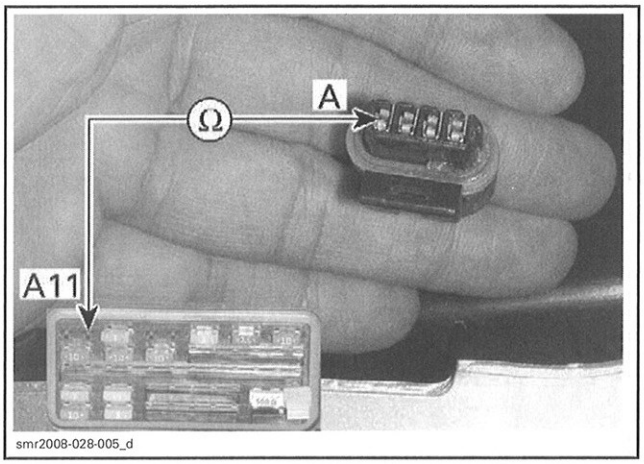
- Remove lanyard.
- Set multimeter to Ω setting.
- Test ground wire continuity, pin B information center connector to battery ground.
- Repair or replace wiring/connectors as required.



GROUND WIRE CONTINUITY (PIN B TO BATTERY GROUND)

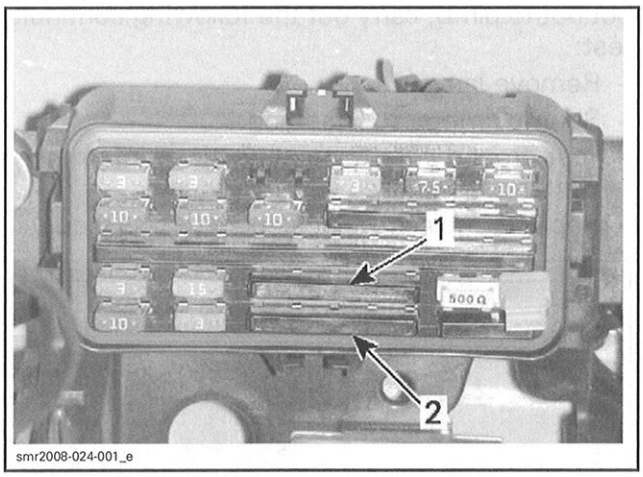
If no voltage is measured, test input voltage wire continuity, pin A to contact A 11 in main fuse box.

- Remove lanyard.
- Set multimeter to Ω setting.
- Test input voltage wire continuity, pin A information center connector to contact A 11 in main fuse box.
- Repair or replace wiring/connectors as required.



INPUT VOLTAGE WIRE CONTINUITY (PIN A TO CONTACT A11 MAIN FUSE BOX)

CAN Bus Continuity Tests (Information Center)



CAN BUS-BARS
1. *CAN High*
2. *CAN Low*

Read the fault codes related to a communication problem then carry out a *CAN BUS CONTINUITY TEST* relating to that component.

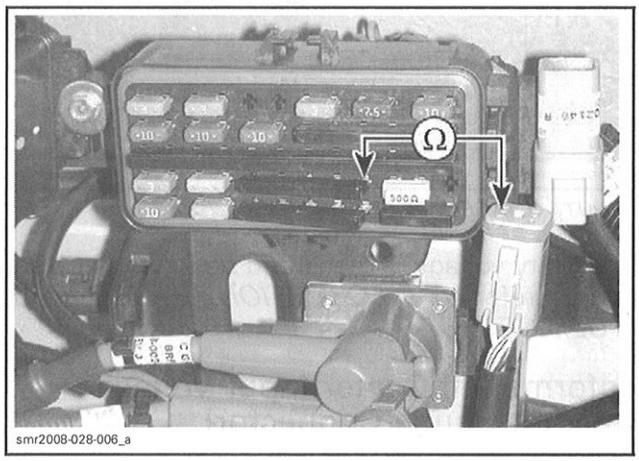
Cannot Communicate with ECM or Information Center

Slightly lift up on the CAN bus-bars enough to access its contacts without completely removing them.

Set multimeter to the Ω setting.

Carry out a continuity test of the wiring from the diagnostic connector to the CAN bus-bars in main fuse box as per following table.

DIAGNOSTIC CONNECTOR TO CAN BUS-BARS		
CAN BUS-BAR	DIAGNOSTIC CONNECTOR	RESISTANCE READING
Bus-bar D	Pin 1 (WHITE/RED)	Close to 0 Ω
Bus-bar E	Pin 2 (WHITE/BLACK)	



CONTINUITY TESTS CAN BUS BARS TO DIAGNOSTIC CONNECTOR

Repair or replace applicable wiring/connectors.

Cannot Communicate with Information Center

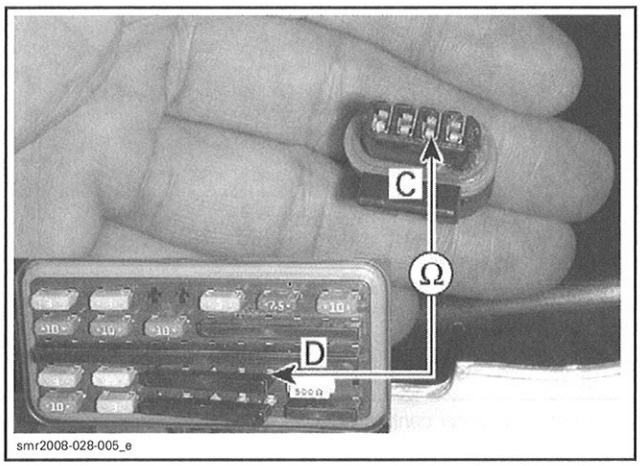
Remove and disconnect the information center, refer to *INFORMATION CENTER REMOVAL* in this section.

Slightly lift up on the CAN bus-bars enough to access its contacts without completely removing them.

Set multimeter to the Ω setting.

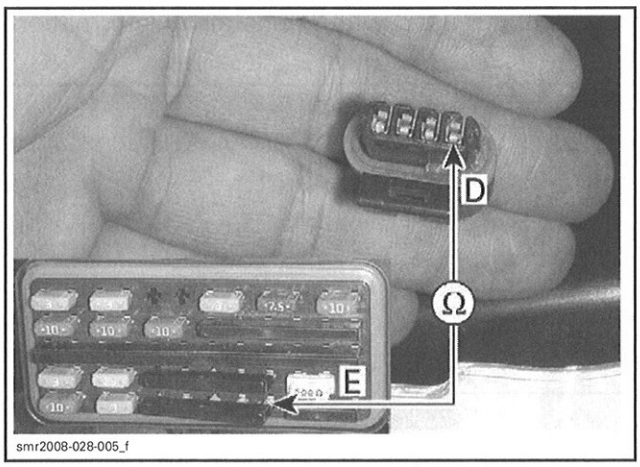
Carry out a continuity test of the wiring from the information center connector to the CAN bus-bars in main fuse box as per following table.

INFORMATION CENTER TO CAN BUS-BARS		
CAN BUS-BAR	INFORMATION CENTER CONNECTOR	RESISTANCE READING
Bus-bar D	Pin C (WHITE/RED)	Close to 0 Ω
Bus-bar E	Pin D (WHITE/BLACK)	



smr2008-028-005_e

CAN HIGH BUS-BAR TO GAUGE CONNECTOR CONTINUITY TESTS



smr2008-028-005_f

CAN LOW BUS-BAR TO GAUGE CONNECTOR CONTINUITY TESTS

If an open circuit is found, repair or replace applicable wiring/connectors.

If you do not find an open circuit, replace the information center.

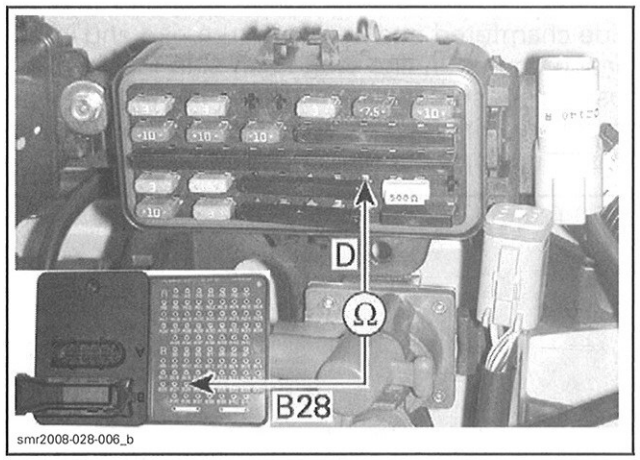
Cannot Communicate with ECM

Remove ECM connector B and install it on the ECM adapter (P/N 420 277 010).

Set multimeter to the Ω setting.

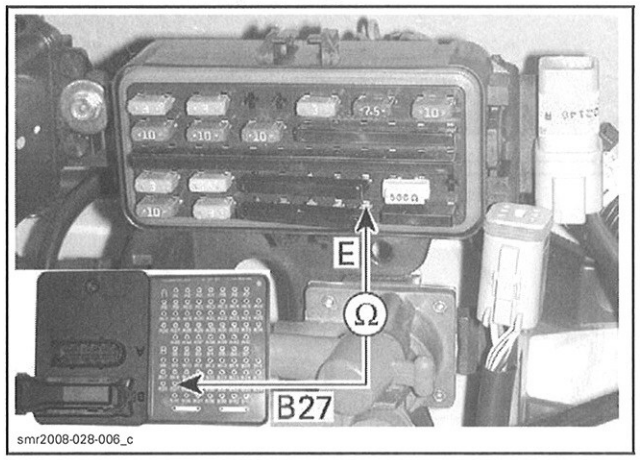
Carry out a continuity test of the wiring from the ECM connector to the CAN bus-bars in main fuse box as per following table.

ECM TO CAN BUS-BARS		
CAN BUS-BAR	ECM CONNECTOR	RESISTANCE READING
Bus-bar D	Pin B-28 (WHITE/RED)	Close to 0 Ω
Bus-bar E	Pin B-27 (WHITE/BLACK)	



smr2008-028-006_b

CAN HIGH BUS-BAR TO ECM CONNECTOR CONTINUITY TESTS



smr2008-028-006_c

CAN LOW BUS-BAR TO ECM CONNECTOR CONTINUITY TESTS

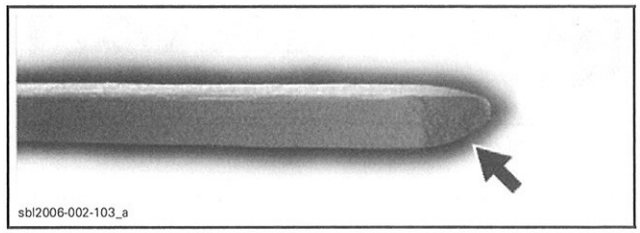
If an open circuit is found, repair or replace applicable wiring/connectors.

If you do not find an open circuit, replace the ECM.

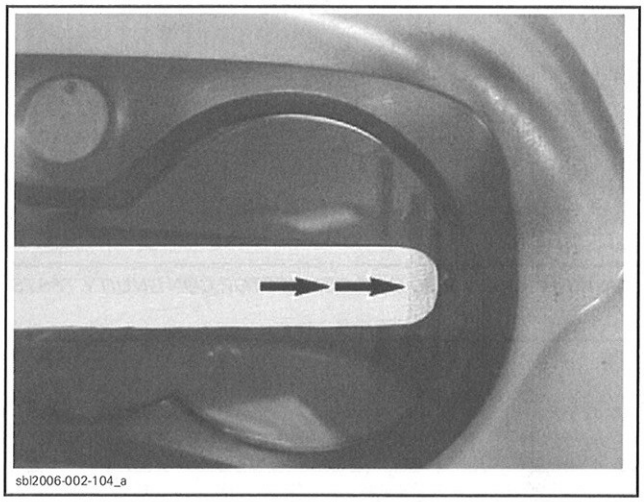
Information Center Removal

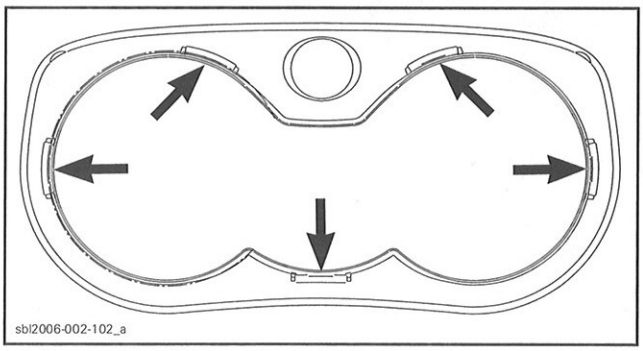
CAUTION: Information center locking tabs may break when removing the gauge trim ring (bezel); extreme care must be taken while performing gauge trim removal procedure.

Take a small wooden stick (coffee stirrer type) and chamfer its end; refer to photo.


sbl2006-002-103_a

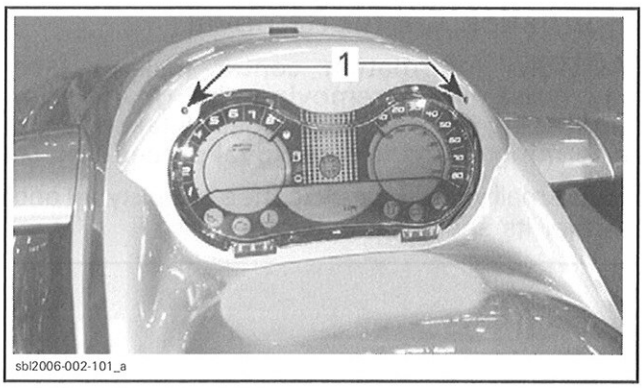
Slide chamfered end between trim ring and information center, in line with each side locking tab, pushing out smoothly while lifting out trim; repeat procedure with lower locking tab and then, gently lift trim upward, out of its upper locking tabs.


sbl2006-002-104_a


sbl2006-002-102_a

TRIM RING LOCKING TAB LOCATIONS

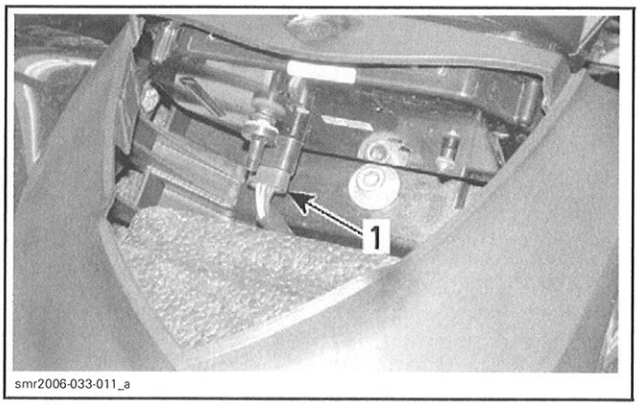
Remove the two gauge mounting screws and retain them for reinstallation.



sbl2006-002-101_a

1. Information center screws

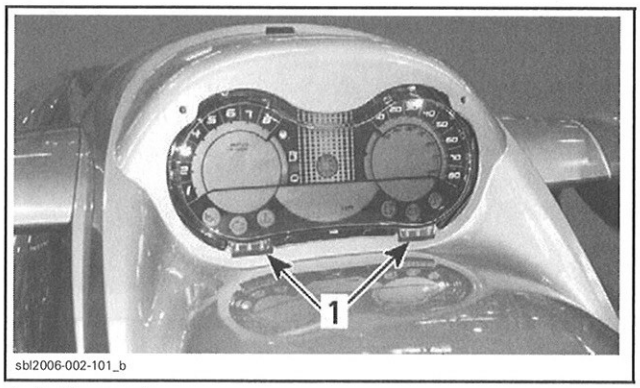
Disconnect the information center and set it aside in a secure area.



smr2006-033-011_a

1. Information center connector

NOTE: At 2 places at the bottom of information center, rubber pads are folded on body for a tight fit; care should be taken not to lose these pads so they can be reused when reinstalling information center.



sbl2006-002-101_b

1. Rubber pads

Information Center Installation

Installation of the information center is the reverse of the removal procedure. However, pay attention to the following.

Torque information center mounting screws to a MAXIMUM of 1.5 N•m (13 lbf•**in**).

Reinstall information center trim ring simply by pushing it in until it snaps back in place.

NOTE: If you are installing a replacement information center (premium model only), refer to *INFORMATION CENTER PROGRAMMING* in this section.

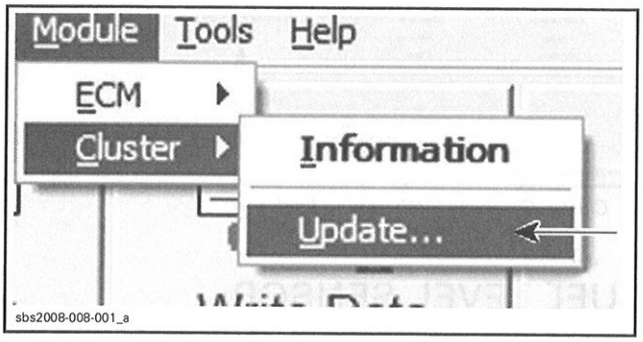
Information Center Programming (Premium Gauge)

NOTE: This procedure is required to be carried out on all new replacement information centers (premium gauge only) as they are delivered without programming.

Connect to the latest applicable B.U.D.S. software, refer to *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

NOTE: B.U.D.S. 2.3.19 or later version must be used.

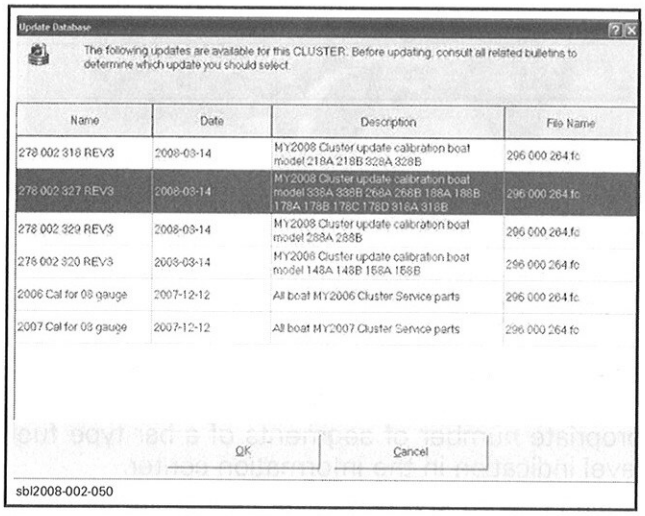
In the menu bar at the top of the window, select **Module**, **Cluster**, **Update**.



sbs2008-008-001_a

In the open window, select the applicable update file and click the **OK** button at the bottom of the window. The file will be installed into the cluster (information center) automatically.

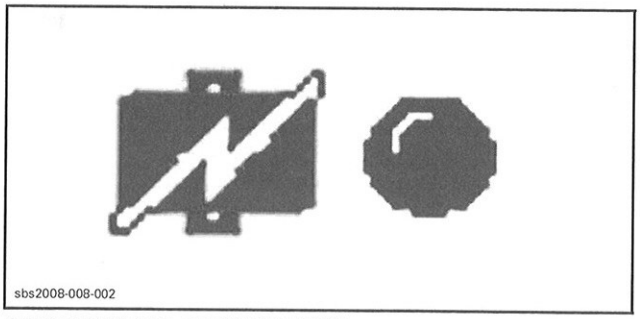
NOTE: The description will tell you by model year, or model number, what calibration file to down load (the model number and year can be found on the vehicle page under Identification).



sbl2008-002-050

If the wrong file is installed, the cluster will not be calibrated correctly and the following discrepancies may appear.

- Fuel gauge will show as empty.
- All segments of the VTS will be turned ON.
- The RPM will indicate 0 or 5000.
- The icon reminding you to flash the cluster will be visible in the lower R/H corner of the B.U.D.S. screen.


sbs2008-008-002

CLUSTER FLASH REMINDER ICON

If the wrong file is installed, simply repeat the procedure using the appropriate file.

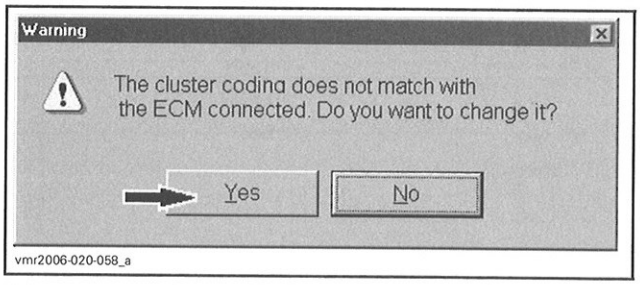
Once the information center is programmed, select all the applicable settings as per following procedure.

Information Center Settings

Use the latest B.U.D.S. software to set the applicable parameters in the information center.

Install safety lanyard on DESS post.

NOTE: If an information center from another watercraft model is installed, the following message will be displayedand **engine starting will not be allowed**.



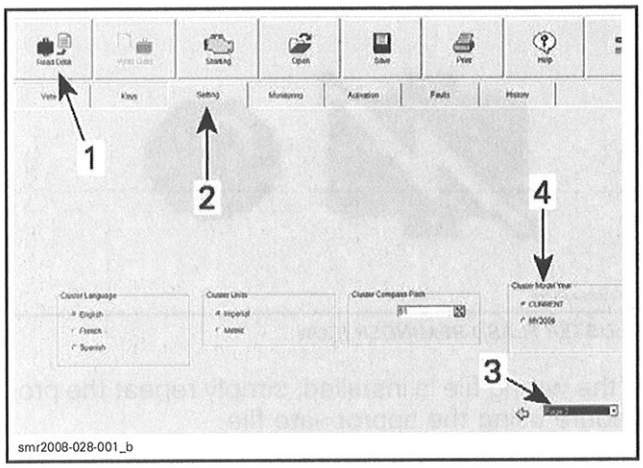
vmr2006-020-058_a

Click **No** and install the appropriate information center for this watercraft.

NOTE: If for some reason, you need to start the engine, click **Yes**. Engine starting will be allowed and the message will not appear anymore. Simply remove and reinstall the safety lanyard, then press the **Start/Stop** button to start engine. However, since this is not the appropriate gauge, some functions may not work properly.

With the appropriate gauge installed, choose the **Setting** page tab, then click the arrow next to page 1 on the bottom R/H side of the page and choose **Page 2**.

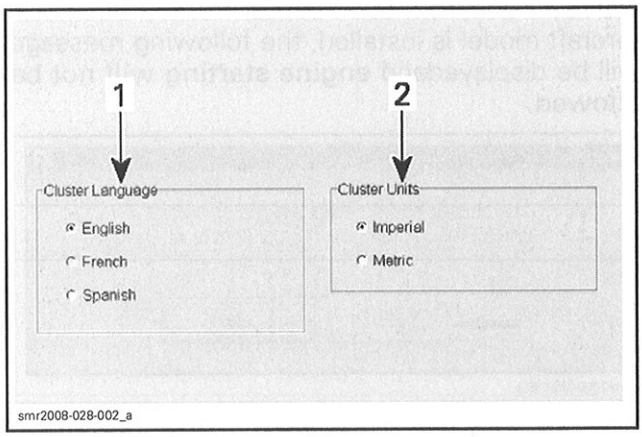
On setting page 2, choose the appropriate model year in the **Cluster Model Year** field.



1. *Read Data button*
2. *Setting page tab*
3. *Setting page 2*
4. *Cluster Model Year field*

NOTE: This setting will allow accurate display of VTS and fuel level scales.

Set **Cluster Language** and **Cluster Units** on same page as described above.

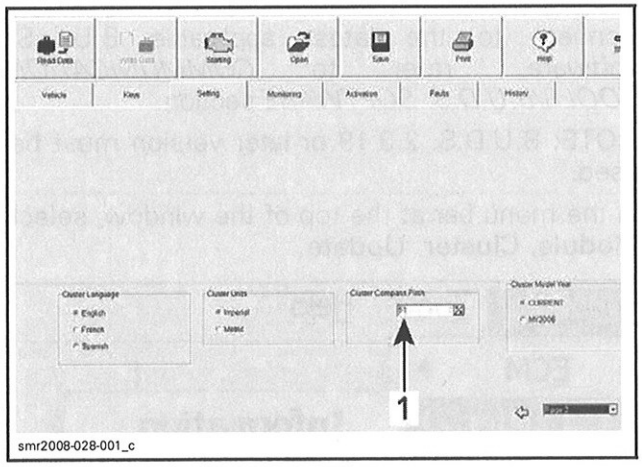


1. *Cluster Language field*
2. *Cluster Units field*

Set compass pitch (if so equipped) on same page as per following table.

COMPASS PITCH SETTINGS IN B.U.D.S.	
MODELS	COMPASS PITCH
GTX and RXT	51
RXP	41

NOTE: Failure to properly set compass pitch will lead to inaccurate display of compass.

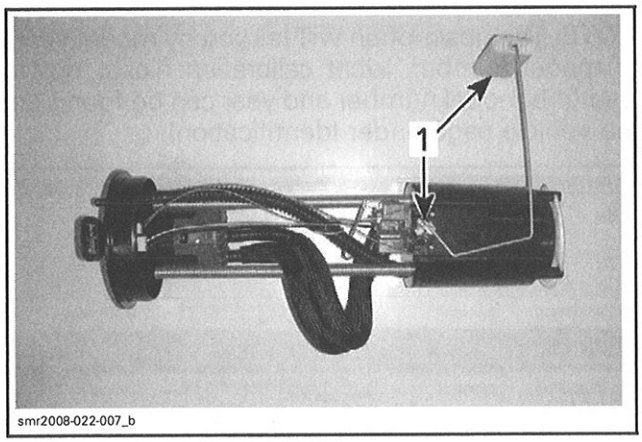


1. *Cluster Compass Pitch setting field*

FUEL LEVEL SENSOR

Fuel Level System Overview

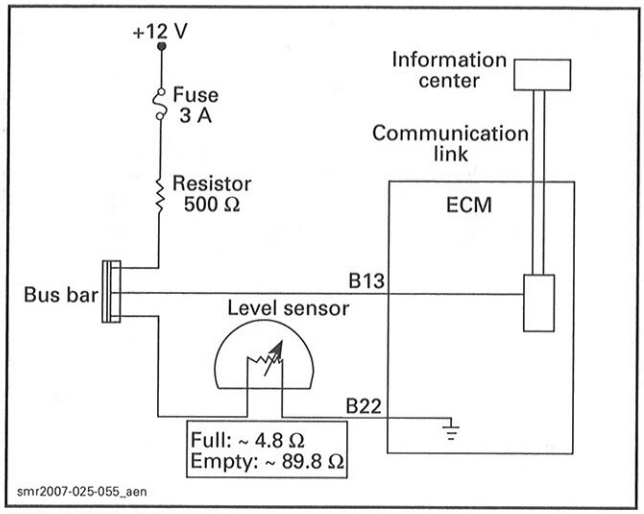
A float type fuel level sensor mounted on the fuel pump module sends a signal to the ECM.



TYPICAL — FUEL PUMP MODULE
1. *Fuel level sensor*

The ECM interprets this signal, then sends another signal through the CAN bus to turn on the appropriate number of segments of a bar type fuel level indication in the information center.

A plug in type 500 Ω resistor located in the main fuse box limits the voltage and current in the system. If the resistor is open circuit, there will not be any indication. If the resistance value is not within acceptable limits, the fuel level indication will be erroneous. Refer to *FUEL LEVEL SYSTEM RESISTOR* in this section for testing procedure.

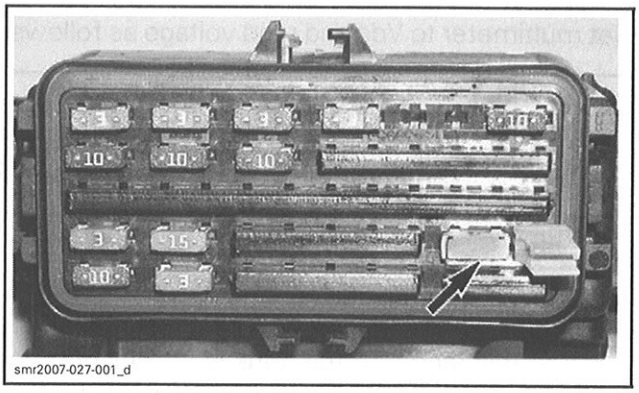


FUEL LEVEL SYSTEM SIMPLIFIED SCHEMATIC

FUEL LEVEL TROUBLESHOOTING	
SYMPTOM	POSSIBLE CAUSE
Fuel gauge always display EMPTY	– Fuse 4 burnt – Resistor 500 Ω open circuit – Wiring/connectors – Fuel level sensor – ECM
Fuel gauge always display FULL	– Water in fuel pump connector
Fuel level sensor fault code	– Fuse 4 – Resistor 500 Ω – Wiring/connectors – Fuel level sensor – ECM
Fuel gauge displays wrong level	– Wrong setting in B.U.D.S. (**page 2 Cluster model year**) – Low battery voltage – Resistor 500 Ω (wrong value) – Fuel level sensor

Fuel Level System Resistor Test

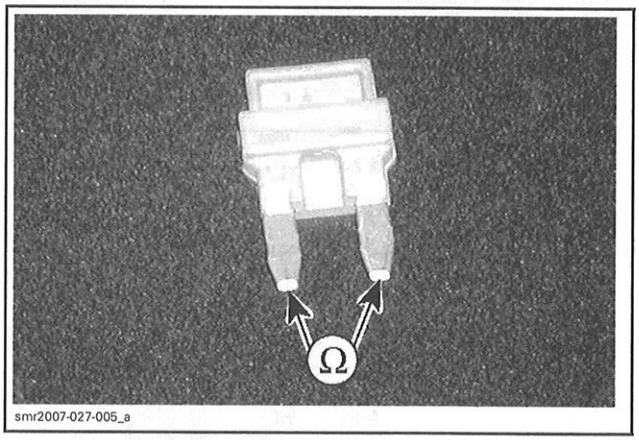
Remove resistor from main fuse box.



TYPICAL – FUEL SYSTEM RESISTOR

Set multimeter to Ω setting and measure its resistance value.

FUEL LEVEL SYSTEM RESISTOR TEST
RESISTANCE @ 20°C (68°F)
475 - 525 Ω



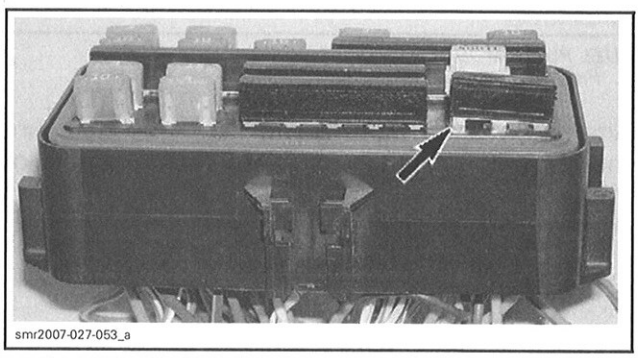
Replace resistor if it is out of specification.

Fuel Level Sensor Voltage Test

First ensure battery voltage is over 12.6 V, refer to *CHARGING SYSTEM*.

Remove main fuse box cover.

Slightly raise the bus bar just below the 500 Ω resistance enough to probe it without loosing the contacts.

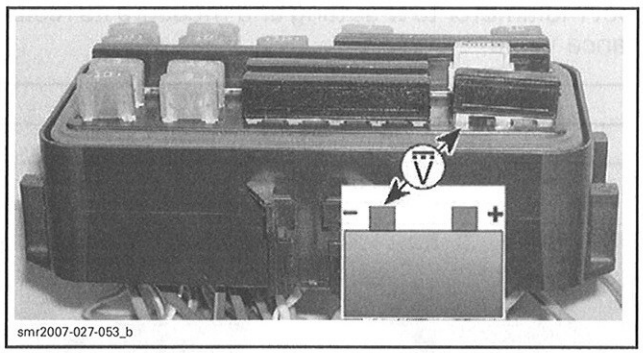


FUEL LEVEL SYSTEM BUS-BAR

Set multimeter to Vdc and read voltage as follows.

FUEL LEVEL SENSOR VOLTAGE TEST		
FUEL TANK LEVEL	FUSE BOX	VOLTAGE
Full	Bus bar and battery ground	0.1 Vdc
Empty		2 Vdc

NOTE: Voltage could be slightly different depending on battery voltage but should remain relatively close to this range. If fuel tank is not full or empty, the voltage value will be proportional to the fuel level (somewhere in-between).

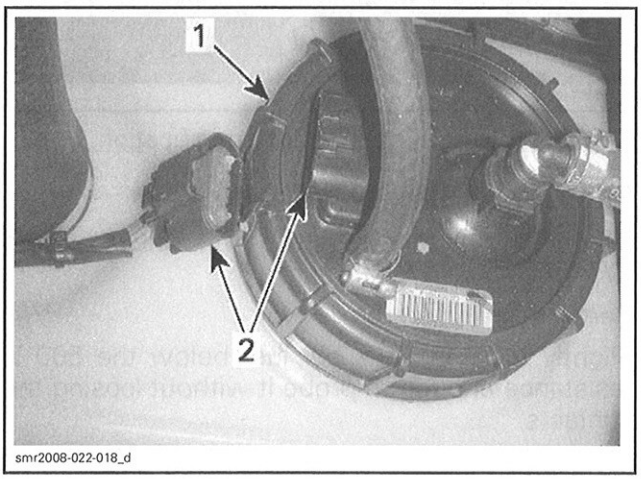


smr2007-027-053_b

If voltage is out of specification, check fuel level sensor resistance.

Fuel Level Sensor Resistance Test

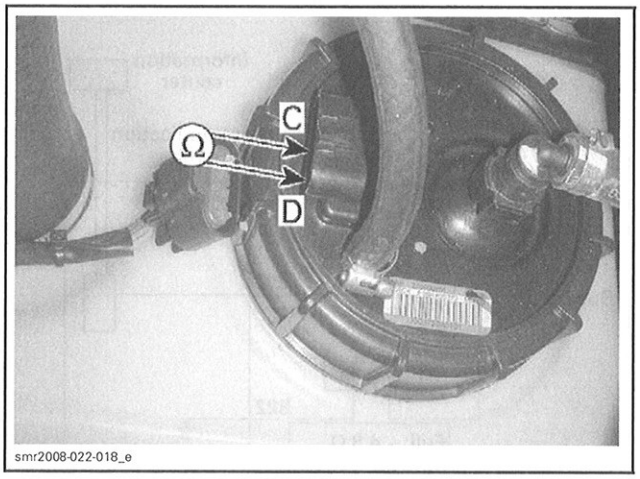
Disconnect fuel pump module connector.



smr2008-022-018_d

FUEL PUMP MODULE
1. Fuel pump module connector

Alternately drain then fill fuel tank and measure the sensor resistance between pins C and D of the fuel pump connector. See table below for full and empty resistance values.



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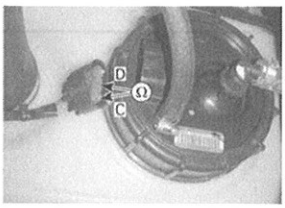
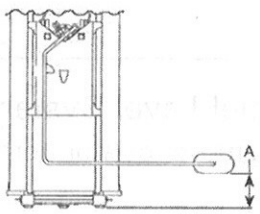
FUEL LEVEL SENSOR RESISTANCE TEST

If the full and empty sensor values are not as specified in table, remove the fuel pump module and test sensor on a work bench.

The resistance measured between sensor terminals must be in accordance with fuel level as per following table.

FUEL LEVEL SENSOR RESISTANCE TEST	
RESISTANCE (Ω)	FLOAT HEIGHT (MM)
4.8 ± 2.2	268.9 ± 3.0 (FULL)
17.8 ± 2.2	240.6 ± 3.0
27.8 ± 2.2	219.1 ± 3.0
37.8 ± 2.2	193.8 ± 3.0
47.8 ± 2.2	161.9 ± 3.0 (HALF)
57.8 ± 2.4	128.3 ± 3.0
67.8 ± 2.8	94.1 ± 3.0
77.8 ± 3.6	60.6 ± 3.0
89.8 ± 3.6	28.8 ± 3.0 (EMPTY)
	 A. Float height

If resistance is out of specification, remove the fuel pump module and replace the sensor. Refer to *FUEL TANK/FUEL PUMP* for fuel pump removal procedure.

If resistance test is good, check wiring continuity and connectors.

When everything else has been tested and fuel level is still not working, check ECM. Refer to *ENGINE MANAGEMENT*.

If it still does not work, try a new information center (unlikely).

WATER TEMPERATURE SENSOR

All Models except GTI

NOTE: The water temperature sensor is a thermistor integrated within the speed sensor.

B.U.D.S. can be used to test its operation.

Water Temp Sensor Activation and Testing

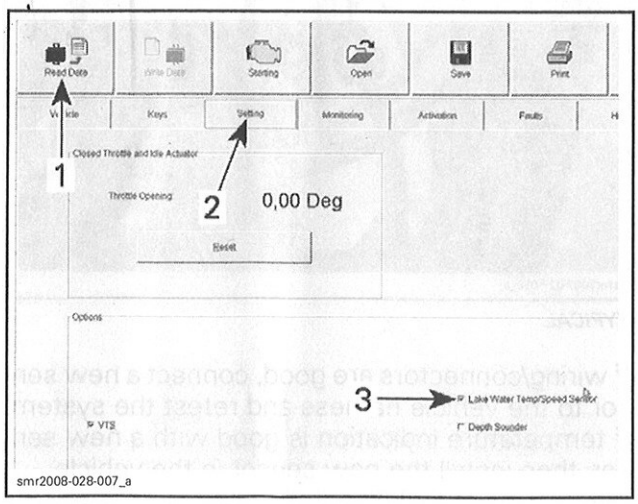
Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Install safety lanyard on DESS post.

Select the **Read Data** button.

Choose the **Setting** tab at the top of the page.

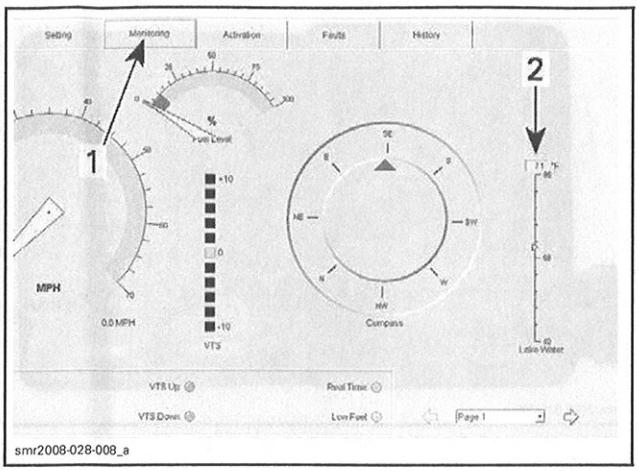
In the **Options** field, ensure the **Lake Water Temp/Speed Sensor** box is selected.



1. *Read Data button*
2. *Setting page tab*
3. *Lake Water Temp/Speed Sensor activation box*

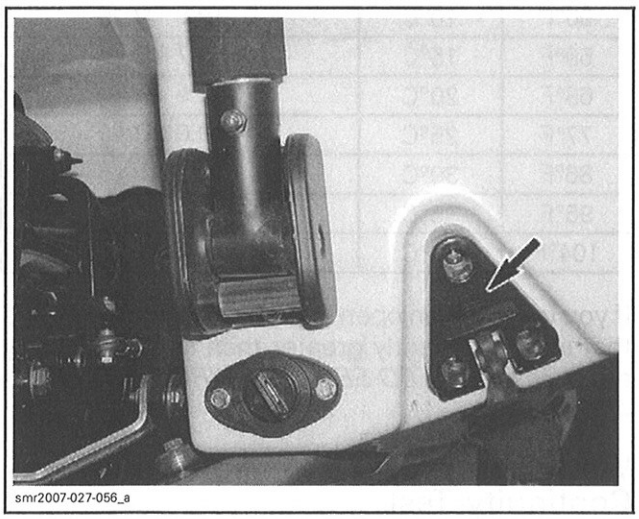
Choose the **Monitoring** tab at the top of the page.

A **Lake Water** temperature bar gauge is visible on the R/H side of the page.



1. *Monitoring*
2. *Lake Water temperature bar gauge*

With a garden hose, spray the speed sensor with water. The temperature reading in the Information Center and in B.U.D.S. should adjust to the water temperature.



TYPICAL – WATER TEMP SENSOR IN SPEED SENSOR

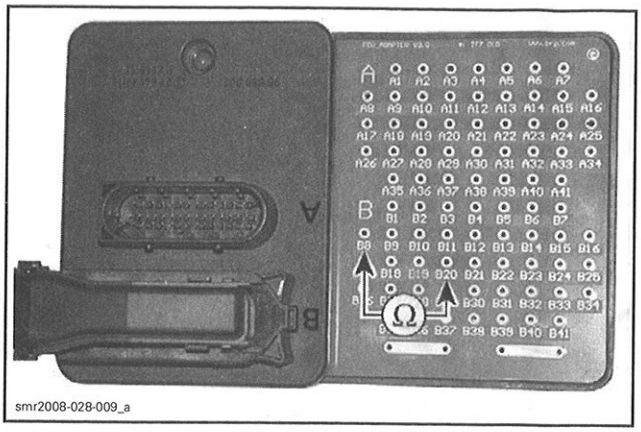
NOTE: If the temperature changes in B.U.D.S. but not in the information center, replace the information center.

If there is no temperature indication or variation, carry out a *TEMP SENSOR RESISTANCE TEST AT ECM*.

Water Temp Sensor Resistance Test (at ECM)

If not, disconnect ECM connector B and install it on the ECM adapter (P/N 420 277 010).

Set multimeter to Ω selection and test sensor resistance and continuity of wiring/connectors as per following table.



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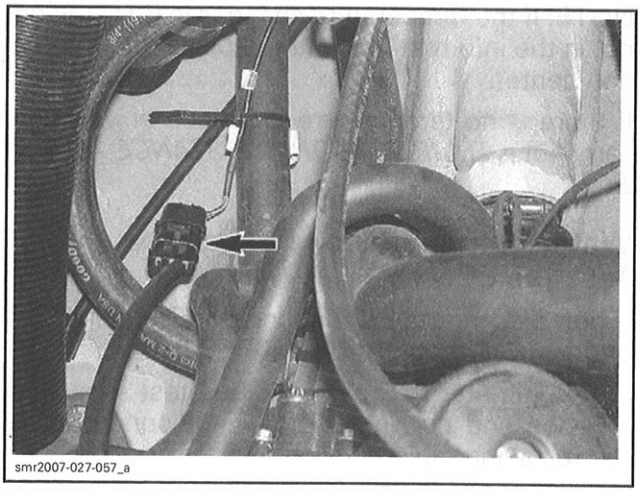
TEMP SENSOR RESISTANCE TEST AT ECM ADAPTER (PINS B8 TO B20)

TEMP SENSOR RESISTANCE TEST AT ECM		
SENSOR TEMP		RESISTANCE PINS B8 TO B20
32°F	0°C	32.3 kΩ
41°F	5°C	25.2 kΩ
50°F	10°C	19.8 kΩ
59°F	15°C	15.7 kΩ
68°F	20°C	12.5 kΩ
77°F	25°C	10.0 kΩ
86°F	30°C	8.1 kΩ
95°F	35°C	6.6 kΩ
104°F	40°C	5.4 kΩ

If you measure an open circuit or resistance values that are significantly greater than specified, carry out a *TEMP/SPEED SENSOR WIRING CONTINUITY TEST.*

Water Temp/Speed Sensor Wiring Continuity Test

Disconnect the speed sensor connector.

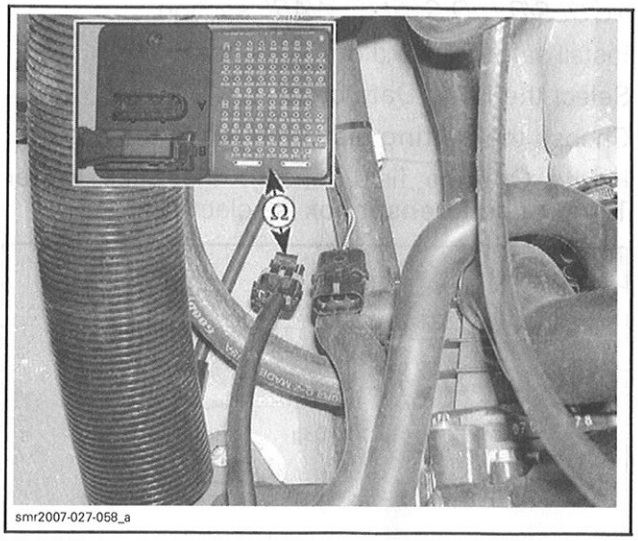

smr2007-027-057_a

TYPICAL – TEMP SENSOR CONNECTOR LOCATION

NOTE: On vehicles equipped with a 255 engine that has the intercooler mounted aft of the engine, the intercooler hoses and the exhaust system hose must be removed to access the temp/speed sensor connector.

Set multimeter to Ω selection and test wiring continuity between speed sensor connector and ECM connector B as per following table.

WATER TEMP/SPEED SENSOR HARNESS CONTINUITY TEST		
SENSOR CONNECTOR TERMINAL	ECM CONNECTOR B	RESISTANCE
A (speed sensor)	B-6	Close to 0 Ω (continuity)
B (temp sensor)	B-8	
C (common)	B-20	



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TYPICAL

If wiring/connectors are good, connect a new sensor to the vehicle harness and retest the system. If temperature indication is good with a new sensor, then install the new sensor in the vehicle.

If the temperature indication is still not functioning correctly, test or try a new ECM. Refer to *ENGINE MANAGEMENT.*

When everything else has been tested and the temperature indication still does not function correctly, try a new information center (unlikely).

COMPASS

Premium Gauge Only

The compass is located inside the information center.

B.U.D.S. can be used to check its operation.

Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

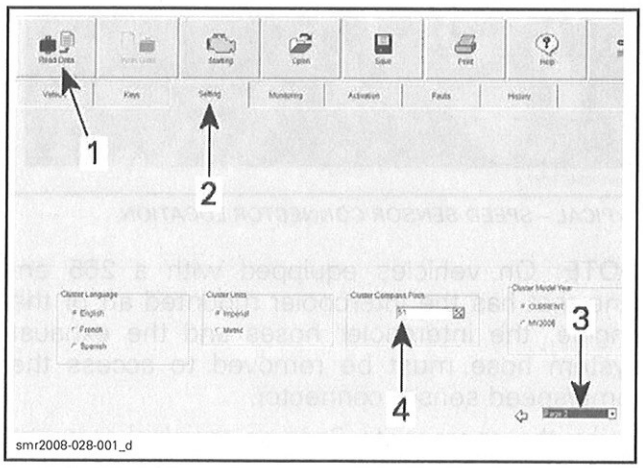
Install safety lanyard on DESS post.

Select the **Read Data** button.

Choose the **Setting** tab at the top of the page.

At the bottom R/H side of the **Setting Page**, choose **page 2**.

In the **Cluster Compass Pitch** field, ensure the proper pitch setting is selected.

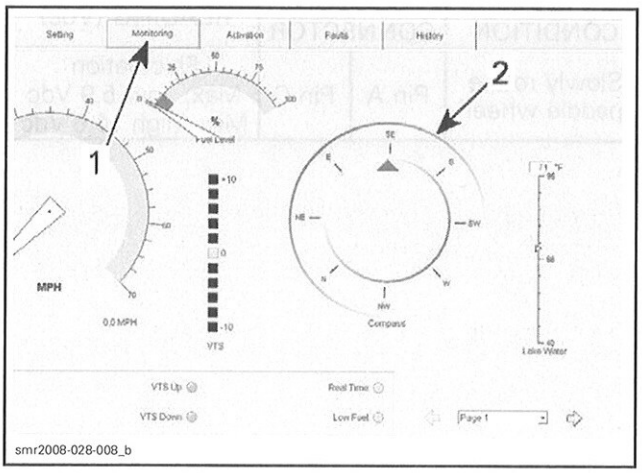


1. *Read Data button*
2. *Setting page tab*
3. *Setting Page 2*
4. *Cluster Compass Pitch*

COMPASS PITCH SETTINGS IN B.U.D.S.	
MODELS	COMPASS PITCH
GTX and RXT	51
RXP	41

Choose the **Monitoring** tab at the top of the page.

A **Compass** is visible on the R/H side of the page.



1. *Monitoring page tab*
2. *Compass indication*

Change the direction of the vehicle. There should be a change of direction on the Information Center and in B.U.D.S. Otherwise, try a new information center.

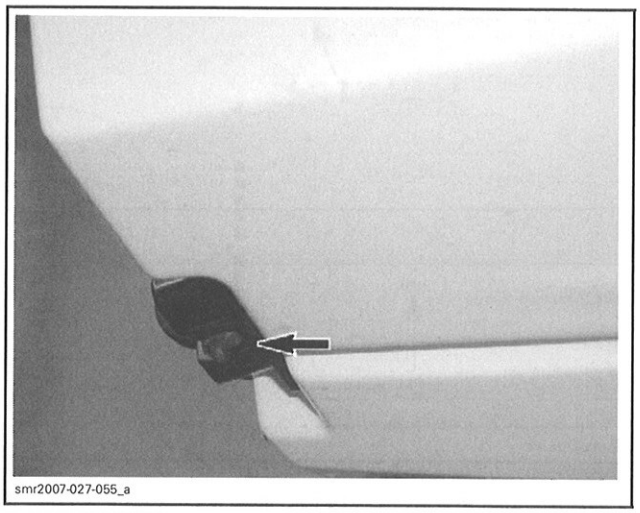
NOTE: To check the accuracy of the compass, you can use a portable compass and point it in the same direction. Compare the given directions, they should be the same. Otherwise, try a new information center.

SPEED SENSOR

All Models (except GTI)

Speed Sensor Operation

As the vehicle moves forward, water flows through the speed sensor which turns a magnetic paddle wheel that triggers an electronic pick-up. This generates a speed signal that is sent to the ECM. The ECM interprets this signal and sends a signal through the CAN bus to the information center which produces a speedometer indication.



SPEED SENSOR

B.U.D.S. can be used to test the speed sensor operation.

Speed Sensor Activation and Testing Using B.U.D.S.

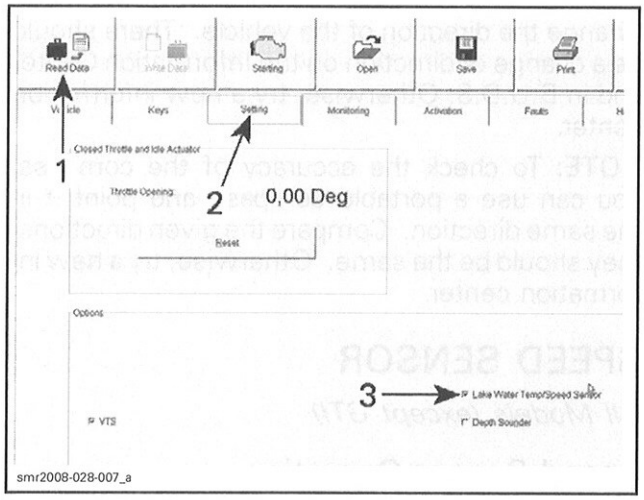
Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Install safety lanyard on DESS post.

Select the **Read Data** button.

Choose the **Setting** tab at the top of the page.

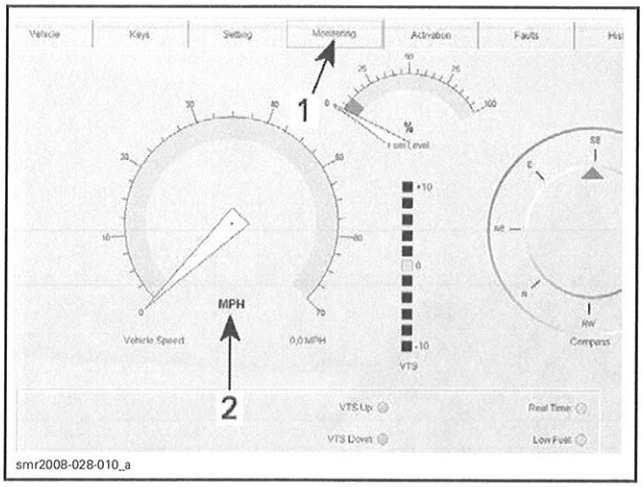
In the **Options** field, ensure the **Lake Water Temp/Speed Sensor** box is selected.



1. *Read Data button*
2. *Setting page tab*
3. *Lake Water Temp/Speed Sensor activation box*

Choose the **Monitoring** tab at the top of the page.

A speedometer is visible on the L/H side of the page.



1. *Monitoring page tab*
2. *Speedometer indication*

To test speed sensor operation, quickly spin it with a finger. The Information Center and the speedometer reading in B.U.D.S. should produce an indication of speed.

NOTE: The wheel should turn freely. Otherwise inaccurate speed will be displayed.

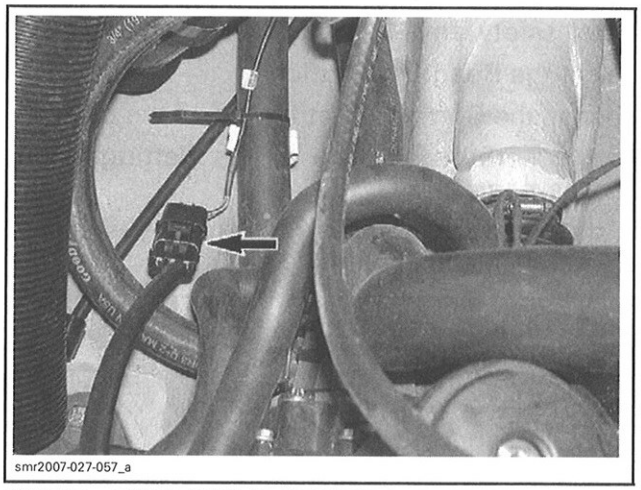
If you do not obtain a speed indication in B.U.D.S. but not in the information center, replace the information center.

If you do not obtain a speed indication in both, carry out a *TEMP/SPEED SENSOR WIRING CONTINUITY TEST* in this section.

If the wiring tests good, carry out a *SPEED SENSOR SIGNAL VOLTAGE TEST*.

Speed Sensor Signal Voltage Test

Disconnect the speed sensor connector.



TYPICAL – SPEED SENSOR CONNECTOR LOCATION

NOTE: On vehicles equipped with a 255 engine that has the intercooler mounted aft of the engine, the intercooler hoses and the exhaust system hose must be removed to access the temp/speed sensor connector.

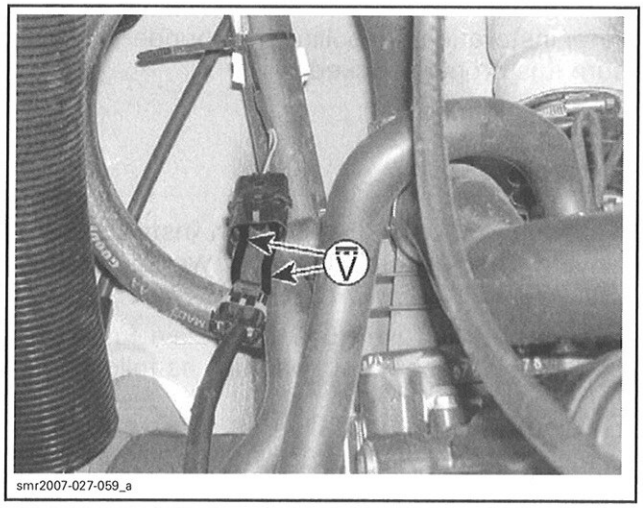
Using the appropriate Snap-on terminal remover (P/N TT600-4), remove male terminals A and C from speed sensor connector housing.

Reconnect speed sensor terminals A and C to the female terminals in the vehicle harness connector.

Connect a multimeter to the exposed speed sensor wire terminals and set it to Vdc.

As you slowly rotate the speed sensor with a finger, measure the signal voltage fluctuations as per following table.

SPEED SENSOR SIGNAL VOLTAGE TEST			
TEST CONDITION	SENSOR CONNECTOR		READING (Vdc)
Slowly rotate paddle wheel	Pin A	Pin C	Fluctuation Max. low 5.9 Vdc Min. high 10.6 Vdc



TYPICAL – SPEED SENSOR SIGNAL VOLTAGE

If you do not obtain voltage readings as specified, ensure battery is fully charged.

If battery voltage is good, connect a new sensor to the vehicle harness and repeat the test. If the indication and voltages are good with a new sensor, install the sensor in the vehicle.

If voltage and indication is not correct with a new sensor, try another ECM.

DEPTH GAUGE

GTX Limited Models

Depth Gauge Troubleshooting

NOTE: Ensure gauge is activated in B.U.D.S. Refer to *DEPTH GAUGE ACTIVATION*.

DEPTH GAUGE TROUBLESHOOTING		
SYMPTOM	POSSIBLE CAUSE	REMEDY
Nothing is displayed in the information center	The depth gauge is not activated in the ECM.	Activate the **Depth Sounder** in the Options field on **Setting** page in B.U.D.S.
0.0 (ft or m) is displayed all the time	Depth sounder not connected.	Connect it properly.
	12 V or ground wire open to depth sounder.	Check fuse 3 and wiring harness.
	Problem with the communication link wires.	Check WHITE/BLACK and WHITE/RED wires to CAN bus-bars in main fuse box.
- - - - (ft or m) is displayed and **Sensor** is blinking after self test for 5 seconds	Watercraft is not in water.	Launch watercraft in water and recheck.
	There is air between the depth sounder and the hull.	See inspection procedure below.
	Depth sounder is defective.	Try a new depth sounder.

Depth Gauge Activation

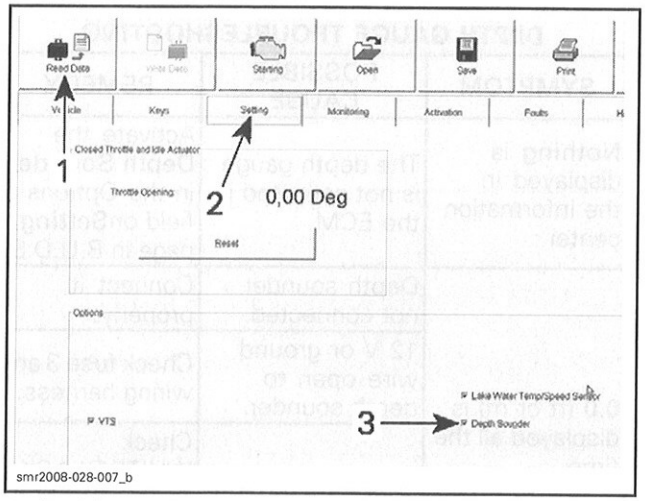
Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS/B.U.D.S. SOFTWARE* section.

Install safety lanyard on DESS post.

Select the **Read Data** button.

Choose the **Setting** tab at the top of the page.

In the **Options** field, ensure the **Depth Sounder** box is selected.

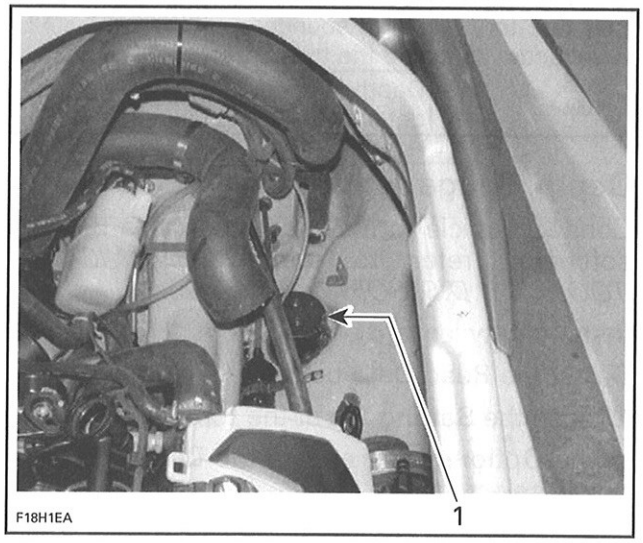


1. *Read Data button*
2. *Setting page tab*
3. *Depth Sounder activation box*

Depth Sounder Removal

Remove muffler.

Turn depth sounder counterclockwise and pull it out.



TYPICAL
1. *Depth sounder*

Depth Sounder Inspection

Ensure the silicone pad is in good condition. There must be no air between the bottom of the depth sounder and the bilge. Otherwise, the sounder will not work.

If silicone pad is damaged, replace it.

Depth Sounder Installation

Ensure O-ring is in good condition and properly positionned.

After installation, try pulling the sounder out to ensure it is properly locked.

Test run sounder.

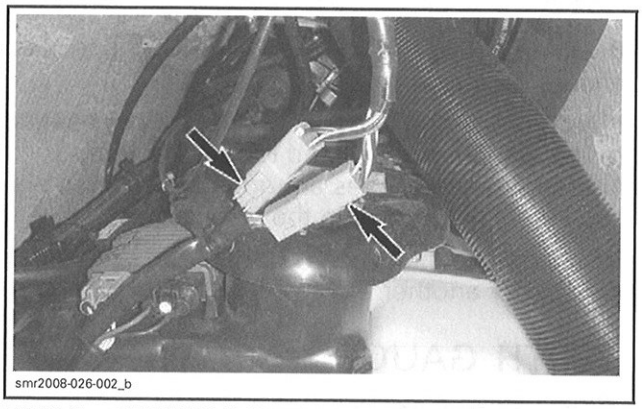
BEEPER

If no beep code is heard when installing safety lanyard, first ensure ECM is powered. Refer to *ENGINE MANAGEMENT*.

Ensure beeper fuse (fuse 2) in main fuse box is good, then test beeper operation as follows.

Beeper Operational Test

Open front storage cover and disconnect the steering harness connectors.

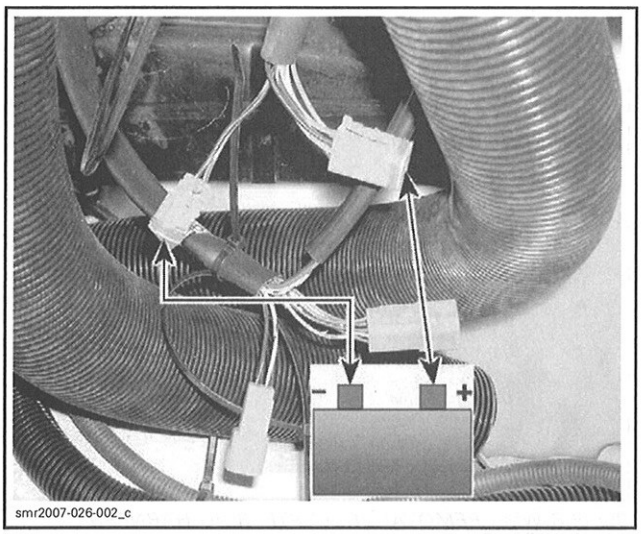


TYPICAL – STEERING HARNESS CONNECTORS

Temporarily install jumper wires on beeper connector, wires must be long enough to make a second connection outside the bilge. Connect wires to an external 12 V battery as per table.

NOTE: If wires are installed in reverse polarity, beeper will not function.

BEEPER OPERATIONAL TEST	
EXTERNAL BATTERY CONNECTIONS TO STEERING HARNESS CONNECTORS	
PURPLE/TAN (**Batt. +**)	TAN/BLACK (**Batt. –**)



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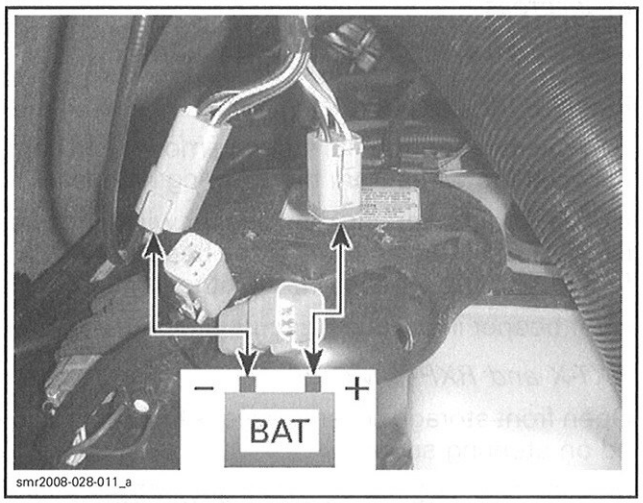

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If beeper does not sound, replace beeper.

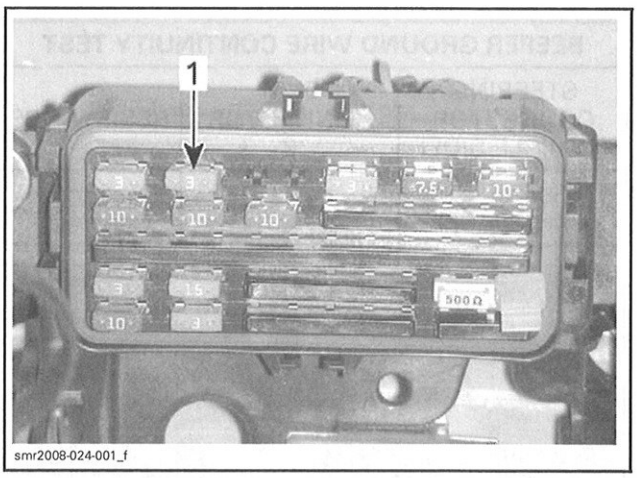
If beeper works, test continuity of power and ground wires as follows.

Beeper Power Wire Continuity Test

Remove jumper wires from steering harness connectors.

Set multimeter to the Ω setting.

Remove fuse 2 (beeper fuse) in main fuse box.

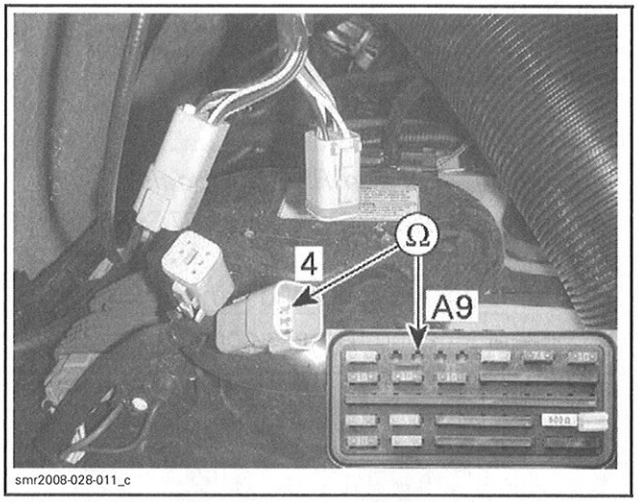


smr2008-024-001_f

1. Beeper fuse (fuse 2)

Measure for beeper power wire continuity as per following table.

BEEPER POWER WIRE CONTINUITY TEST		
STEERING CONNECTOR (VEHICLE SIDE)	MAIN FUSE BOX TERMINAL	RESISTANCE
Pin 4 (PURPLE/TAN)	A9	Close to 0 Ω (continuity)



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BEEPER POWER WIRE CONTINUITY TO MAIN FUSE BOX

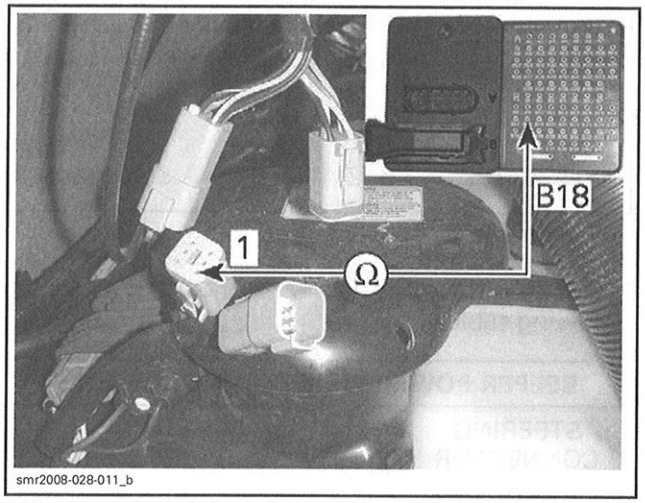
If continuity is not measured, repair wiring/connectors.

Beeper Ground Wire Continuity Test

Remove ECM connector B and install it on the ECM adapter (P/N 420 277 010).

Test continuity of ground circuit as per following table.

BEEPER GROUND WIRE CONTINUITY TEST		
STEERING CONNECTOR (VEHICLE SIDE)	ECM CONNECTOR B	RESISTANCE
Socket 1 (TAN/BLACK)	B-18	Close to 0 Ω (continuity)



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BEEPER GROUND WIRE CONTINUITY TO ECM

If continuity is not measured, repair wiring/connectors.

If continuity is good for both wires, check ECM. Refer to *ENGINE MANAGEMENT*.

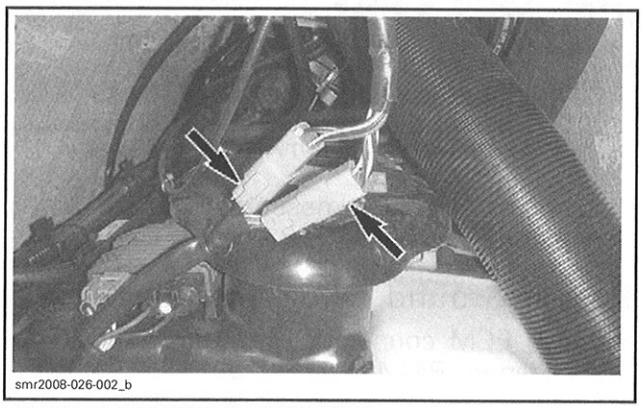
Beeper Removal

All except RXT-X and RXP-X Models

Open steering padding. Refer to *STEERING SYSTEM*.

Open front storage cover and remove storage bin.

Disconnect steering harness connectors.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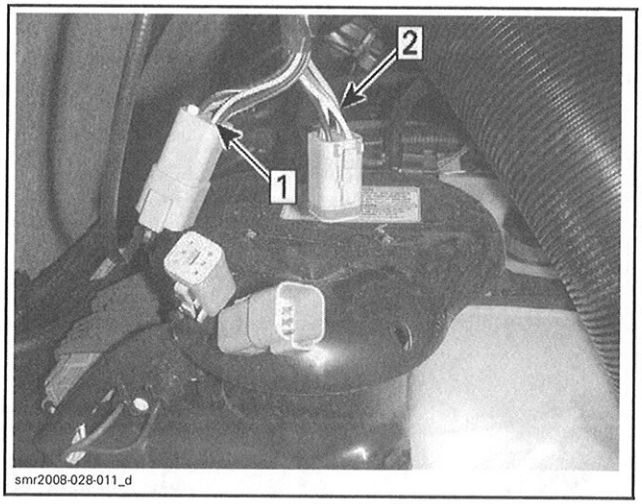
STEERING HARNESS CONNECTORS

Extract beeper wires from the front steering harness connectors.



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BEEPER WIRE REMOVAL FROM STEERING HARNESS CONNECTORS
Step 1: Remove TAN/BLACK wire (pin 1)
Step 2: Remove PURPLE/TAN wire (socket 4)

Remove the beeper retaining nut.

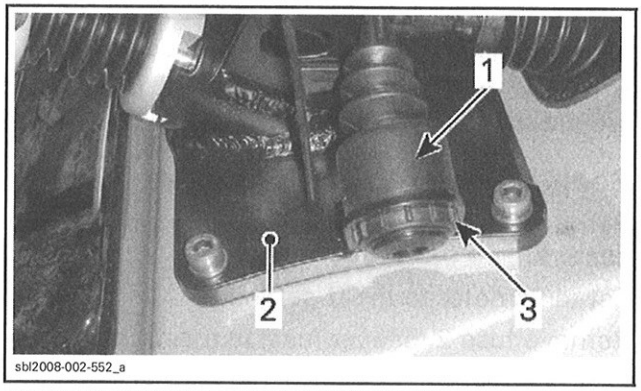
Remove beeper from its steering mount and carefully pull the wires from the steering harness.

NOTE: To aid in routing new beeper wires in steering harness, attach a string to the beeper wires before pulling the wires from the steering harness.

After beeper installation, secure steering padding.

RXT-X and RXP-X Models

Open front storage cover to access beeper mounted on steering support.



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BEEPER X PACKAGE MODEL ILLUSTRATED
1. *Beeper*
2. *Steering support*
3. *Retaining nut*

Beeper Installation

Installation is the reverse of the removal procedures however, pay attention to the following.

Refer to wiring diagram for pin locations in steering connectors.

Apply Locktite 425 threadlocker (P/N 293 800 040) to the beeper threads.

Torque beeper retaining nut to 1.5 N•m (13 lbf•**in**).

JET PUMP

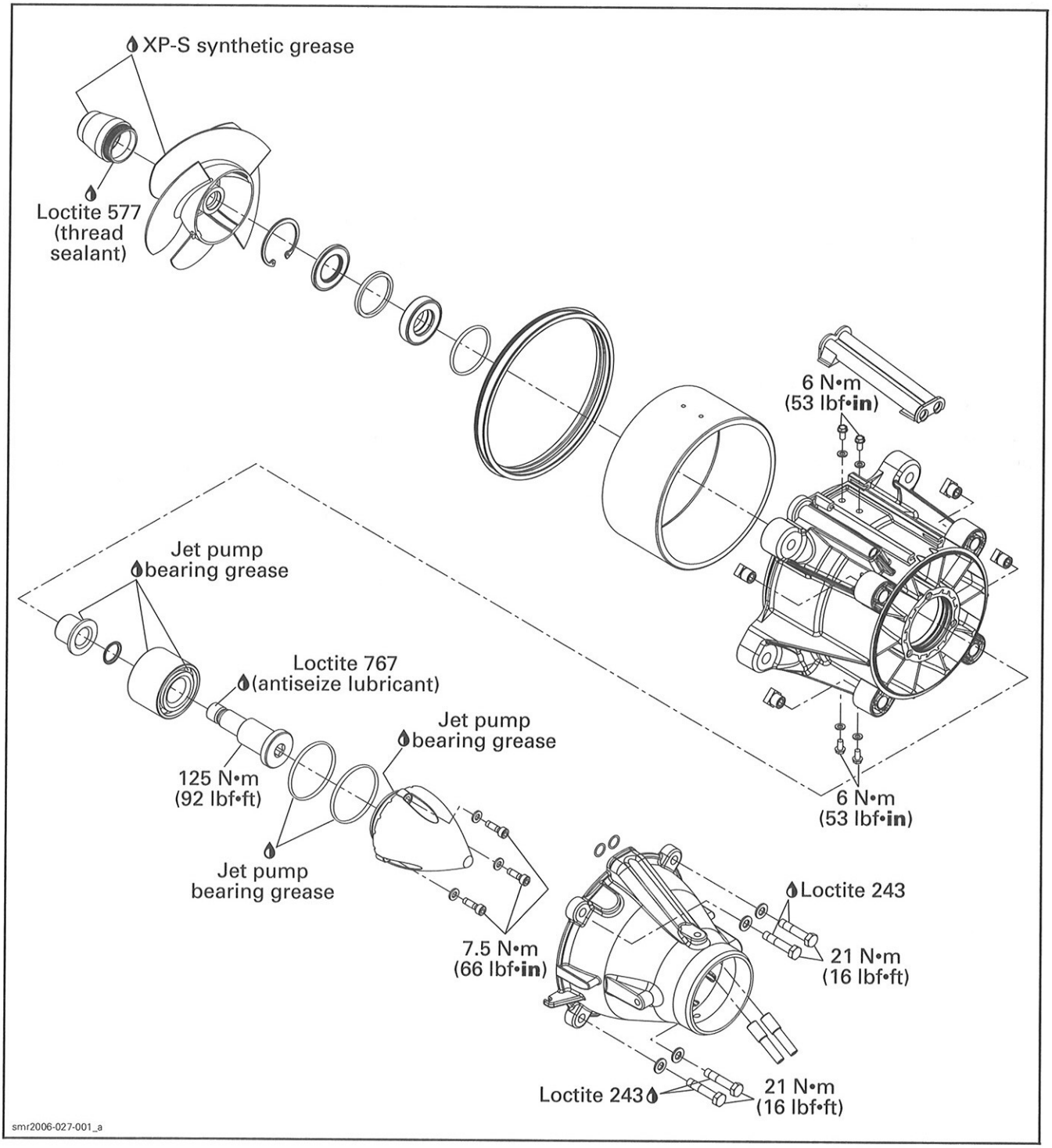
SERVICE TOOLS

Description	Part Number	Page
vacuum/pressure pump	529 021 800	351
seal/bearing pusher	529 035 819	361–362
Impeller remover/installer	529 035 820	357–358
pressure cap	529 035 843	351
impeller shaft pusher	529 035 955	360, 362
Impeller remover/installer	529 035 956	357–358
drive shaft holder	529 035 986	353

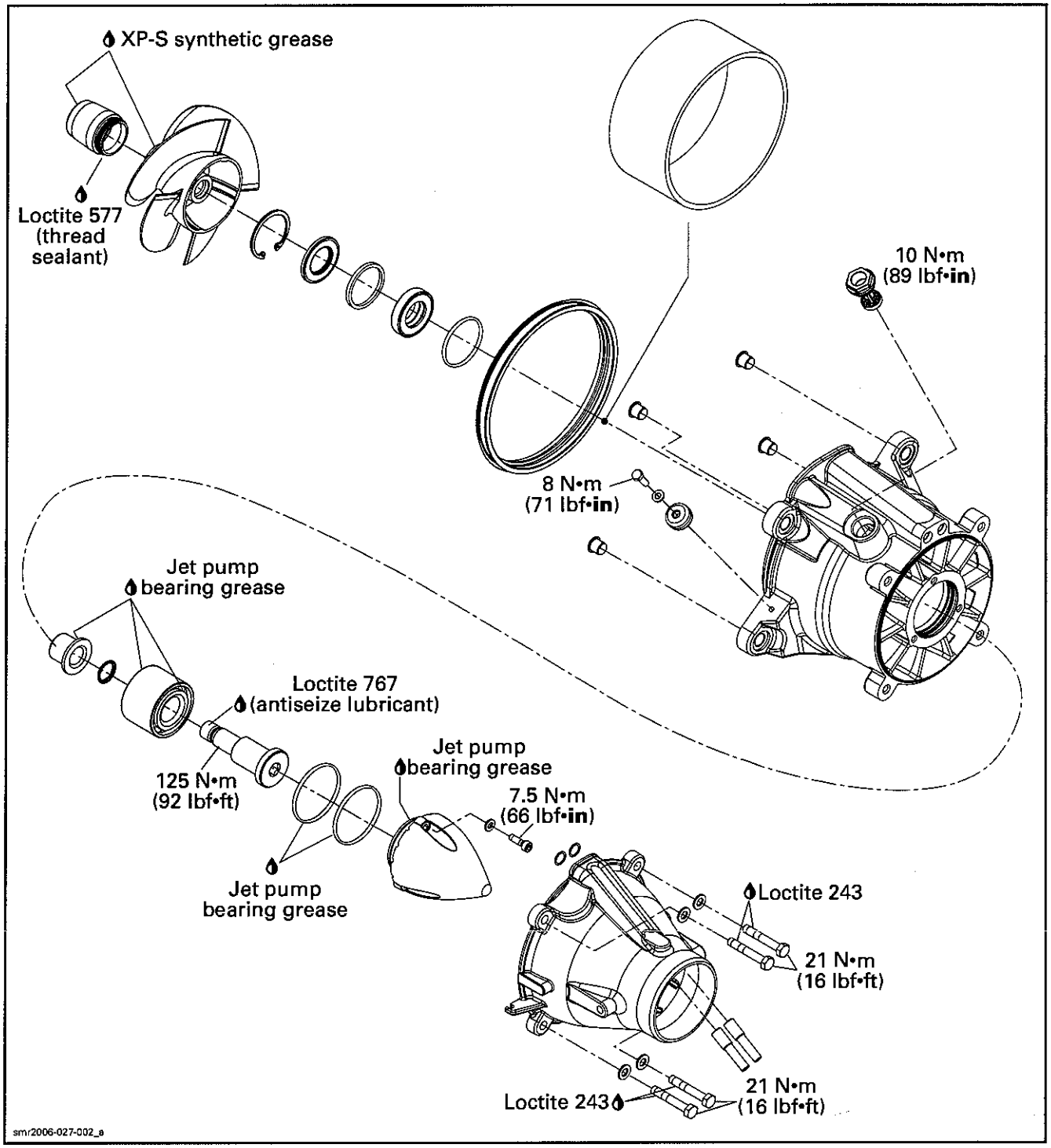
SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic grease	293 550 010	354, 358
jet pump bearing grease	293 550 032	356, 362–363
XP-S Lube	293 600 016	355, 358
Loctite 243 (blue)	293 800 060	353–355
Loctite 767 (antiseize lubricant)	293 800 070	358
pulley flange cleaner	413 711 809	354, 358

PLASTIC HOUSING



ALUMINUM HOUSING



GENERAL

To identify the watercraft jet pump type, refer to *TECHNICAL SPECIFICATIONS*.

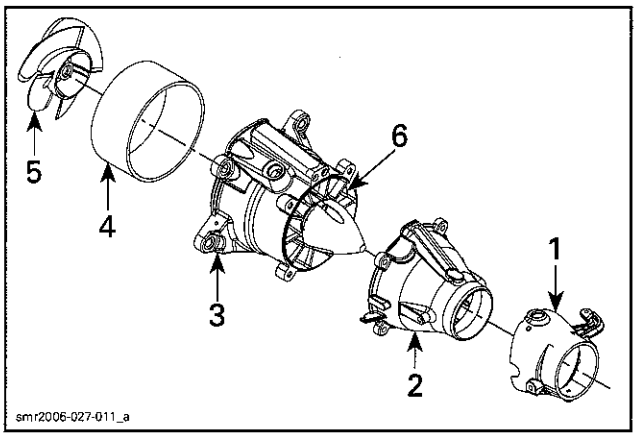
During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENER* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new.

Jet Pump Main Components

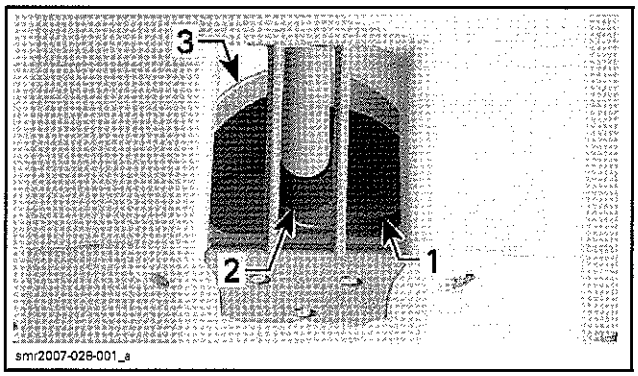


TYPICAL
1. *Nozzle*
2. *Venturi*
3. *Jet pump housing*
4. *Wear ring*
5. *Impeller*
6. *Stator*

INSPECTION

IMPELLER CONDITION

Condition of impeller, impeller boot and wear ring can be quickly checked from underneath of the watercraft. With the vehicle on the trailer, use a flashlight and look through the inlet grate.



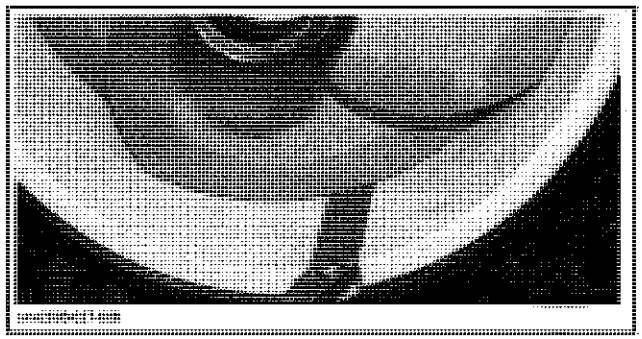
TYPICAL — UNDERNEATH HULL
1. *Impeller*
2. *Impeller boot*
3. *Wear ring*

IMPELLER/WEAR RING CLEARANCE

This clearance is critical for jet pump performance.

To check clearance, remove jet pump.

Using a feeler gauge, measure clearance between impeller blade tip and wear ring. Measure each blade at its center.



MODEL	MAXIMUM WEAR CLEARANCE mm (in)
All models except GTI rental	0.35 (.014)
GTI rental	0.80 (.032)

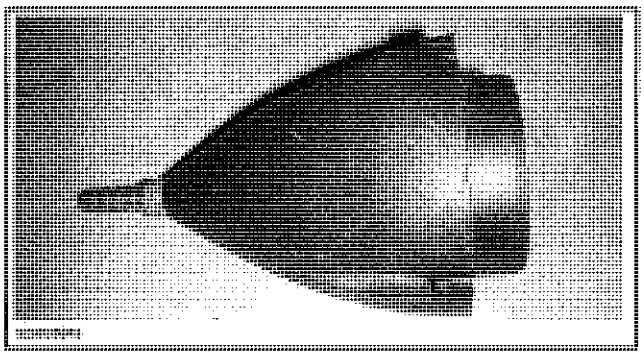
NOTE: The inner diameter of the wear ring on Rental GTI's aluminum pump is larger than the other models. The minimum clearance between impeller and wear ring is 0.70 mm (.028 in). This wear ring is BLACK and do not replace it with another type.

LEAK TEST

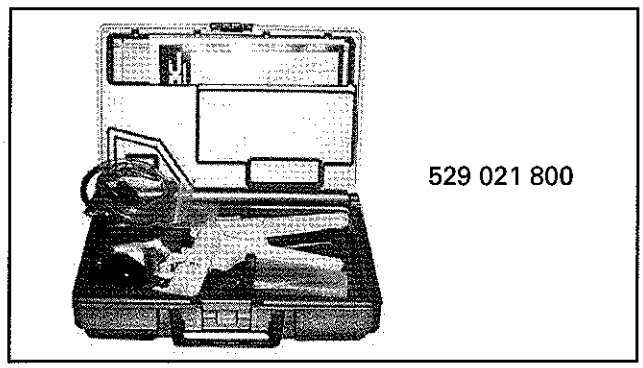
Whenever doing any type of repair on jet pump, a leak test should be done to check for leakage.

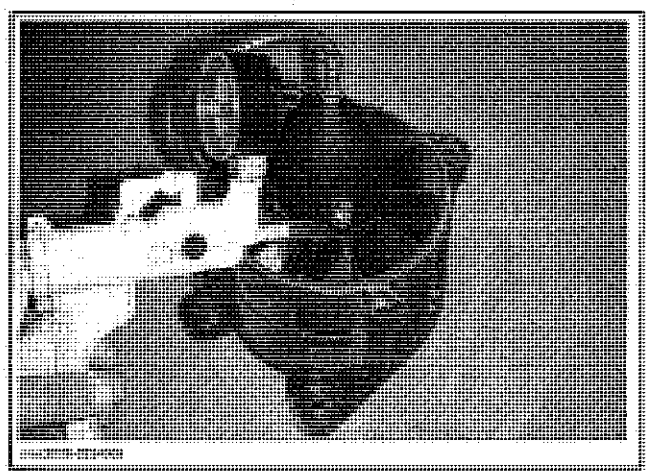
Proceed as follows:

- Remove impeller cover. Install the pressure cap (P/N 529 035 843) on pump housing.



- Connect the vacuum/pressure pump (P/N 529 021 800) to fitting.





- Pressurize pump to a maximum of 70 kPa (10 PSI).
- Pump must maintain this pressure for at least 5 minutes.

CAUTION: Repair any leak, failure to correct a leak will lead to premature wear of pump components.

NOTE: If there is a pressure drop spray soapy water around cover. If there are no bubbles, impeller shaft, impeller shaft seal, or jet pump housing is leaking through porosity and has to be replaced. Jet pump unit has to be disassembled. There may be 2 or 3 bubbles coming out from the area of sleeve and its seal. This small leak is acceptable. Leaks from other areas must be repaired.

- Disconnect pump and remove pressure cap.
- Reinstall impeller cover with 3 new self-locking screws. Push cover against pump housing while tightening screws.

PROCEDURES

NOTE: Whenever removing a part, visually check for damage such as: corrosion, crack, split, break, porosity, cavitation, deformation, distortion, heating discoloration, wear pattern, defective plating, missing or broken balls in ball bearing, water damage diagnosed by black-colored spots on metal parts, etc. Renew any damaged part. As a quick check, manually feel clearance and end play, where applicable, to detect excessive wear.

SACRIFICIAL ANODE

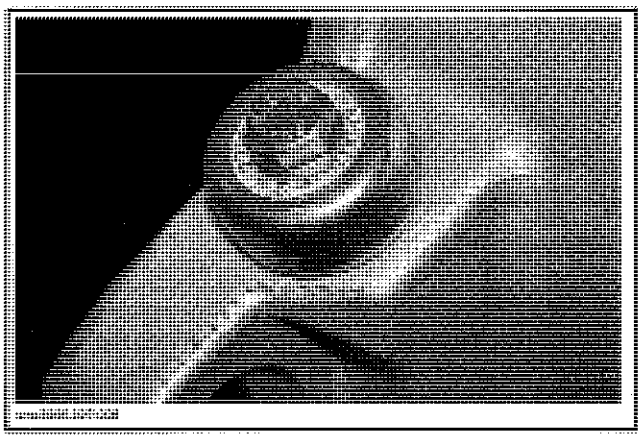
Models with an Aluminum Housing

Sacrificial Anode Inspection

Check for wear. If worn more than half, replace anode.

Sacrificial Anode Removal

Unscrew sacrificial anode bolt then remove anode.



Sacrificial Anode Installation

The installation is the reverse of the removal procedure.

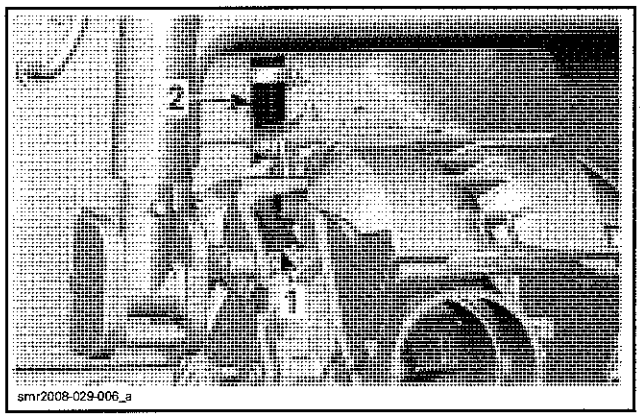
VENTURI

Venturi Removal

NOTE: In this procedure, the venturi is removed as an assembly with the reverse gate and the steering nozzle.

GTX 155/215, RXT 215/255 and WAKE 155/215 Models

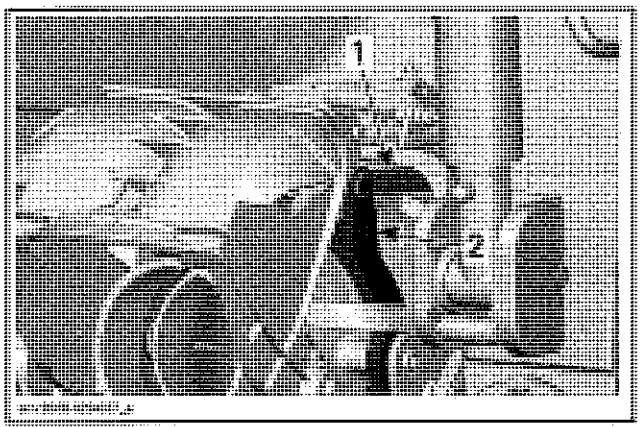
Unplug O.P.A.S. hose from filter.



1. *Filter*
2. *O.P.A.S. hose*

RXP 155/215/255, RXT 255 and WAKE 155/215 Models

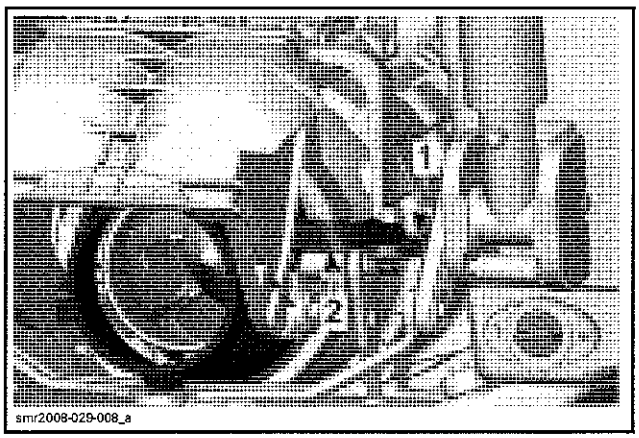
Disconnect VTS link rod from VTS ring.



1. *Link rod*
2. *VTS ring*

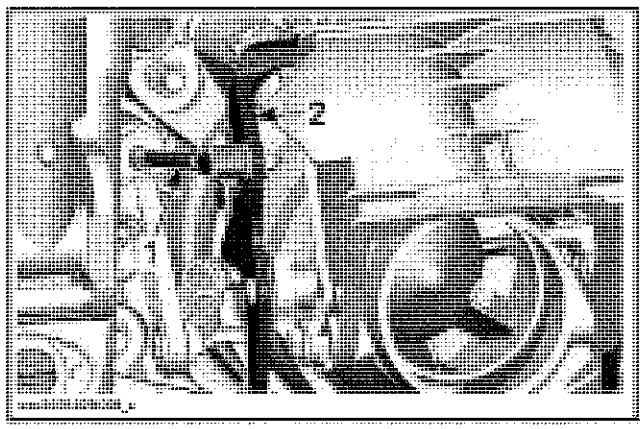
All Models

Detach the steering cable from the nozzle.



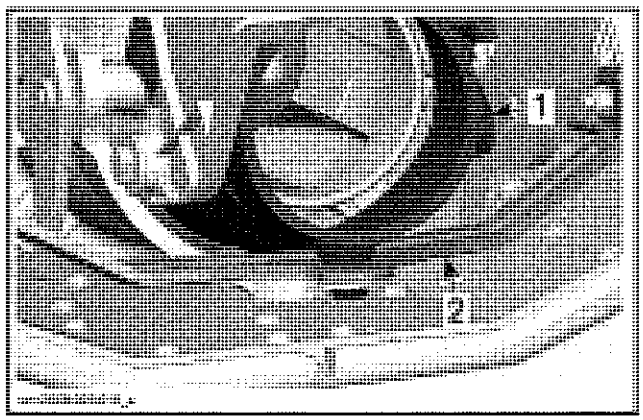
1. *Steering cable*
2. *Nozzle*

Detach the reverse cable from reverse arm.



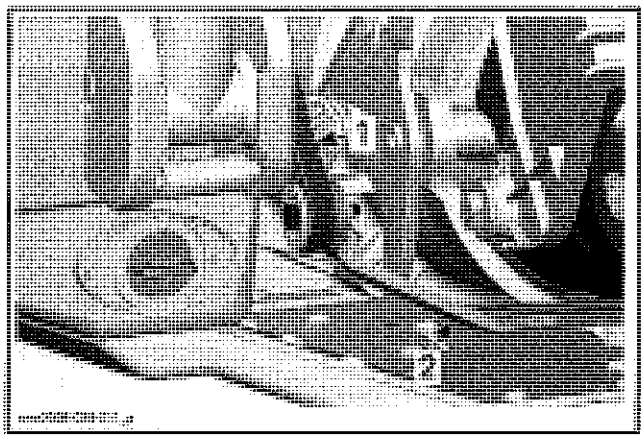
1. *Reverse cable*
2. *Reverse arm*

Remove the screw retaining the O.P.A.S. U lever under nozzle.



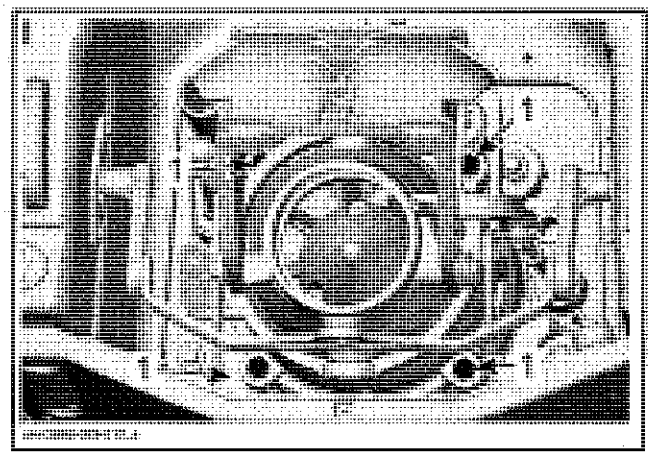
1. *Nozzle*
2. *O.P.A.S. U lever*

On both sides, remove bolts securing the O.P.A.S. U lever to side levers.



1. *LH side lever*
2. *O.P.A.S. U lever*

Remove bolts securing venturi to jet pump housing.

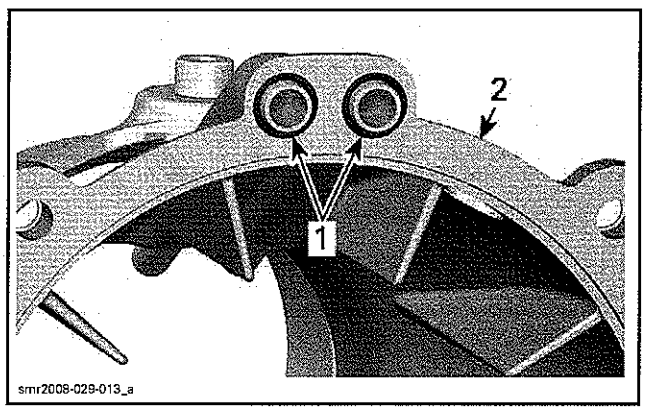


1. *Venturi bolts*

Venturi Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

If needed, install new O-rings around bailer passages.



1. *O-rings*
2. *Venturi*

Position venturi with bailer passages on top.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of venturi bolts.

NOTE: If new venturi bolts are used, the threads are coated with a self-locking product.

Install venturi bolts and flat washers.

Tighten bolts to 21 N•m (16 lbf•ft).

JET PUMP HOUSING

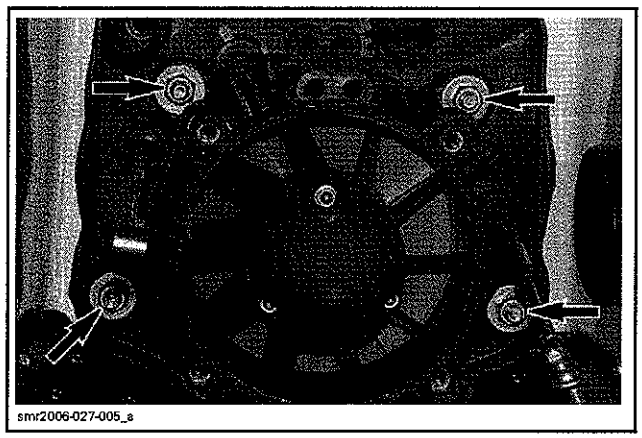
NOTE: The jet pump housing can be removed as an assembly with the reverse gate, nozzle and venturi. This is the preferred procedure when either the drive shaft or engine removal is required.

Jet Pump Housing Removal

Remove venturi, see procedure above.

NOTE: To remove jet pump as an assembly, follow venturi removal procedure but do not unscrew venturi from jet pump housing.

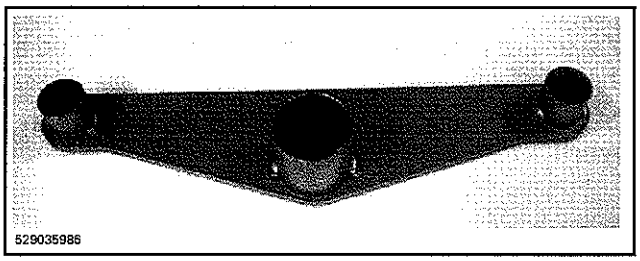
Remove nuts or bolts that attach jet pump housing to pump support.

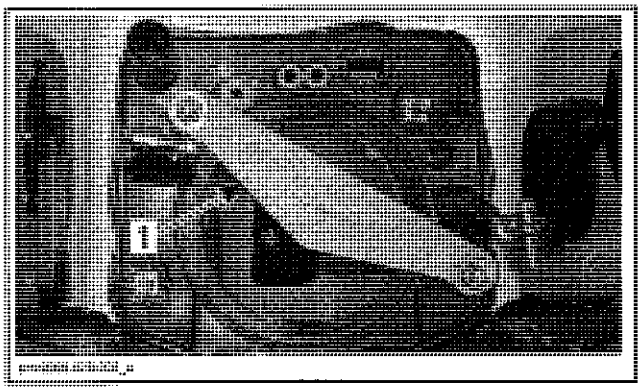


Remove jet pump with a wiggle movement.

CAUTION: When removing pump unit, shims could have been installed between hull and pump housing. Be sure to reinstall them otherwise engine and jet pump alignment will be altered.

When removing jet pump from vehicle, install the drive shaft holder (P/N 529 035 986) to support drive shaft and avoid engine oil seal damages.

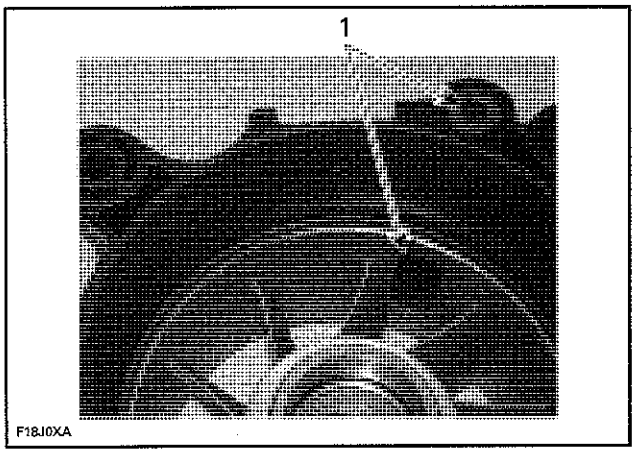




TYPICAL
1. Drive shaft holder

Jet Pump Housing Inspection and Cleaning

Carefully check water passages. Blow low pressure compressed air through them and make sure they are clear.



1. Water passages

Jet Pump Housing Installation

Properly clean all threads.

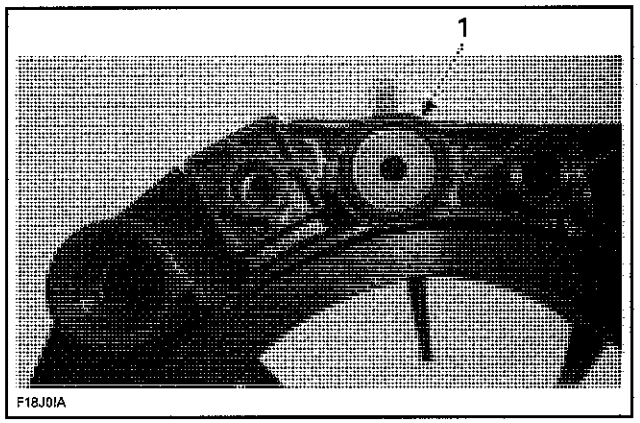
Remove all O-rings and clean parts in a solvent.

Brush and clean impeller splines and drive shaft splines with pulley flange cleaner (P/N 413 711 809) or equivalent. Free threads and splines from any residue.

The water flow is controlled by a calibrated reducer located between the jet pump support and the jet pump on the inlet side.

Make sure that the required reducer is installed as shown.

CAUTION: Improper installation can cause overheating and damage to exhaust system.



1. Calibrated reducer

MODELS	CALIBRATED REDUCER COLOR
130, 155 and 215 engines	Yellow
255 engines	Green

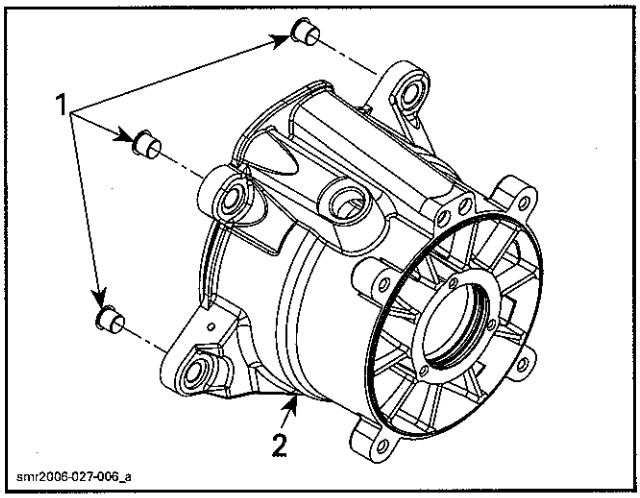
Generously apply XP-S synthetic grease (P/N 293 550 010) on drive shaft splines.

Install jet pump. If necessary, wiggle jet pump to engage drive shaft splines in impeller.

CAUTION: Some watercraft require a shim between hull and pump; if shim has been removed at pump removal, be sure to reinstall it, otherwise engine alignment will be altered.

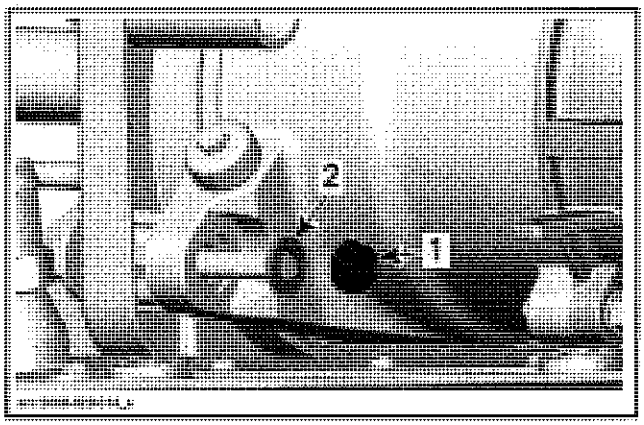
On **RXP Series and RXT 255**, apply Loctite 243 (blue) (P/N 293 800 060) on threads of jet pump housing screws.

On models with aluminum housing, ensure to reinstall bushings in fastener holes.

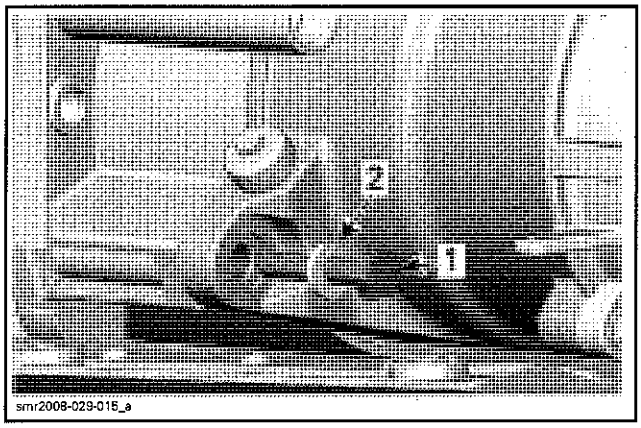


1. Bushings
2. Aluminum housing

Install nuts or bolts with theirs washers.

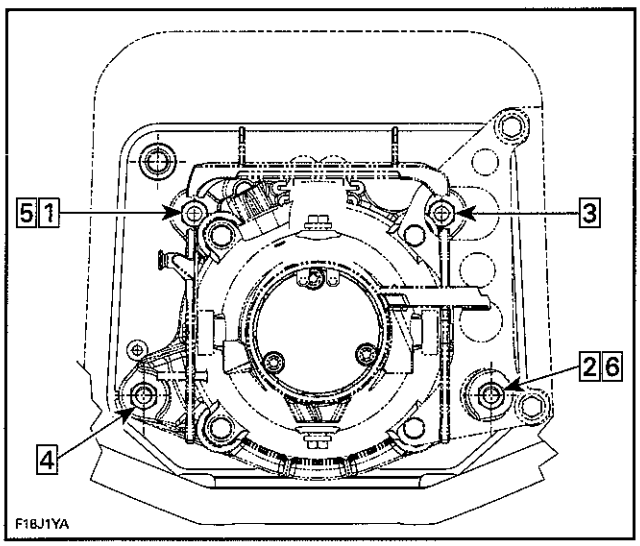


ALL EXCEPT RXP SERIES AND RXT 255
1. *Jet pump housing nut*
2. *Washer*



RXP SERIES AND RXT 255
1. *Jet pump housing bolt*
2. *Washer*

Tighten as per the following sequence.



TYPICAL
*From 1 to 2: 16 N•m (142 lbf•**in**)*
From 3 to 6: 31 N•m (23 lbf•ft)

NOTE: Slightly lubricate wear ring with XP-S Lube (P/N 293 600 016) to minimize friction during initial start.

Reconnect O.P.A.S. hose. Torque clamp screw to 4 N•m (35 lbf•**in**).

Fasten O.P.A.S. "U" lever to nozzle and side levers.

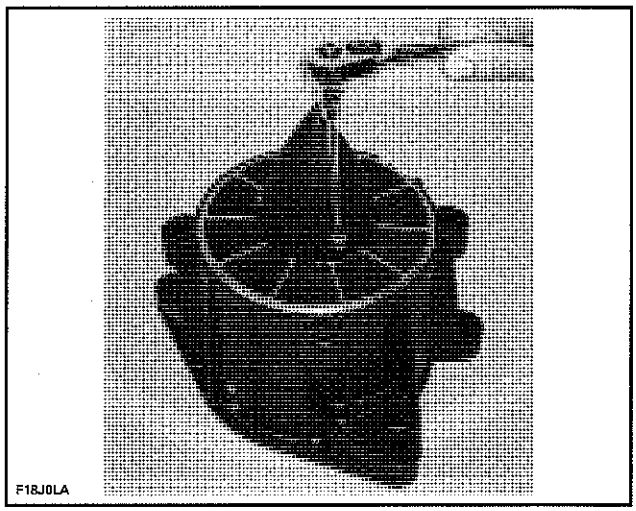
Apply Loctite 243 (blue) (P/N 293 800 060) on screw threads (or use new self- locking screws).

Torque center screw to 25 N•m (18 lbf•ft) and side screw to 7 N•m (62 lbf•**in**).

IMPELLER COVER

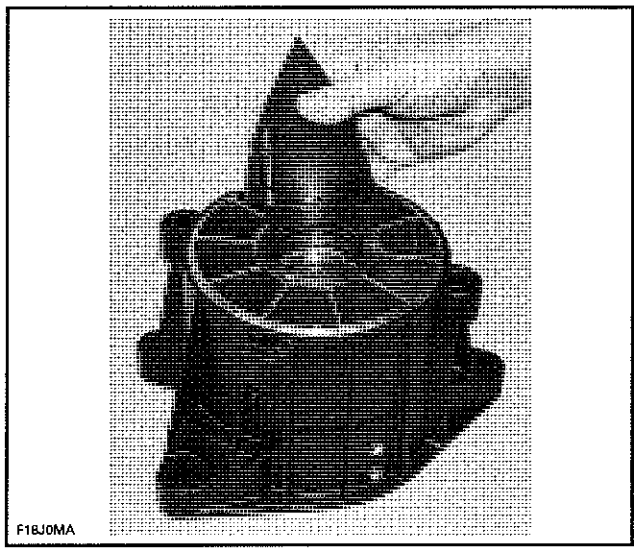
Impeller Cover Removal

With pump housing in vertical position, remove and discard 3 retaining screws.

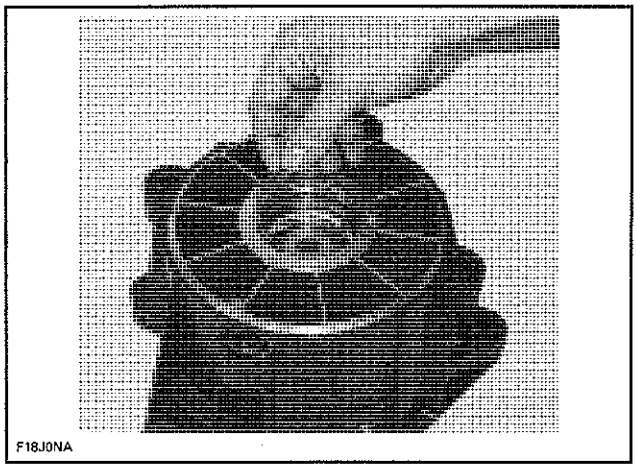


Using a fiber hammer, gently tap impeller cover to release it from jet pump housing.

Use flat screwdriver to remove cover.

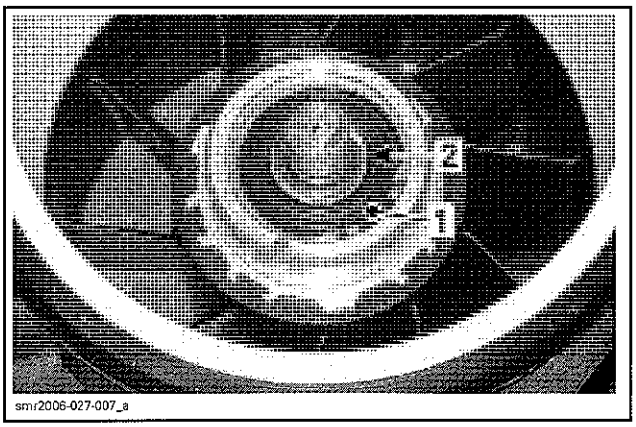


Remove both O-rings.



Impeller Cover Inspection

Check for presence of water in cover and bearing. If so, replace seal and sleeve on impeller side. Also replace O-rings and/or impeller cover.



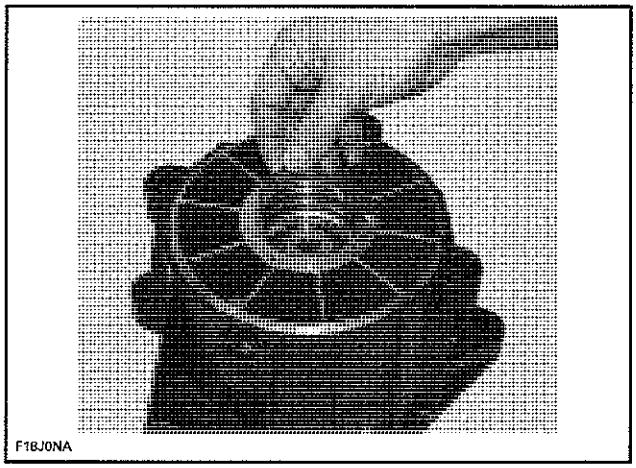
1. *Seal*
2. *Sleeve*

Check O-rings condition. Replace as required.

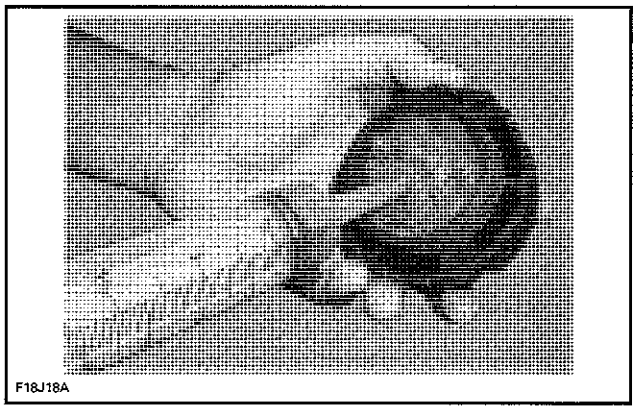
Perform a leak test. Refer to *LEAK TEST* at the beginning of this section.

Impeller Cover Installation

Install O-rings in their respective groove.



Put 25 grams of jet pump bearing grease (P/N 293 550 032) in cover.



TYPICAL

Install impeller cover with **NEW** self-locking screws.

Torque to 7.5 N•m (66 lbf•**in**).

NOTE: Push cover against pump housing while tightening screws. Make sure O-rings are positioned correctly and they are not damaged when pushing the cover.

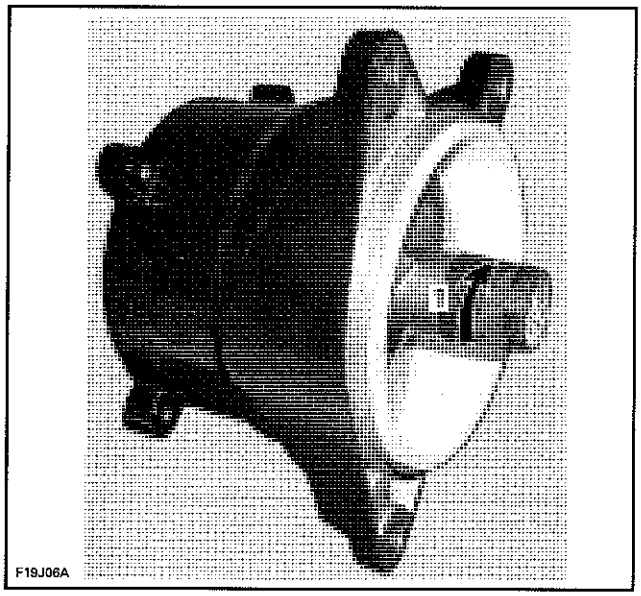
IMPELLER

Impeller Removal

Remove jet pump housing. Refer to *JET PUMP HOUSING* in this section.

Remove impeller cover. Refer to *IMPELLER COVER* in this section.

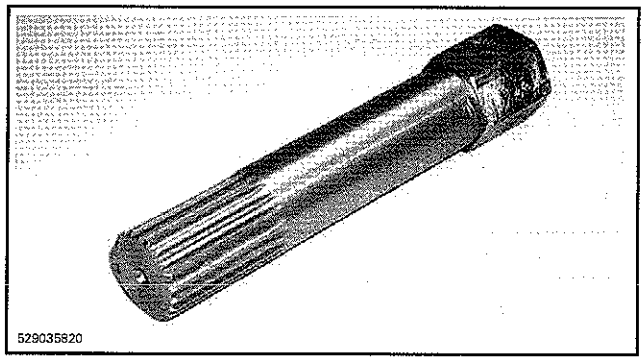
Remove impeller boot by turning it clockwise.



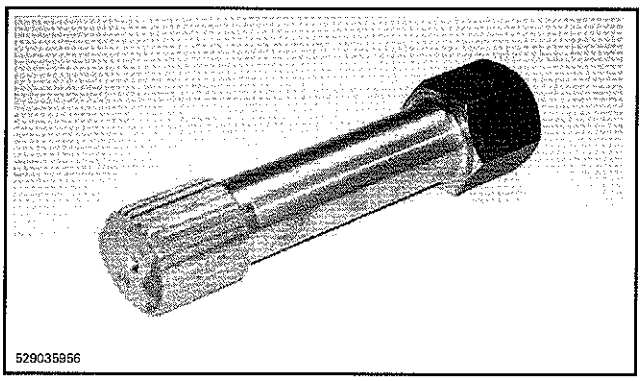
1. Unscrew clockwise

Mount the proper impeller remover/installer in a vise.

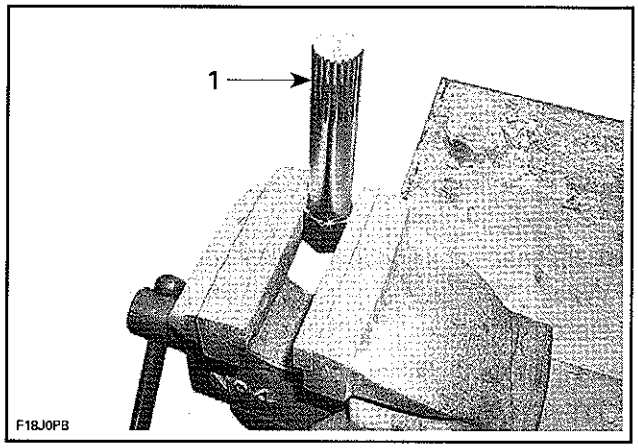
MODEL	TOOL
130 and 155 engines	Impeller remover/installer (P/N 529 035 820)
215 and 255 engines	Impeller remover/installer (P/N 529 035 956)



TOOL FOR 130 AND 155 ENGINES

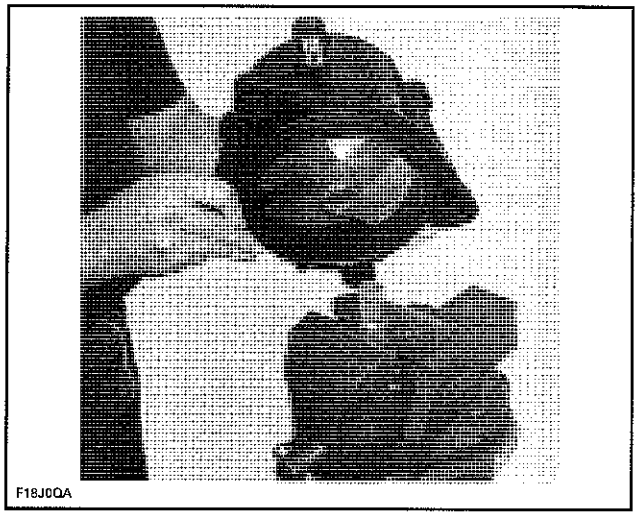


TOOL FOR 215 AND 255 ENGINE



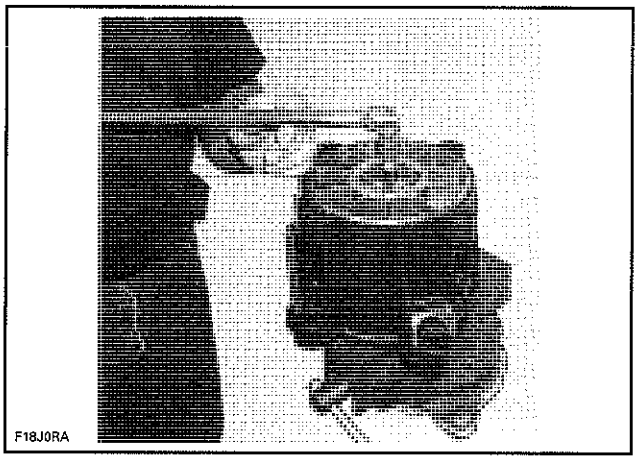
1. Impeller remover/installer

Install jet pump housing over this tool.



Using a 12 mm Allen key, unscrew the impeller.

NOTE: It may be needed to heat the impeller to release the threads.



CAUTION: Never use any impact wrench to loosen impeller.

To remove impeller, apply a rotating movement and pull at same time. Slide impeller out of housing.

Impeller Inspection

Check impeller boot for damages. Replace if necessary.

Visually inspect impeller splines for:
- Wear
- Deformation.

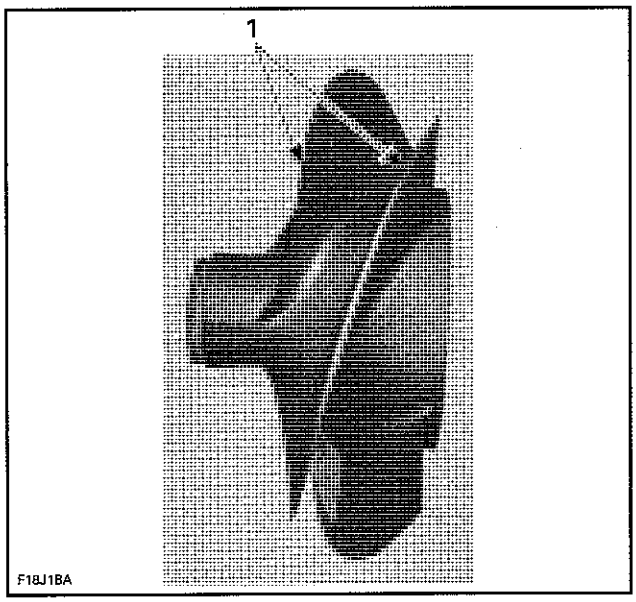
Renew parts if damaged.

NOTE: Check also the drive shaft condition. Refer to *DRIVE SYSTEM* section.

Examine impeller in wear ring for distortion.

Check if blade tips are:
- Blunted round
- Chipped
- Broken.

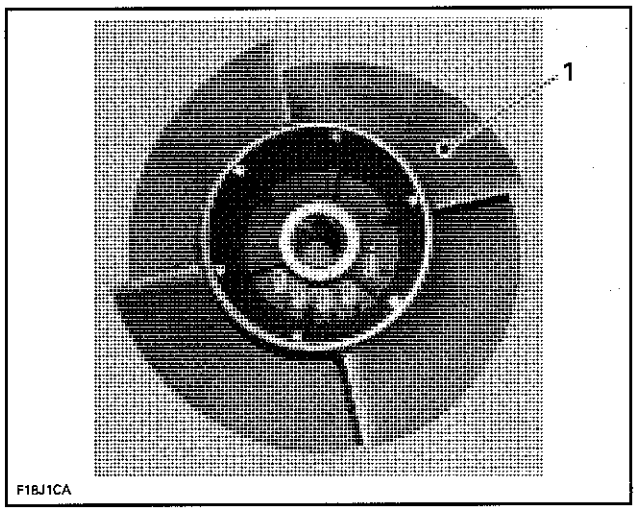
NOTE: Such impeller is unbalanced and will vibrate and damage wear ring, impeller shaft, shaft seal or bearings.



1. Blade tips

Renew if damaged.

Check impeller for:
- Cavitation damage
- Deep scratches
- Any other damage.



1. Impeller blade

Impeller Cleaning

Brush and clean impeller shaft threads, impeller splines and drive shaft splines with pulley flange cleaner (P/N 413 711 809) or equivalent. Free threads and splines from any residue.

Impeller Installation

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on impeller shaft.

Apply XP-S Lube (P/N 293 600 016) on the wear ring surface.

Start screwing the impeller on its shaft.

Make sure to turn it smooth enough so that engine starter should turn it.

Mount the proper impeller remover/installer in a vise.

MODEL	TOOL
130 and 155 engines	Impeller remover/installer (P/N 529 035 820)
215 and 255 engines	Impeller remover/installer (P/N 529 035 956)

Install partially screwed impeller on it.

Use a 12 mm Allen key to torque impeller shaft to 125 N•m (92 lbf•ft) then remove tool.

CAUTION: Never use any impact wrench to tighten impeller shaft.

Apply XP-S synthetic grease (P/N 293 550 010) on impeller boot threads.

WEAR RING

Wear Ring Inspection

Check wear ring for:
- Deep scratches
- Irregular surface
- Any apparent damage.

Check *IMPELLER/WEAR RING CLEARANCE*, see procedure at the beginning of this section.

Wear Ring Removal

Remove jet pump housing and impeller. See procedures above.

On plastic pump housing, remove the screws retaining wear ring in the jet pump housing.

Place jet pump housing in a vise with soft jaws. It is best to clamp housing using a lower ear.

Cut wear ring at two places.

CAUTION: When cutting ring, be careful not to damage jet pump housing.

NOTE: Wear ring can be cut using a jigsaw, a small grinder or a low clearance hacksaw.

After cutting ring, insert a screwdriver blade between jet pump housing and ring outside diameter.

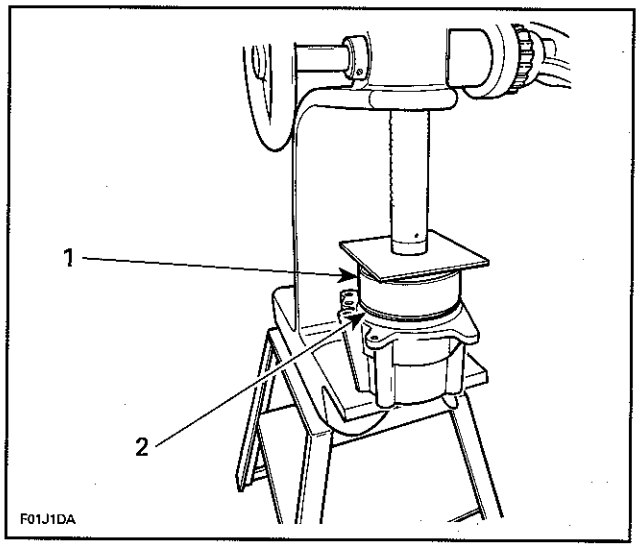
Push ring so that it can collapse internally.

Pull ring out.

Wear ring Installation

To install ring in housing, use a square steel plate of approximately 180 x 180 mm x 6 mm thick (7 x 7 in x 1/4 in) and a press.

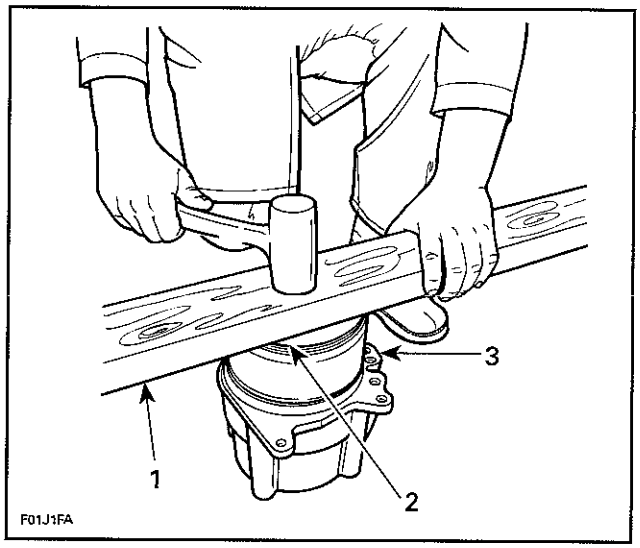
Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.



1. *Rounded edge*
2. *Press wear ring*

If a press is not readily available, a piece of wood such as a 2 x 4 in x 12 in long, can be used.

Manually engage ring in housing making sure it is equally inserted all around. Place wood piece over ring. Using a hammer, strike on wood to push ring. Strike one side then rotate wood piece about 90° and strike again. Frequently rotate wood piece so that ring slides in evenly until it seats into bottom of housing.



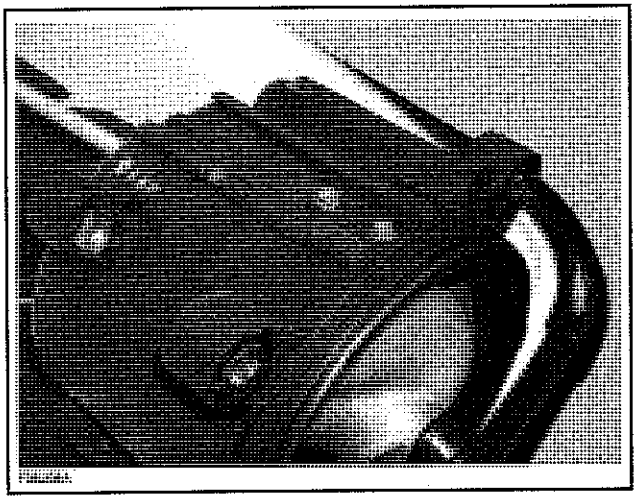
1. *Piece of wood*
2. *Rounded edge*
3. *Wear ring*

Models with a Plastic Pump Housing

After wear ring installation, install wear ring screws. Using their holes in jet pump housing as a drilling guide, drill 4 mm (5/32 in) diameter holes in wear ring. The depth of holes does not exceed 5 mm (3/16 in).

CAUTION: Drill carefully paying attention not to damage threads in jet pump housing. Drilling holes prior to screw installation will avoid wear ring deformation. Do not drill through wear ring.

Install screws and torque to 6 N•m (53 lbf•**in**).



TYPICAL

IMPELLER SHAFT AND BEARING

Impeller Shaft and Bearing Inspection

Wear

IMPORTANT: Make sure to reassemble ball cage, bearing inner and outer races to their original position.

Inspect ball bearing. Check for corrosion, scoring, pitting, chipping or other evidence of wear.

With your finger nail, feel contact surface of sleeve. If any irregular surface is found, renew sleeve and seal.

Install bearing, then install impeller shaft and rotate it. Make sure it turns smoothly.

Radial Play

Radial play is critical for jet pump unit life span.

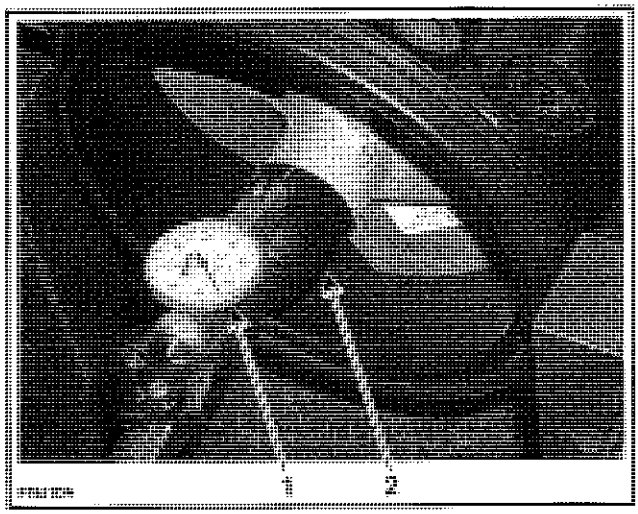
Radial play of impeller shaft is checked with shaft in housing, with impeller.

Retain housing in a soft jaw vise making sure not to damage housing lug.

Set a dial gauge and position its tip onto metal end, close to end of threads.

Move shaft end up and down. Difference between highest and lowest dial gauge reading is radial play.

The radial play should be 0 (zero).



TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY
1. Dial gauge
2. Measure close to threads at shaft end

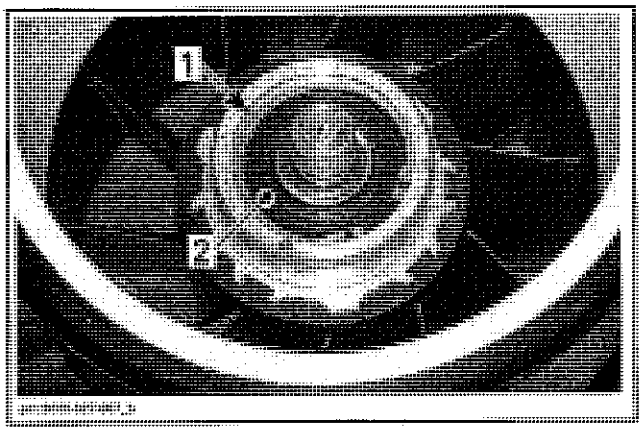
Excessive play can come either from worn bearing or damaged jet pump housing bearing surface.

Impeller Shaft and Bearing Removal

Remove impeller cover. See procedure in this section.

Remove impeller.

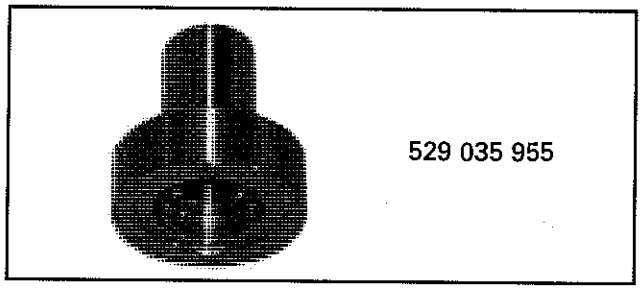
Remove circlip, seal and shaft sleeve.

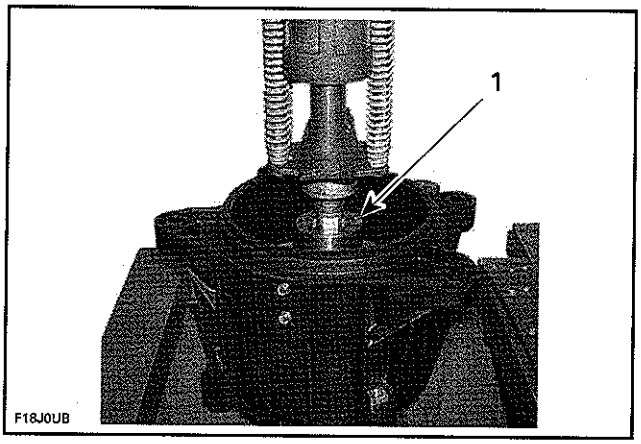


1. Circlip
2. Seal

NOTE: Ensure to keep shaft sleeve and O-ring in position. The impeller shaft pusher will work against shaft sleeve to properly push bearing out.

Use the impeller shaft pusher (P/N 529 035 955) to press out impeller shaft of pump housing. Bearing, will come out with the impeller shaft.

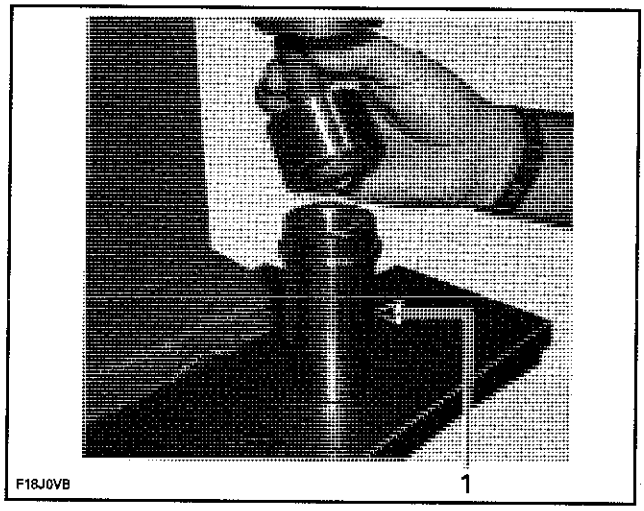




1. Impeller shaft pusher

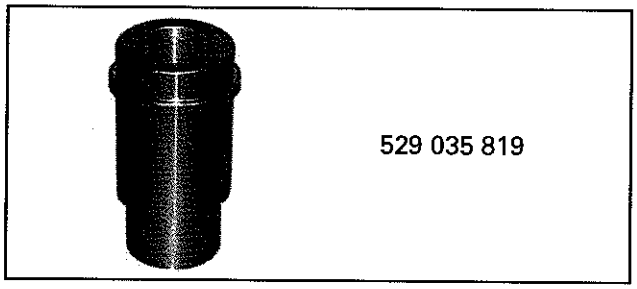
CAUTION: Bearing inner race being in 2 parts, bearing may fall apart during removal.

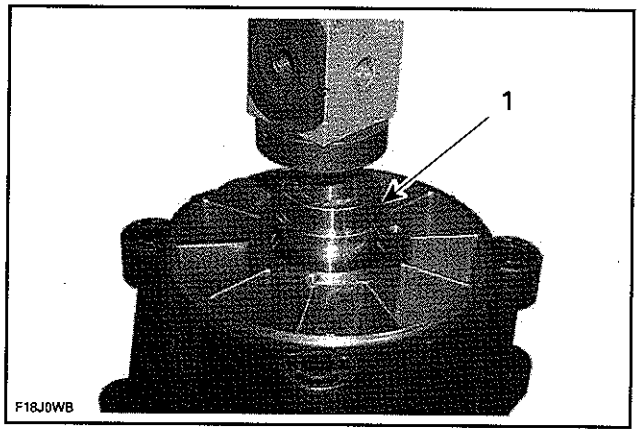
Use the seal/bearing pusher (P/N 529 035 819) to press out bearing from impeller shaft.



1. Seal/bearing pusher

From the outlet side of pump, use the seal/bearing pusher (P/N 529 035 819) to press out the seal.





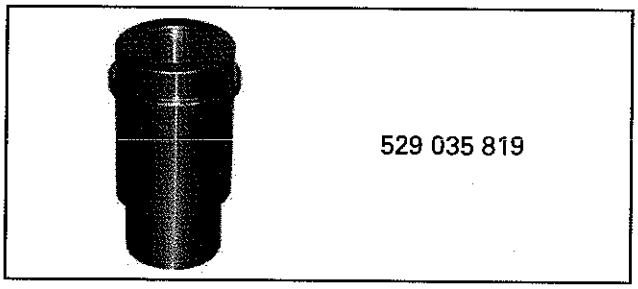
1. Seal/bearing pusher

Remove large O-ring from pump housing.

Impeller Shaft and Bearing Installation

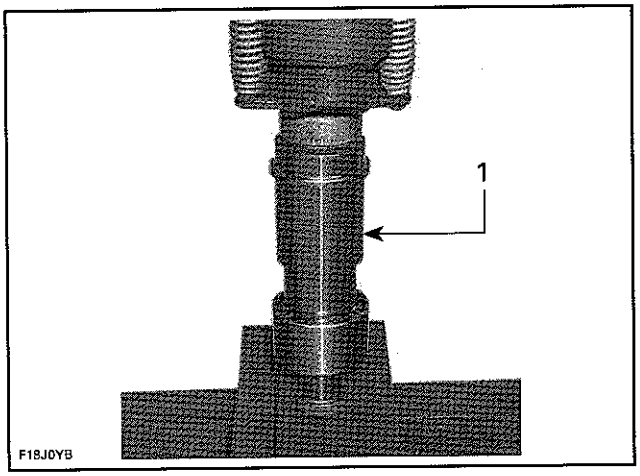
The installation is essentially the reverse of the removal procedure. However, pay attention to the following.

Using the seal/bearing pusher (P/N 529 035 819) press the bearing by its inner race on the impeller shaft.



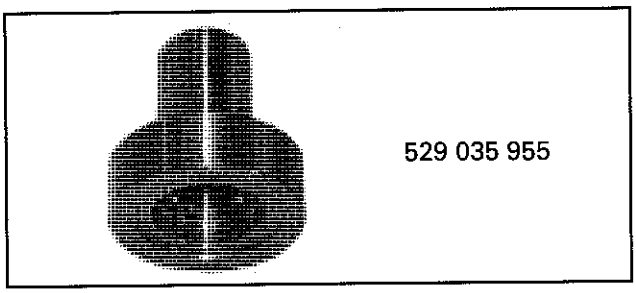
Be careful when removing the plastic retainer from the bearing to avoid the inner races from falling apart. Make sure to reassemble bearing parts to their original position.

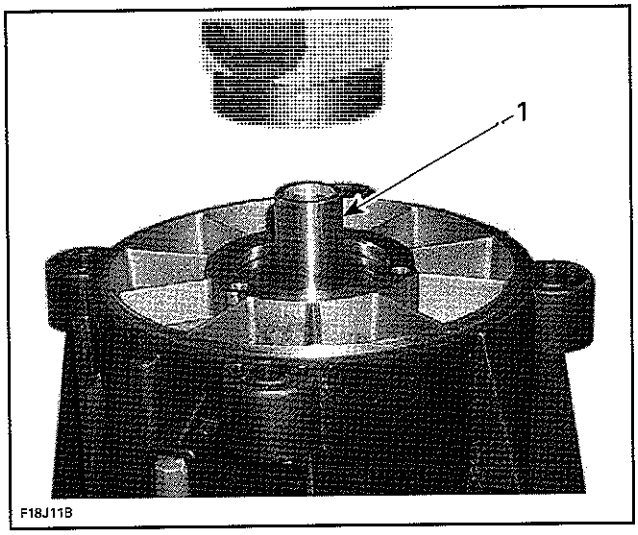
The bearing can be installed either side.



1. Seal/bearing pusher

From the outlet side of pump, press impeller shaft assembly into housing using the impeller shaft pusher (P/N 529 035 955).

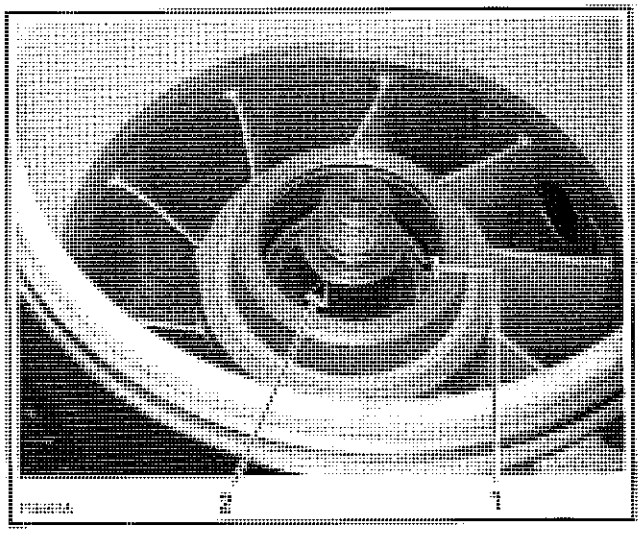




1. Shaft pusher

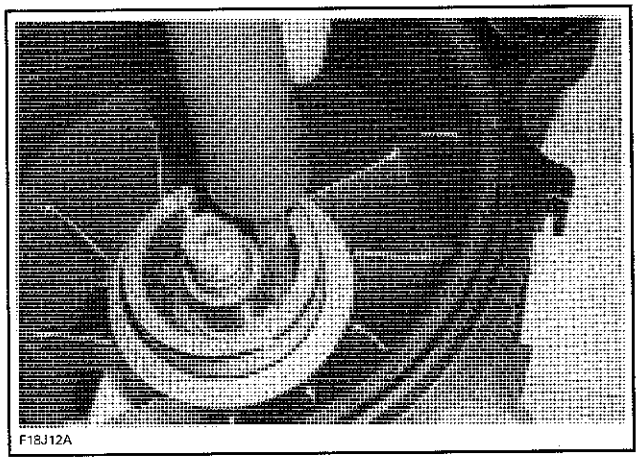
Coat shaft surface with jet pump bearing grease (P/N 293 550 032).

Install O-ring and shaft sleeve on shaft.

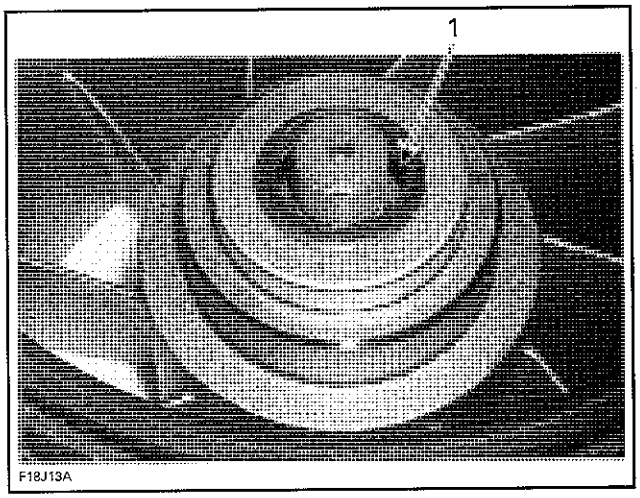


1. O-ring at bottom
2. Shaft sleeve

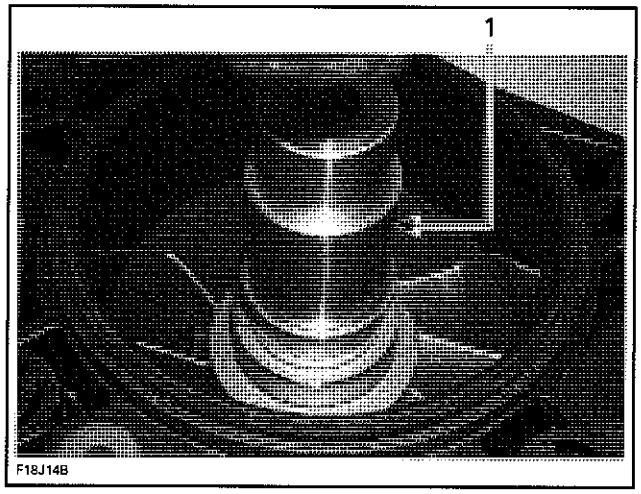
Apply 4 grams of jet pump bearing grease (P/N 293 550 032) on bearing.



Press NEW seal using the seal/bearing pusher (P/N 529 035 819) until tool bottoms. Make sure seal lips are facing up.



1. Lips facing up



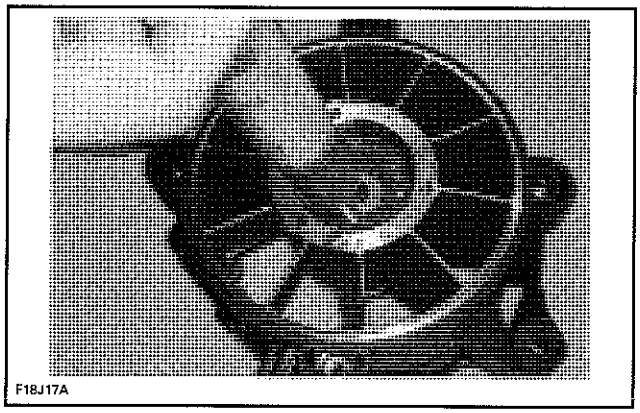
1. Seal/bearing pusher

Install spacer and the other seal. Ensure seal lip is facing up.

Install circlip.

Before installing any other parts, pump can be pressurized to insure proper seal installation. See *LEAK TEST* at the beginning of this section.

Apply 26 grams of jet pump bearing grease (P/N 293 550 032) in the impeller shaft area.



TYPICAL

Install the *IMPELLER COVER*, see procedure in this section.

DRIVE SYSTEM

SERVICE TOOLS

Description	Part Number	Page
Floating ring tool	529 035 841	368, 373
PTO seal support tool	529 035 842	367, 371
drive shaft holder tool	529 035 986	366, 372
Floating ring tool	529 035 987	368, 373
drive shaft circlip remover	529 036 026	367

SERVICE PRODUCTS

Description	Part Number	Page
anticorrosion spray	219 700 304	366, 370
XP-S synthetic grease	293 550 010	370
XP-S Lube	293 600 016	368
pulley flange cleaner	413 711 809	369

GENERAL

Jet pump must be removed to replace any components of the drive system. Refer to *JET PUMP* for removal procedure.

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new one.

MAINTENANCE

CORROSION PROTECTION

To prevent possible drive shaft corrosion in salt water, apply anticorrosion spray (P/N 219 700 304) as per interval in *MAINTENANCE CHART*.

⚠ WARNING

Always work in a well ventilated area. Carefully read application instructions on product can.

Drive shaft should be dry and clean prior to applying the anticorrosion product.

Place a plastic sheet underneath hull to recover the excess of sprayed anticorrosion product.

From underneath hull, spray the anticorrosion product through the intake grate all over the visible portion of drive shaft.

Dispose of the soiled plastic sheet as per your local environmental regulations.

On **215 engines**, remove the supercharger air inlet hose.

On **255 engines**, remove muffler hose, intercooler inlet and outlet air hoses and the supercharger air inlet hose.

From inside bilge, lift rubber protector to expose PTO seal assembly.

Cover carbon seal ring and floating ring with a rag or plastic wrap to prevent the anticorrosion product to reach the carbon ring. Place a rag on bottom of hull to recover the excess of sprayed anticorrosion product. Spray the visible portion of drive shaft. When done, dispose soiled rag as per your local environmental regulations.

Install the following parts before positioning the rubber protector:

- On **215 engines**, install the supercharger air inlet hose.
- On **255 engines**, install the supercharger air inlet hose, intercooler inlet and outlet air hoses and the muffler hose.

Reposition rubber protector.

Wait 2 hours prior to using the watercraft to allow the anticorrosion product to dry.

PROCEDURES

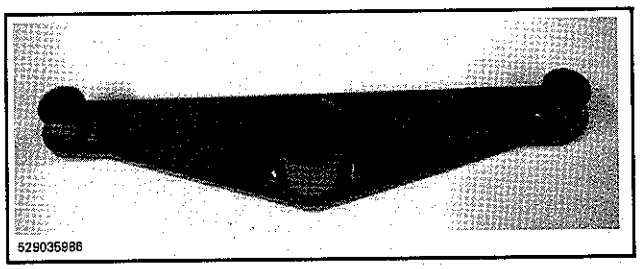
DRIVE SHAFT

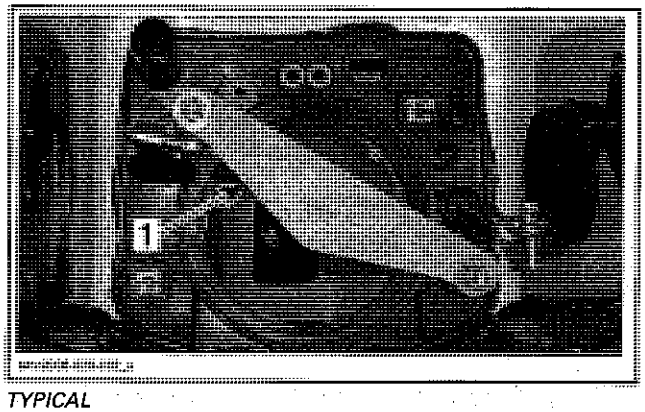
Drive Shaft Removal

NOTE: When drive shaft will be removed, some oil will flow out. To prevent it, start engine, run at 4000 RPM for 10 seconds and stop engine at this RPM. This will move oil out of PTO housing into oil tank. If engine cannot be started, remove oil from the PTO area by following the procedure in *PTO HOUSING REMOVAL* of the *PTO HOUSING AND MAGNETO* section.

Remove jet pump. Refer to *JET PUMP* section.

Install the drive shaft holder tool (P/N 529 035 986) on pump support. Secure it with jet pump housing fastener (nuts/bolts and washers).





TYPICAL
1. Drive shaft holder

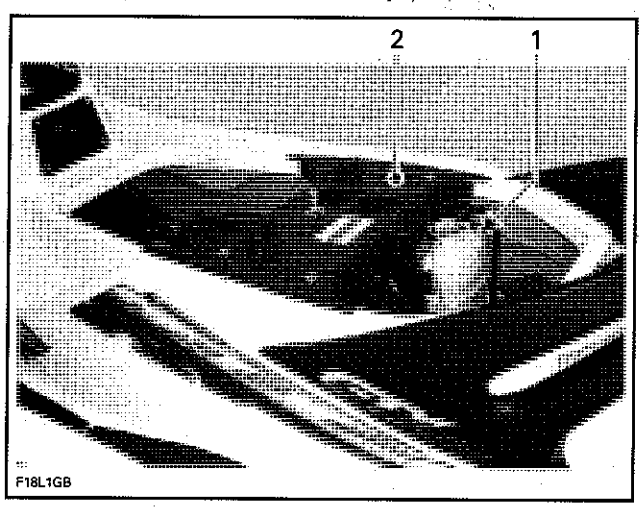
Remove seat(s).

RXP Series

Remove engine cover.

GTX Series and RXT Series

Detach coolant expansion reservoir from vent tube support then move away.



TYPICAL
1. Detach expansion reservoir
2. Remove vent tube support

Detach vent tube.

Remove vent tube support.

255 Engines

Detach the muffler hose and move it aside to make room.

Remove the intercooler air inlet and air outlet hoses.

215 and 255 Engines

Remove supercharger. Refer to *SUPERCHARGER* in *ENGINE* section.

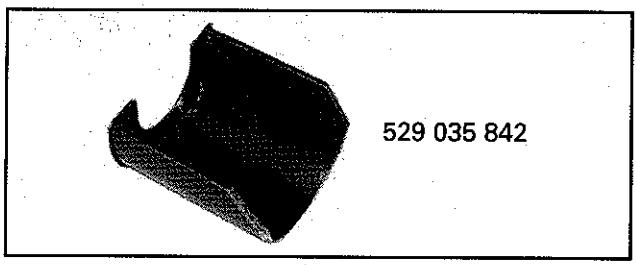
All Models

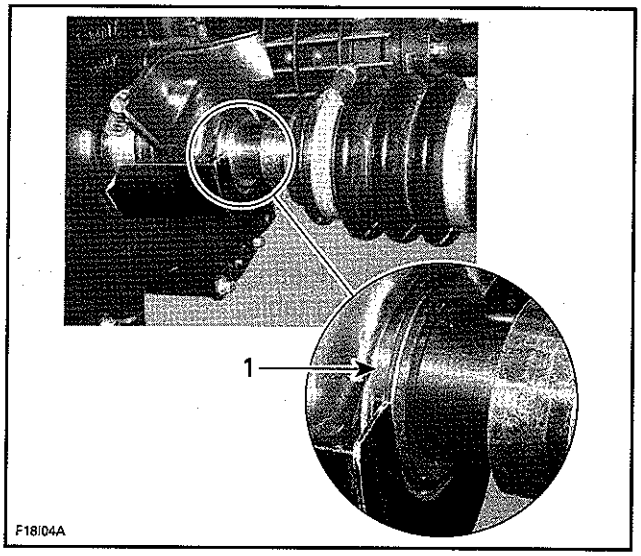
NOTE: Use this sequence to minimize the amount of movement the drive shaft will slide back into PTO seal assembly.

Lift rubber protector to expose PTO seal assembly.

Install the PTO seal support tool (P/N 529 035 842) on bottom of PTO seal assembly as shown.

CAUTION: Strictly follow this procedure otherwise damage to component might occur.

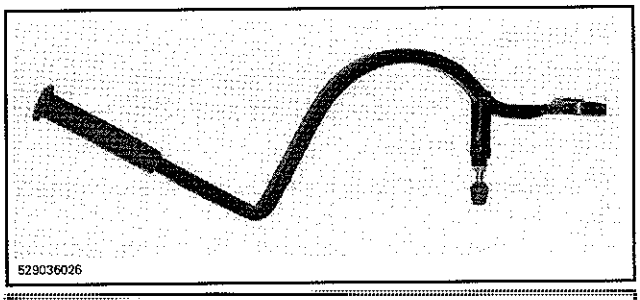


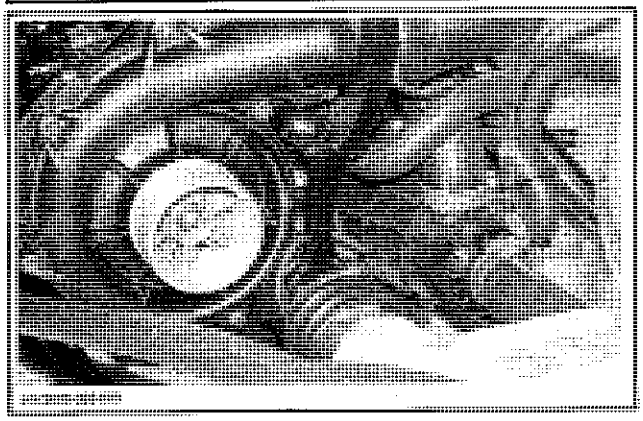


1. Insert in groove of PTO seal assembly

Due to configuration of some models, it may be necessary to disconnect EGTS sensor to make room.

Using the drive shaft circlip remover (P/N 529 036 026), push the floating ring rearwards to expose the circlip. This step is done to ensure floating ring is free and not stuck on the drive shaft. Do not remove circlip at this time.





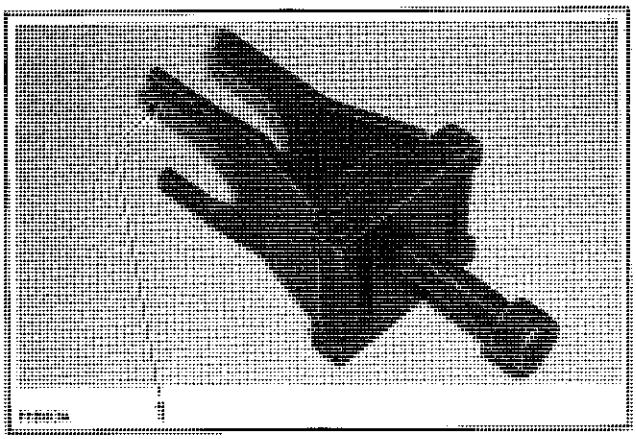
NOTE: Place the fork of drive shaft circlip remover against floating ring and the adjustable arm on engine. Move the tool handle toward the front of vehicle to push floating ring.

Remove the drive shaft circlip remover and the drive shaft holder.

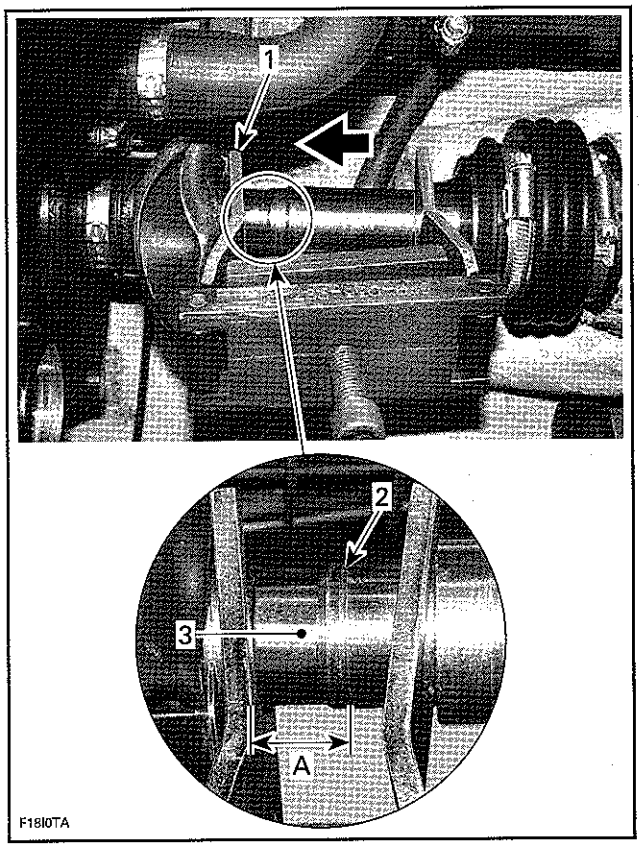
Select the appropriate floating ring tool in accordance with the following table.

MODEL	TOOL
GTI 130/155 GTX 155/215 RXP 255 RXT 215/255 Wake 155/215	Floating ring tool (P/N 529 035 841)
RXP 155/215	Floating ring tool (P/N 529 035 987)

Install tool as shown.



TYPICAL
1. Largest opening on PTO seal side



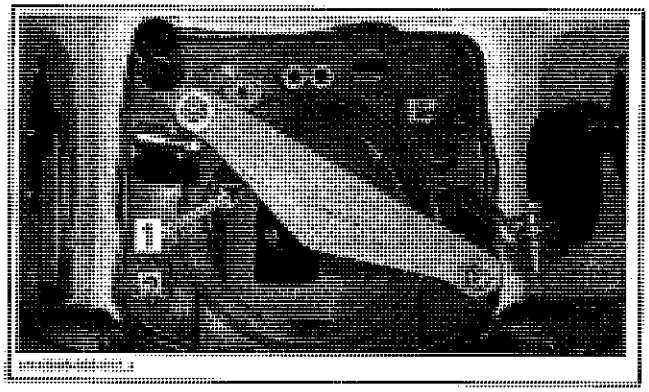
TYPICAL
1. Largest opening here
2. Telltale groove
3. Lubricate O-rings contact area
A. 18 mm (.71 in)

Turn screw clockwise so that the tool pushes the PTO seal forward and the drive shaft to the rear to expose the O-rings contact area. Continue to pull drive shaft out until there is a distance of 18 mm (.71 in) between the telltale groove and the tool edge. Lubricate O-rings contact area with XP-S Lube (P/N 293 600 016).

NOTE: This is necessary to ease drive shaft removal later in this procedure.

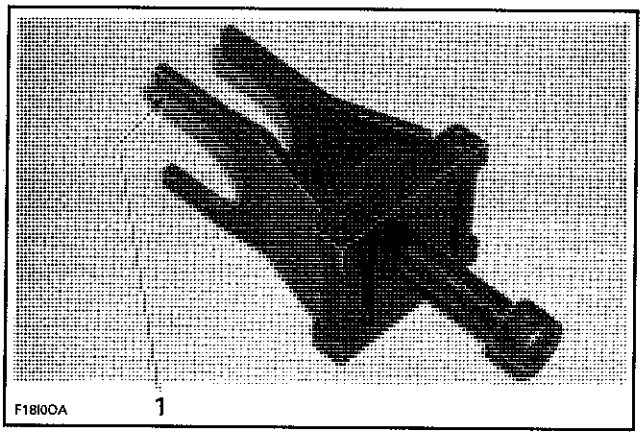
Remove the floating ring tool.

Push drive shaft in and reinstall drive shaft holder tool.



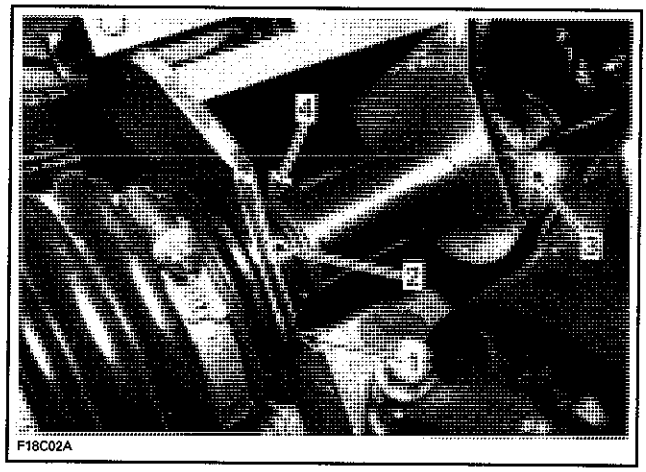
TYPICAL
1. Drive shaft holder

Reinstall the floating ring tool as shown.



TYPICAL
1. Largest opening on PTO seal side

Push floating ring rearwards to expose circlip and remove it. Discard circlip.



TYPICAL
1. Largest opening here
2. Floating ring
3. PTO seal support tool
4. Remove circlip

Remove drive shaft holder tool then the floating ring tool.

Place rags under PTO housing to prevent spillage. If spillage occurs, clean immediately with the pulley flange cleaner (P/N 413 711 809) to prevent oil stains.

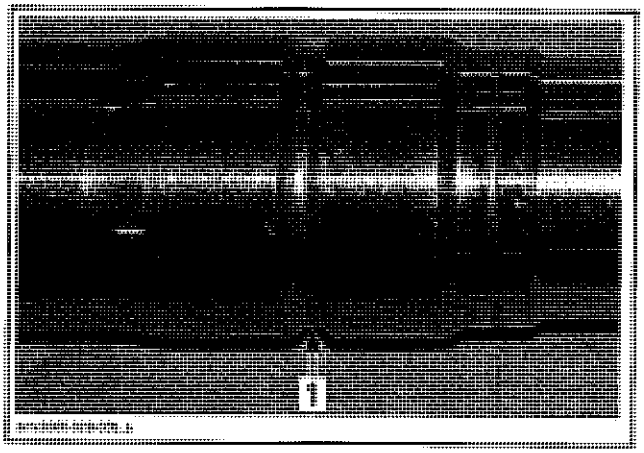
Remove drive shaft.

NOTE: A slight jerk to the rear may be required to remove the drive shaft from the PTO seal assembly.

Drive Shaft Inspection

Drive Shaft

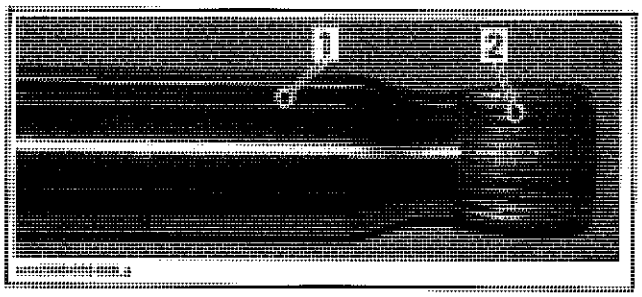
Inspect condition of circlip groove. If there is any damage or severe wear, replace drive shaft.



1. Circlip groove

Inspect condition of drive shaft splines. If splines are damaged, replace drive shaft.

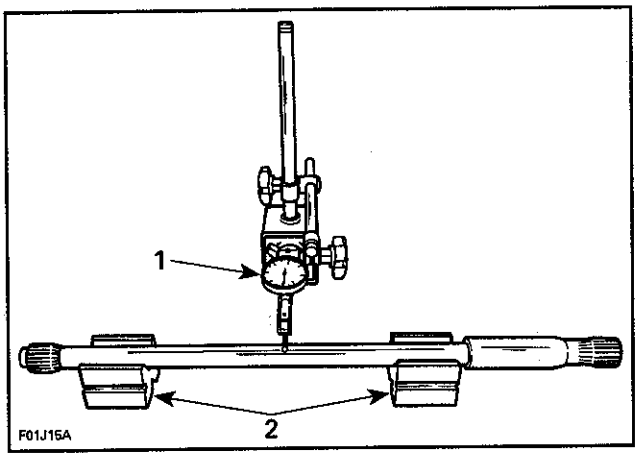
With your finger nail, feel machined surface of drive shaft. If any irregular surface is found, renew drive shaft.



TYPICAL
1. Surface condition
2. Splines condition

Excessive deflection could cause vibration and damage to drive shaft splines, impeller or floating ring.

Place drive shaft on V-blocks and set-up a dial gauge in center of shaft. Slowly rotate shaft; difference between highest and lowest dial gauge reading is deflection. Refer to the following illustration.



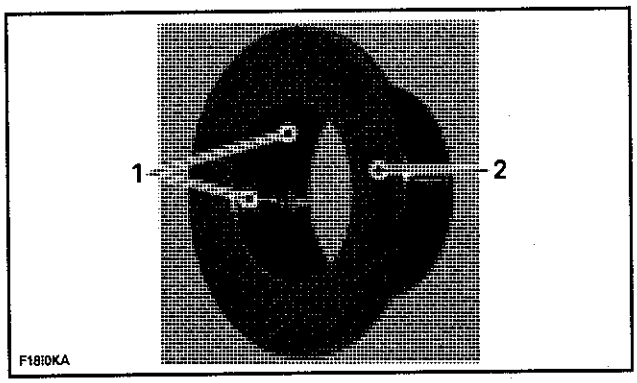
MEASURING DRIVE SHAFT DEFLECTION
1. *Dial gauge*
2. *V-blocks*

Maximum permissible deflection is 0.5 mm (.020 in).

Floating Ring

Inspect condition of O-rings and contact surface of floating ring.

Replace as required.



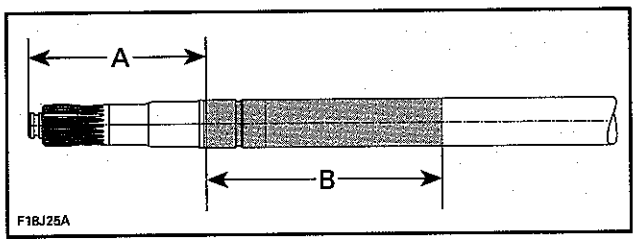
1. *O-rings*
2. *Contact surface*

Drive Shaft Lubrication

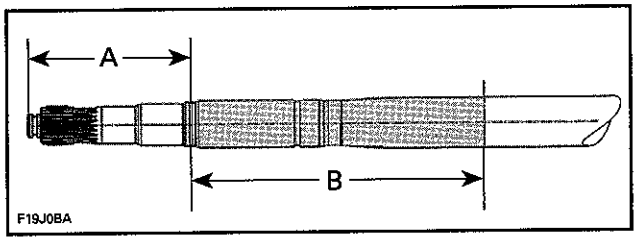
Drive Shaft

To prevent possible drive shaft corrosion when the vehicle is used in salt water, apply anticorrosion spray (P/N 219 700 304) on drive shaft where shown.

NOTE: Drive shaft should be dry and clean prior to applying the anticorrosion product. If the drive shaft is slightly corroded, a rotating wire brush may be used.



ALL MODELS EXCEPT RXP 155/215
A. 89 mm (3.3 in)
B. 131 mm (5.2 in) — zone to apply anticorrosion product



RXP 155/215 MODELS
A. 101 mm (4 in)
B. 180 mm (7.1 in) — zone to apply anticorrosion product

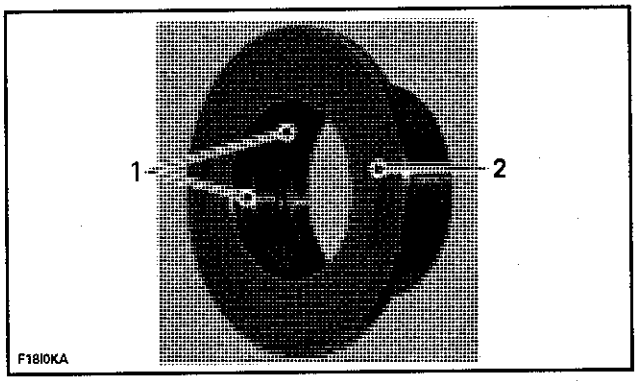
⚠ WARNING

Always work in a well ventilated area. Carefully read application instructions on product can.

Wait 2 hours prior to using the watercraft to allow anticorrosion product to dry.

Floating Ring

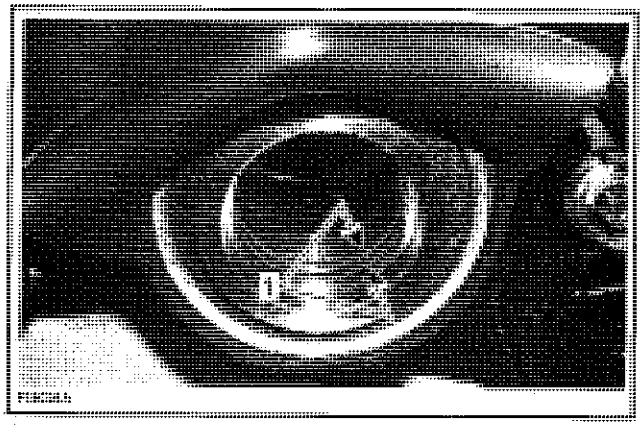
Apply a thin coat of XP-S synthetic grease (P/N 293 550 010) on the floating ring O-rings. Do not get grease on floating ring contact surface.



1. *XP-S synthetic grease on O-rings*
2. *No lubrication on contact surface*

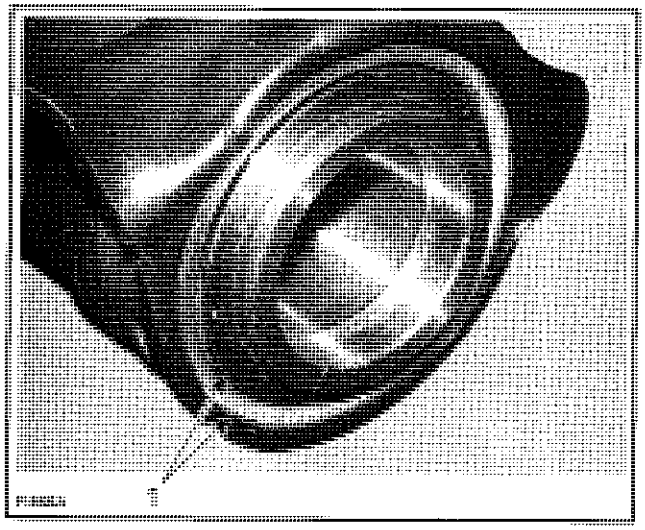
Drive Shaft Installation

Before installing drive shaft, discard both O-rings inside PTO seal and install NEW ones.

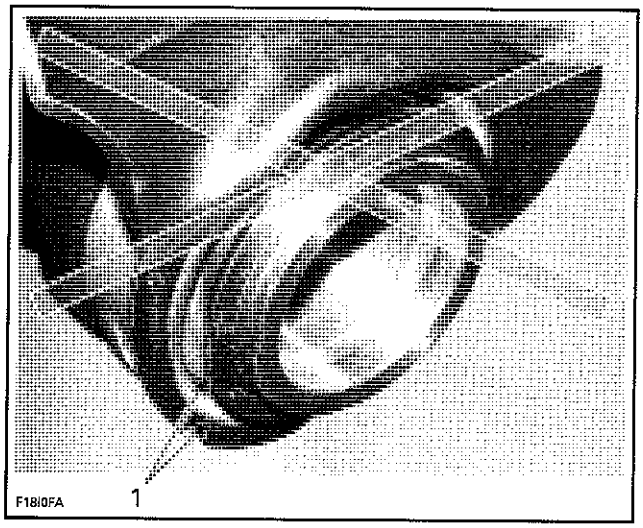


1. O-rings

Inspect PTO seal assembly. The inner sleeve must be flush with outer circumference of the assembly. Otherwise, gently push or tap on inner sleeve until flush.

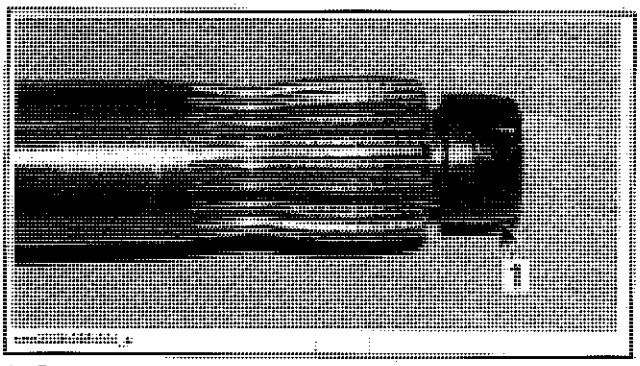


CORRECT POSITION
1. Inner sleeve flush with outer circumference



INCORRECT POSITION
1. Inner sleeve not flush with outer circumference

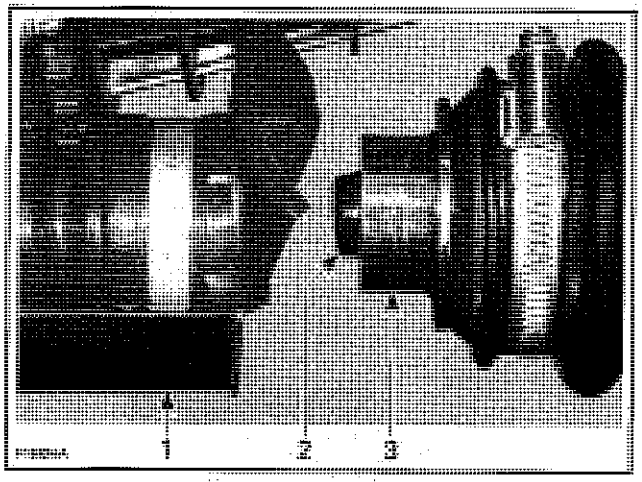
Remove the damper at the end of drive shaft and replace it with a NEW one.



1. Damper

Install the PTO seal support tool (P/N 529 035 842) on PTO seal assembly.

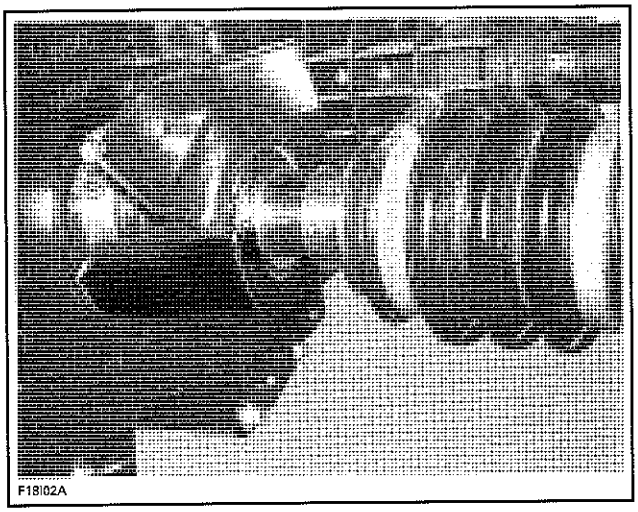
Slide drive shaft far enough to install floating ring.



1. PTO seal support
2. Drive shaft end
3. Insert floating ring on shaft end

Continue pushing drive shaft towards engine carefully guiding it in the PTO seal then in crankshaft splines. It may be necessary to move PTO seal assembly up and down to position it in the same axis as the drive shaft.

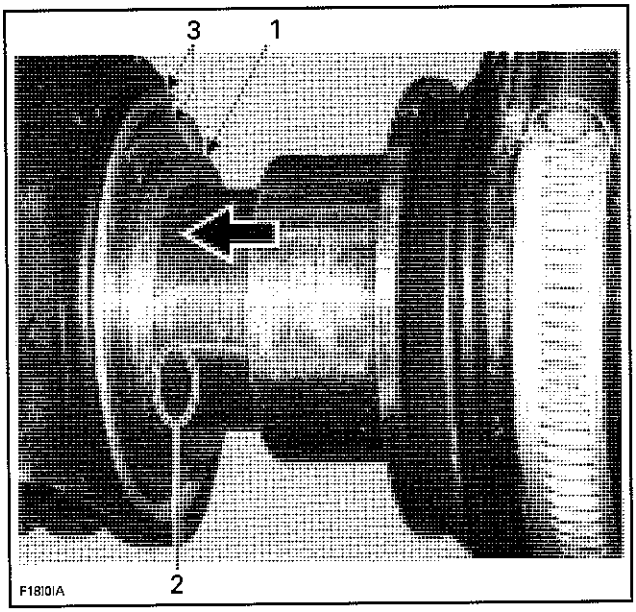
NOTE: If drive shaft does not enter into the PTO seal, check engine alignment.



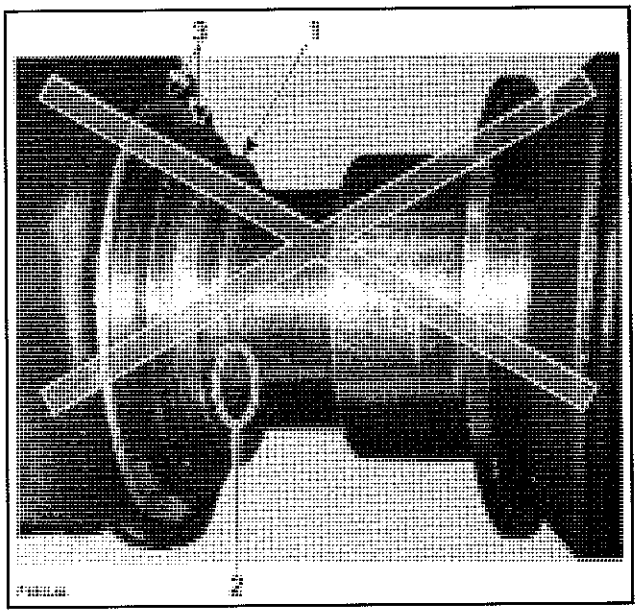
TYPICAL

Maintain PTO seal assembly in the proper position and tap shaft end until it bottoms against engine. At this time, the telltale groove **MUST NOT** be visible. This validates the correct position.

CAUTION: If the telltale groove is exposed, the installation is wrong and PTO seal assembly will be pressed into crankshaft splines which could rub a hole in seal thus creating an oil leak.

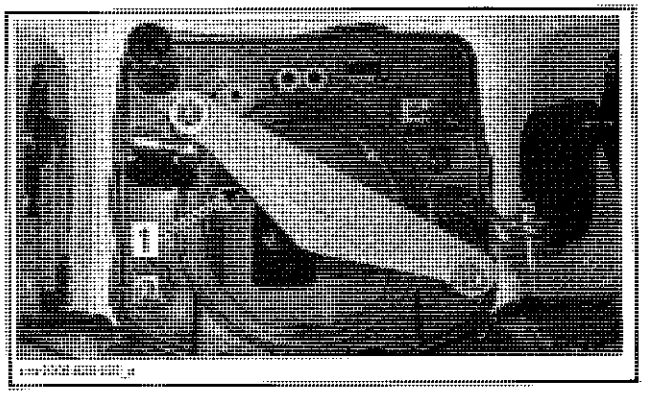


CORRECT INSTALLATION
1. *PTO seal assembly*
2. *Shaft pushed in, hiding telltale groove*
3. *Inner sleeve flush with outer circumference*



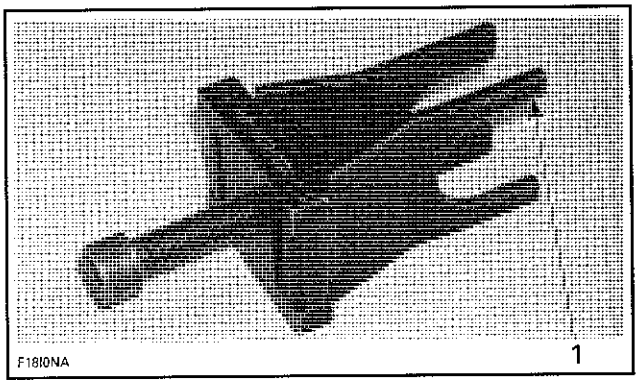
IMPROPER INSTALLATION
1. *PTO seal assembly*
2. *Telltale groove visible*
3. *Inner sleeve NOT flush with outer circumference*

Install the drive shaft holder tool (P/N 529 035 986).



TYPICAL
1. *Drive shaft holder*

Install the floating ring tool as shown. Ensure PTO seal support is still in place.

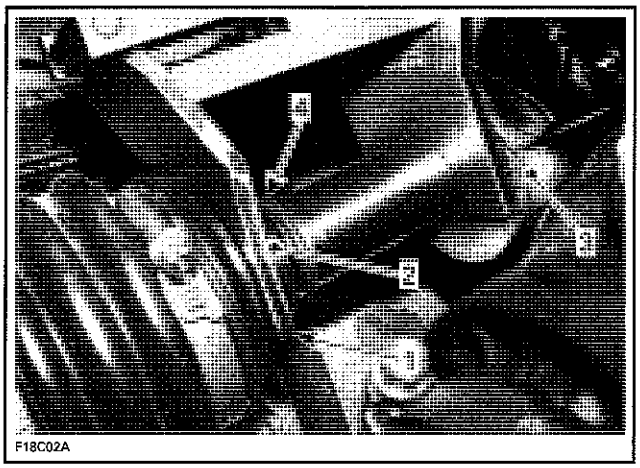


TYPICAL
1. *Largest opening on through-hull fitting side*

Refer to the following table to use the appropriate tool according to the model.

MODEL	TOOL
GTI 130/155 GTX 155/215 RXP 255 RXT 215/255 Wake 155/215	Floating ring tool (P/N 529 035 841)
RXP 155/215	Floating ring tool (P/N 529 035 987)

Push floating ring rearwards and install a **NEW** circlip.



TYPICAL
1. *Largest opening*
2. *Floating ring*
3. *PTO seal support tool*
4. *Install circlip*

Remove floating ring tool, drive shaft holder then PTO seal support.

NOTE: Pushing drive shaft boot rearwards will ease removal of PTO seal support tool.

Now ensure everything is properly positioned:
- Telltale groove is not visible
- Inner sleeve is flush with outer circumference of PTO seal assembly
- Circlip is not exposed.

If telltale groove is visible, push PTO seal assembly rearwards to fully extend it.

If inner sleeve is not flush, gently tap it until it is flush.

Reposition rubber protector.

Reconnect EGTS sensor.

Install jet pump. Refer to *JET PUMP* section.

Check engine oil level. Refill as necessary.

Run watercraft then ensure there is no oil leak in PTO seal area.

DRIVE SHAFT BOOT

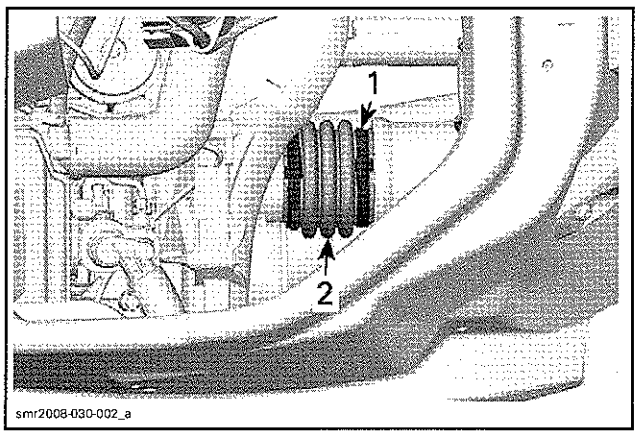
Drive Shaft Boot Inspection

Inspect the condition of boot. If there is any damage or evidence of wear, replace it.

Drive Shaft Boot Removal

Remove drive shaft. Refer to *DRIVE SHAFT* in this section.

Loosen gear clamp holding boot, then carefully pull boot and carbon ring from hull insert.



1. *Loosen this clamp*
2. *Drive shaft boot*

Drive Shaft Boot Installation

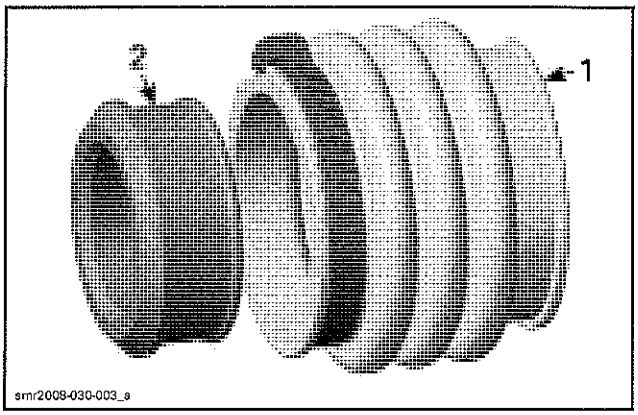
The installation is the reverse of the removal procedure.

CARBON RING

Carbon Ring Removal

Remove *DRIVE SHAFT BOOT*, see procedure above in this section.

Loosen gear clamp then pull carbon ring from drive shaft boot.



1. *Drive shaft boot*
2. *Carbon ring*

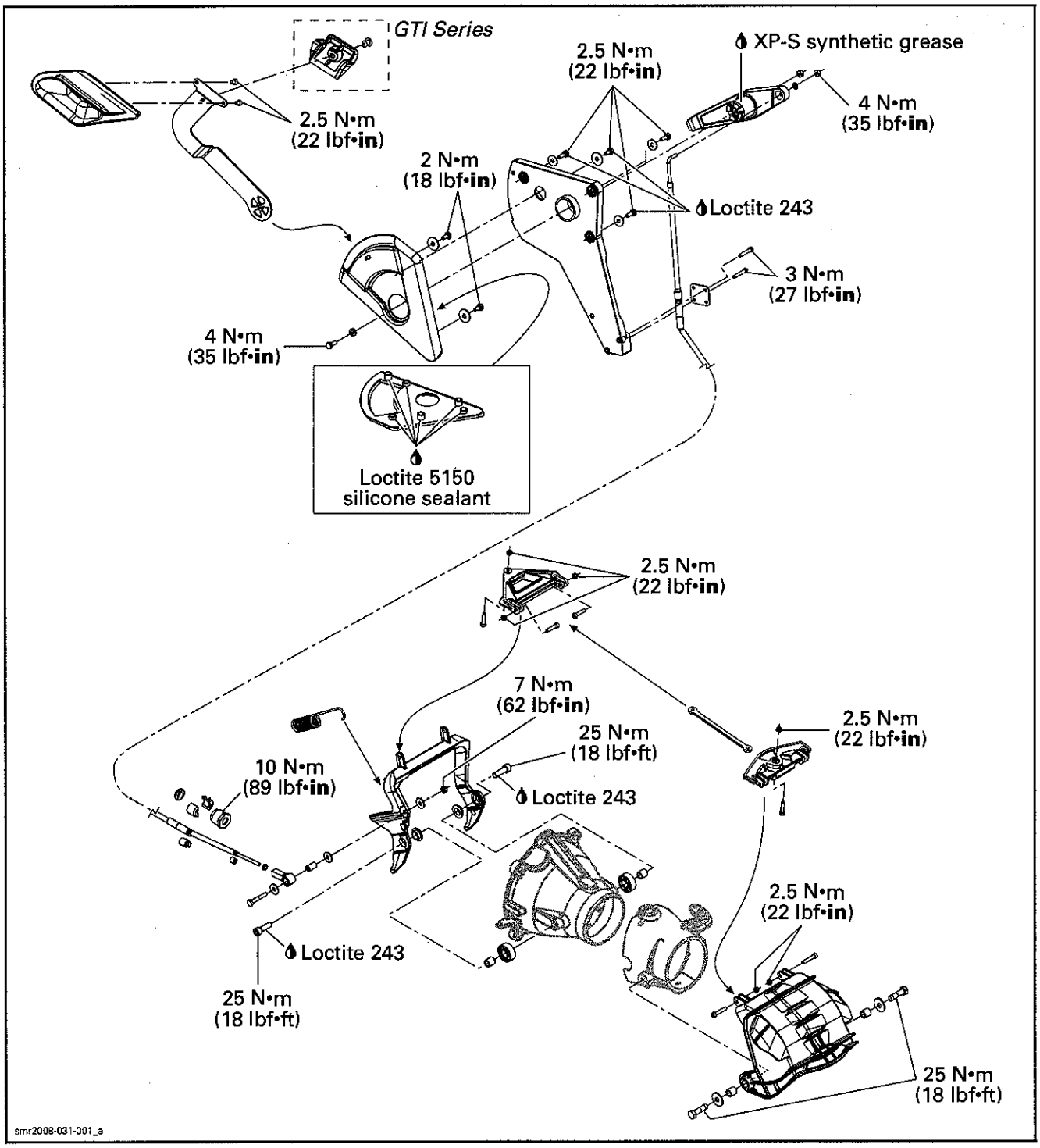
Carbon Ring Installation

The installation is the reverse of the removal procedure.

REVERSE SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic grease	293 550 010	379
Loctite 243 (blue)	293 800 060	381
Loctite 5150 (silicone sealant)	293 800 086	381



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

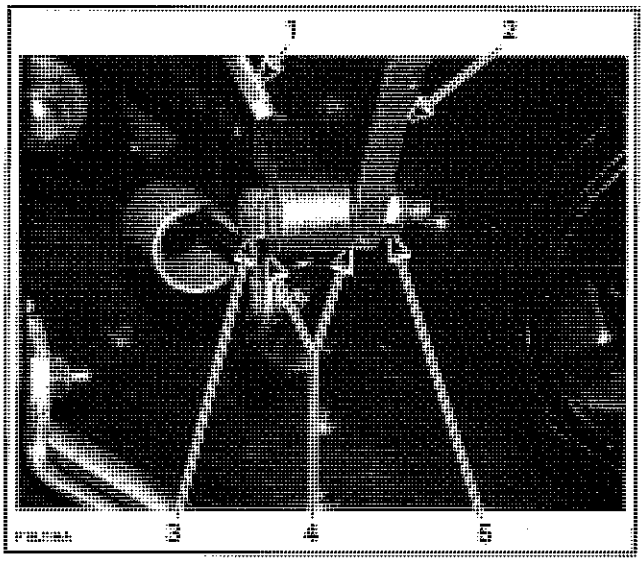
CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

PROCEDURES

REVERSE CABLE

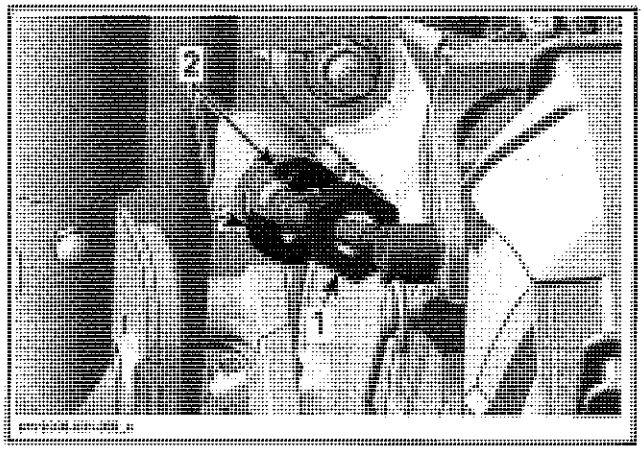
Reverse Cable Removal

Remove bolt securing reverse cable attachment to pivot arm.



1. *Reverse cable*
2. *Pivot arm*
3. *Bolt*
4. *Washer*
5. *Elastic stop nut*

Unscrew the cable lock then remove the half rings.



1. *Cable lock*
2. *Half rings*

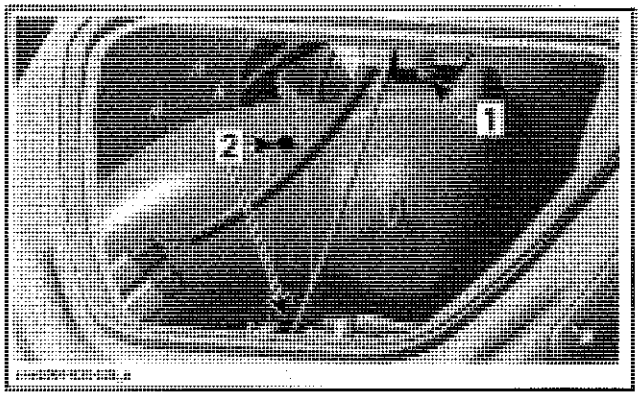
RXP Series

Open storage compartment and remove basket.

Remove nut of front vent tube.

Unsnap wiring harness.

Remove darts to separate vent tube.



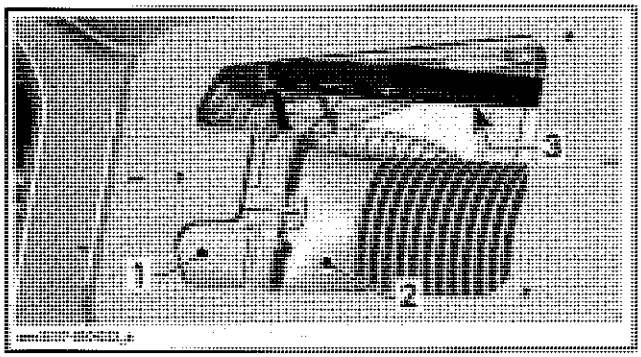
1. *Remove nut*
2. *Remove darts*

Pull out bottom part first then top part.

GTX and RXT Series

Remove the seat(s) and the glove box. Refer to *BODY* section.

Disconnect the flexible vent tube from the air collector by lifting the locking tabs then move tube toward the front of vehicle. DO NOT REMOVE the flexible vent tube completely.



TYPICAL
1. *Air collector*
2. *Flexible vent tube*
3. *Reverse cable lever*

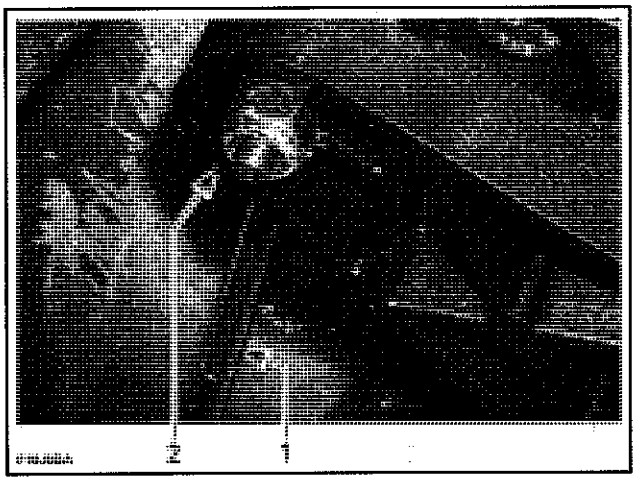
NOTE: There are two locking tabs, one above and one underneath flexible vent tube.

GTI Series

Remove glove box. Refer to *BODY* section.

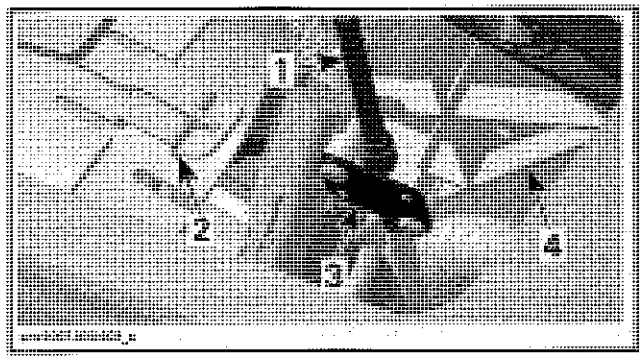
All Models

On the reverse cable lever, remove the elastic stop nut and the washer retaining the reverse cable.



TYPICAL
1. *Reverse cable*
2. *Reverse cable lever*

Remove the plate securing reverse cable at the bottom of reverse cable support.



TYPICAL
1. *Reverse cable*
2. *Air collector*
3. *Plate*
4. *Reverse cable support*

Before removing reverse cable from hull, note cable routing for reinstallation.

Reverse Cable Installation

The installation is the reverse of the removal procedure.

When completed, perform cable adjustment.

Reverse Cable Adjustment

Put shift lever in forward position.

⚠ WARNING

When adjusting reverse cable, make sure lever is well engaged into the spring slot.

Place reverse gate in the up position.

Turn the joint at the end of reverse cable and align its hole with hole in pivot arm.

Secure with bolt, washers, spacer and elastic stop nut.

Torque nut to 7 N•m (62 lbf•**in**).

REVERSE CABLE LEVER

Cable Lever Removal

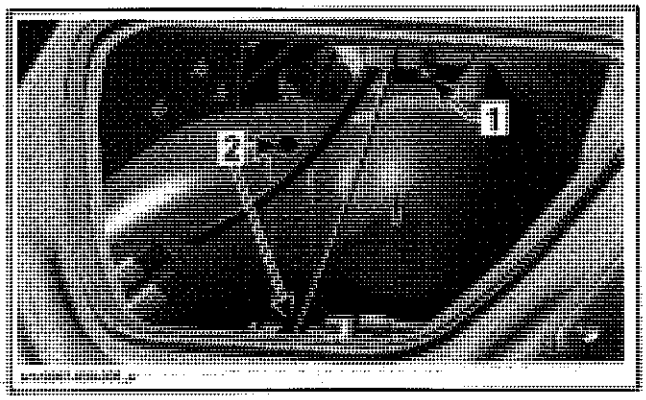
RXP Series

Open storage compartment and remove basket.

Remove nut of front vent tube.

Unsnap wiring harness.

Remove darts to separate vent tube.



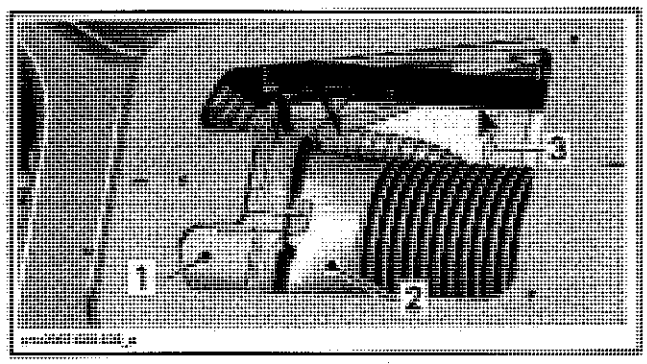
1. *Remove nut*
2. *Remove darts*

Pull out bottom part first then top part.

GTX and RXT Series

Remove the seat(s) and the glove box. Refer to *BODY* section.

Disconnect the flexible vent tube from the air collector by lifting the locking tabs then move tube toward the front of vehicle. DO NOT REMOVE the flexible vent tube completely.



TYPICAL
1. *Air collector*
2. *Flexible vent tube*
3. *Reverse cable lever*

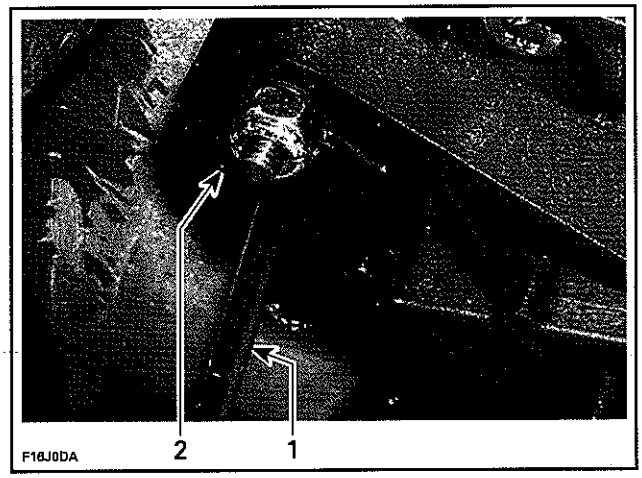
NOTE: There are two locking tabs, one above and one underneath flexible vent tube.

GTI Series

Remove glove box. Refer to *BODY* section.

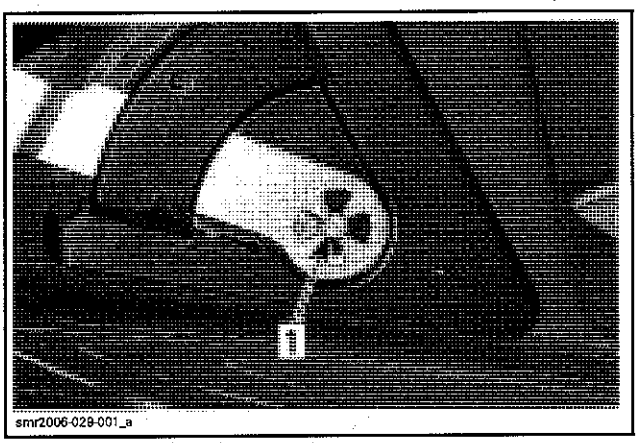
All Models

Detach the reverse cable from reverse cable lever.



TYPICAL
1. *Reverse cable*
2. *Reverse cable lever*

Unscrew the shift lever retaining bolt, washer and nut, then remove reverse cable lever.



1. *Shift lever retaining bolt*

Cable Lever Inspection

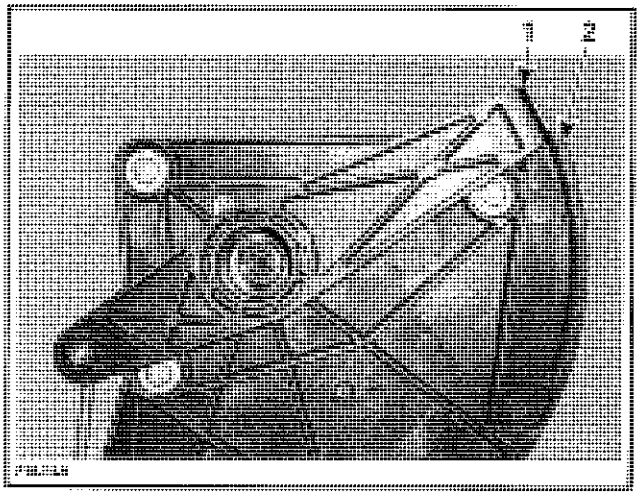
Check reverse cable lever for cracks or wear. Replace as required.

Cable Lever Installation

Apply XP-S synthetic grease (P/N 293 550 010) on the reverse cable lever pivot and in the reverse cable support hole.

Install the reverse cable lever in a rotating movement. Engage properly the reverse cable lever tabs in the shift lever slots.

Insert reverse cable lever into reverse cable support slider and make sure that the lever slides freely in the support.



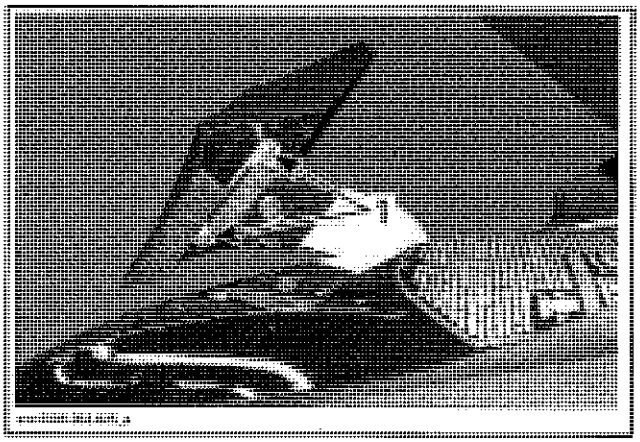
TYPICAL
1. Reverse cable lever
2. Reverse cable support slider

Make sure the shift lever action is smooth and precise. Forward and reverse positions should be easy to select with a decent position between each.

SHIFT LEVER

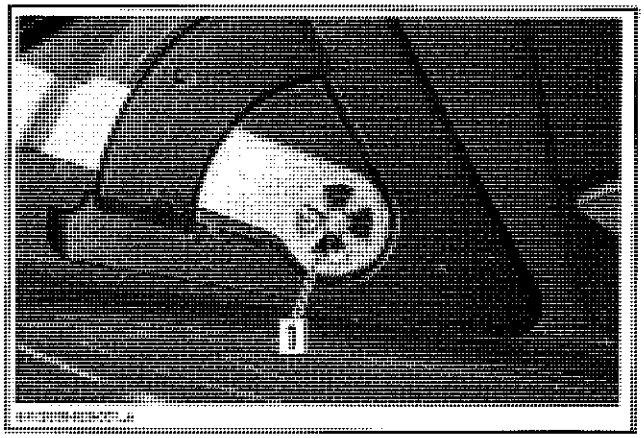
Shift Lever Removal

Remove shift lever handle.



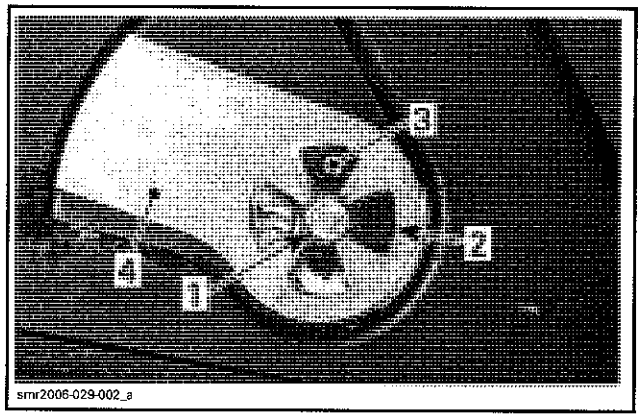
TYPICAL
1. Shift lever handle screws

Unscrew the shift lever retaining bolt, washer and nut.



1. Shift lever retaining bolt

Disengage the shift lever slots from reverse cable lever tabs, then remove the shift lever.



TYPICAL
1. Shift lever retaining bolt
2. Shift lever slot
3. Reverse cable lever tab
4. Shift lever

Shift Lever Inspection

Check shift lever for cracks or wear. Replace as required.

Shift Lever Installation

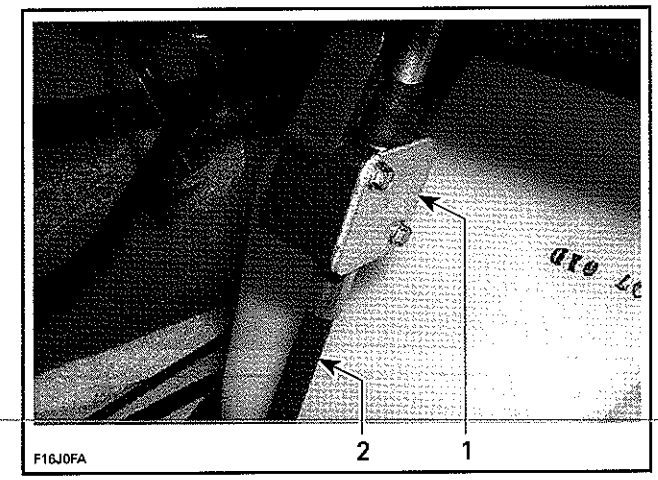
The installation is the reverse of the removal procedure.

REVERSE CABLE SUPPORT

Cable Support Removal

Remove *SHIFT LEVER*. See procedures above.

At the bottom of reverse cable support, remove the plate securing reverse cable to its support.



TYPICAL
1. *Plate*
2. *Reverse cable*

Separate reverse cable lever from reverse cable support. Leave cable attached to lever.

Unscrew all bolts securing reverse cable support then remove it.

Cable Support Inspection

Check the reverse cable support for cracks or wear. Replace as required.

Cable Support Installation

The installation is the reverse of the removal procedure.

SHIFT LEVER HOUSING

Housing Removal

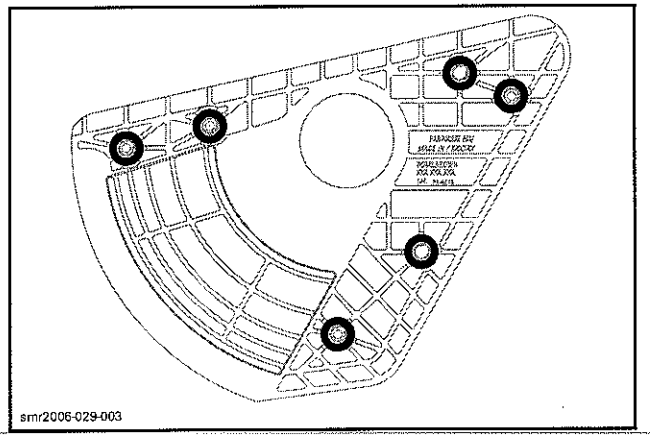
Remove shift lever, reverse cable lever and reverse cable support. See procedures above.

Unscrew all bolts securing shift lever housing and remove it.

Housing Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) around screws locations on shift lever housing as indicated by the shaded areas in the next illustration.



When installing shift lever housing, apply Loctite 243 (blue) (P/N 293 800 060) on threads of screws.

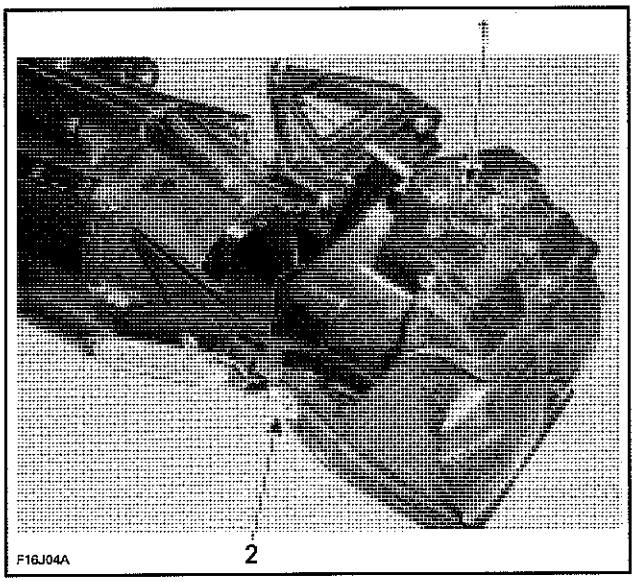
REVERSE GATE

Reverse Gate Removal

To remove reverse gate, put shift lever in reverse position.

Unscrew pivot bolt.

Remove both reverse gate screws.

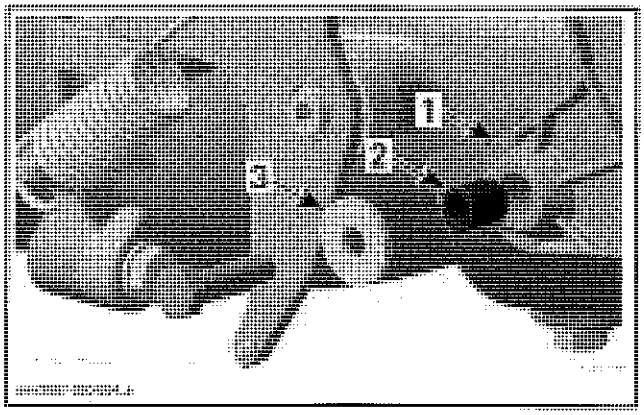


1. *Pivot bolt*
2. *Reverse gate screw*

Reverse Gate Installation

Install reverse gate with spacer and washer.

Torque reverse gate screws to 25 N•m (18 lbf•ft).



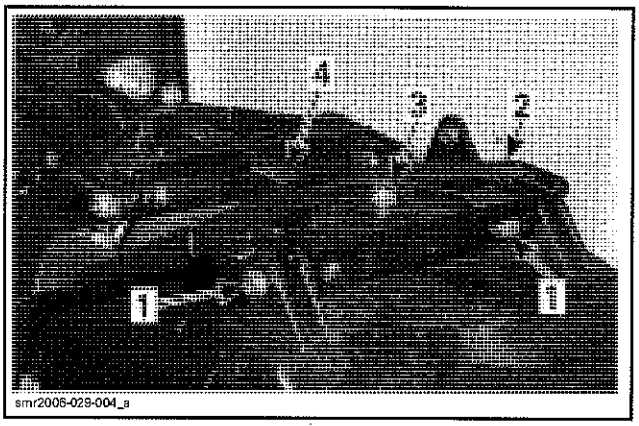
1. *Reverse gate*
2. *Spacer*
3. *Washer*

PIVOT SUPPORT

Pivot Support Removal

Unscrew pivot support bolts.

Remove pivot bolt that attach link rod to pivot support.



1. *Pivot support bolts*
2. *Pivot support*
3. *Pivot bolt*
4. *Link rod*

Withdraw pivot support.

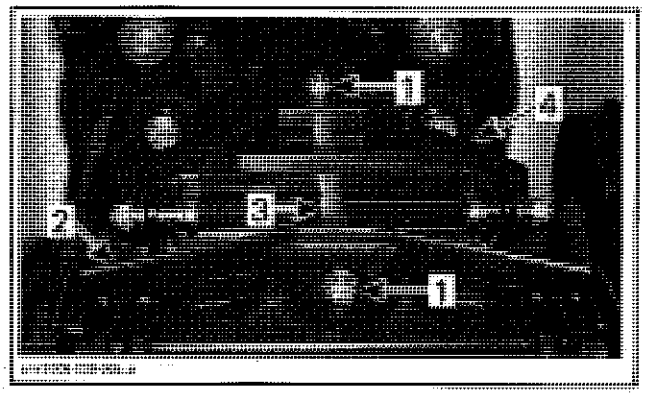
Pivot Support Installation

The installation is the reverse of the removal procedure.

LINK ROD

Link Rod Removal

Unscrew both pivot bolts and remove link rod.



TYPICAL
1. *Pivot bolts*
2. *Pivot support*
3. *Link rod*
4. *Pivot triangle*

Link Rod Installation

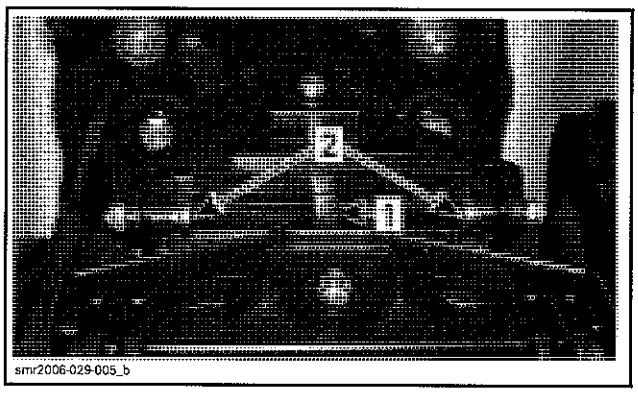
The installation is the reverse of the removal procedure.

PIVOT TRIANGLE

Pivot Triangle Removal

Remove link rod.

Unscrew pivot triangle bolts and remove pivot triangle.



TYPICAL
1. *Link rod*
2. *Pivot triangle bolts*

Pivot Triangle Installation

Install head bolts toward inside.

NOTE: Make sure the pivot triangle moves freely.

PIVOT ARM

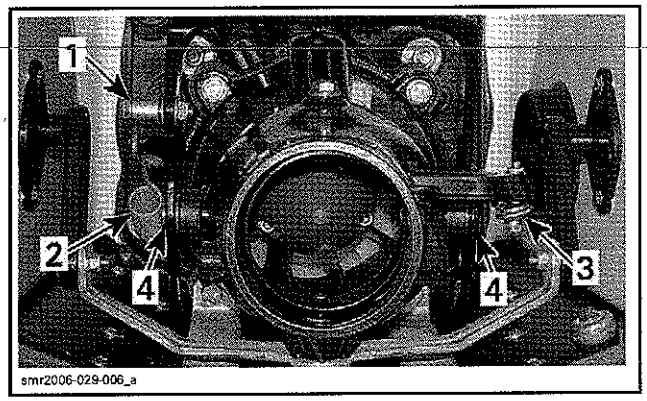
Pivot Arm Removal

Remove *REVERSE GATE*, see procedure in this section.

Position shift lever in forward.

On left side, remove the reverse cable, spring and pivot arm bolt.

On right side, remove steering cable and pivot arm bolt.



1. *Reverse cable*
2. *Spring*
3. *Steering cable*
4. *Pivot arm bolts*

Withdraw pivot arm.

Pivot Arm Installation

For installation, reverse the removal procedure.

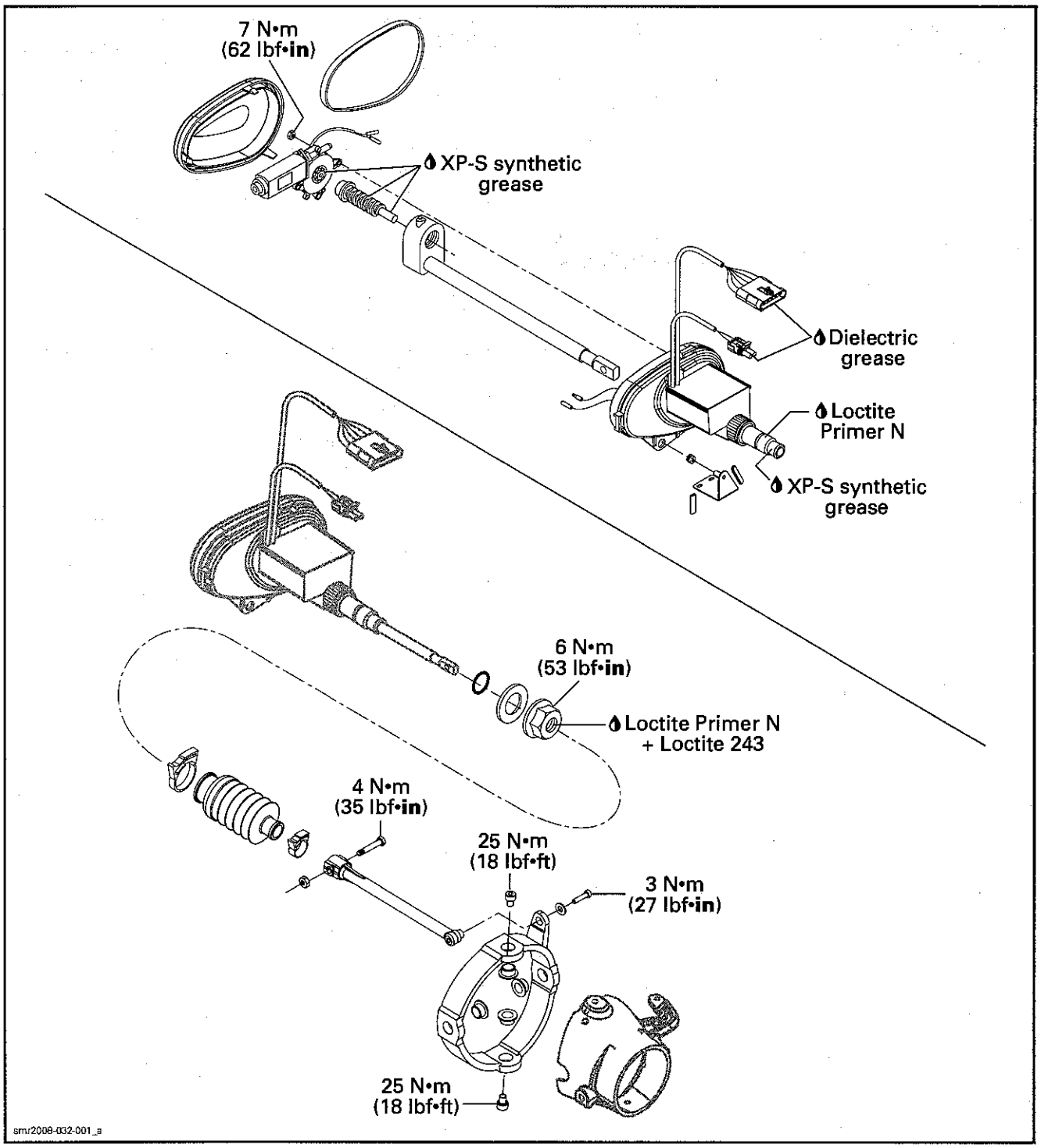
VARIABLE TRIM SYSTEM (VTS)

SERVICE TOOLS

Description	Part Number	Page
VTS socket tool	295 000 133	388, 391

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic grease	293 550 010	390–391
Loctite Primer N	293 800 041	391
Loctite 243 (blue)	293 800 060	391



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

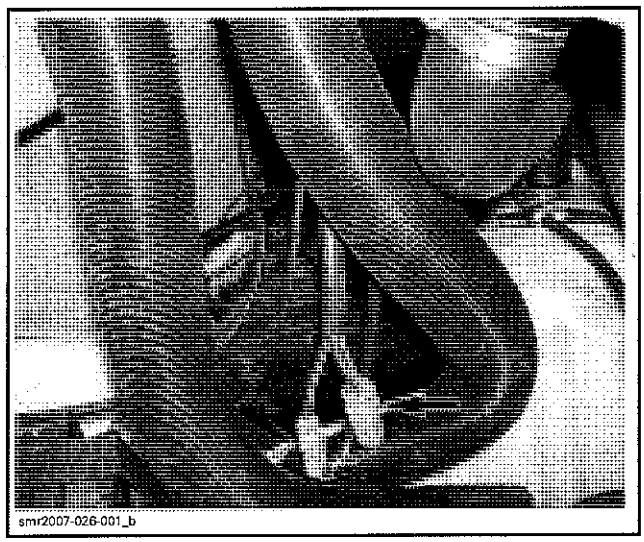
TEST

NOTE: Ensure VTS is activated in B.U.D.S. Look in Options under Settings.

VTS SWITCH

Always confirm first that the VTS fuse no. 5 (7.5 A) is in good condition.

Disconnect VTS switch connector.


smr2007-026-001_b

Use a multimeter and set it to ohm.

Probe switch wires as follows.

VTS SWITCH POSITION	WIRES	RESISTANCE
Pressed	BLACK and BLUE/WHITE	0 - 20 Ω
Released		OL (open)
Pressed	BLACK and GREEN/WHITE	0 - 20 Ω
Released		OL (open)

If test failed, replace switch.

VTS MOTOR

Always confirm first that the VTS fuse no. 5 (7.5 A) is in good condition.

Use a multimeter and set it to ohm.

Disconnect motor wires as per table.

Probe wires as follows.

2-PIN CONNECTOR	RESISTANCE
RED/PURPLE/WHITE and BLACK	Close to 1.5 Ω

If motor seems to jam and it has not reached the end of its stroke, the following test could be performed.

First remove motor. Then manually rotate worm to verify VTS system actuating mechanism for free operation.

Connect motor through a 15 A fuse directly to the battery.

Connect wires one way then reverse polarities to verify motor rotation in both ways.

If VTS actuating mechanism is correct and the motor turns freely in both ways, VTS module could be defective.

If VTS motor does not stop at the end of its stroke while installed, the motor could be defective.

VTS CONTROL MODULE

NOTE: It receives its current from the same wire from fuse box as the motor.

Resistance Test

Disconnect wires of VTS control module as per following table.

Use a multimeter and set it to ohm.

Probe wires after motor stopped as follows.

VTS SWITCH	WIRES	RESISTANCE @ 20°C (68°F)
Push DOWN until motor stops	BROWN/BLACK and BROWN/WHITE	22 - 26 Ω
Push UP until motor stops		150 - 184 Ω

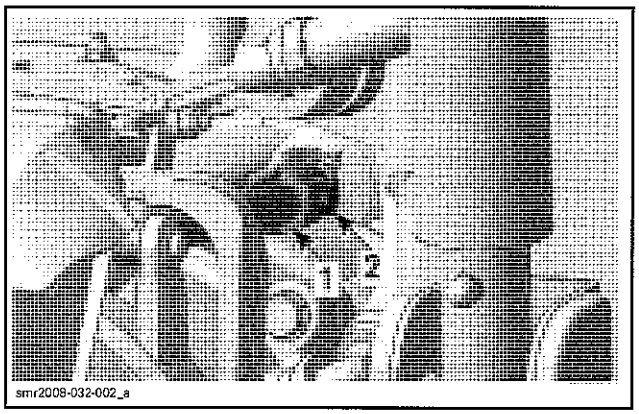
NOTE: If the VTS control module passes this resistance test, it does not mean it is in perfect condition.

PROCEDURES

VTS UNIT

VTS Unit Removal

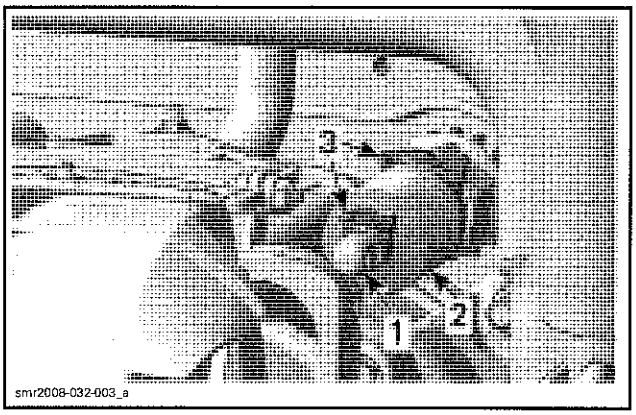
Remove bolt retaining VTS rod to sliding shaft.



1. *VTS rod*
2. *VTS rod bolt*

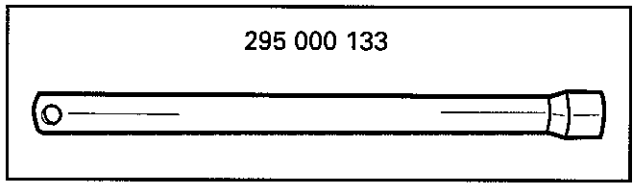
Remove clamps.

Remove rubber boot.

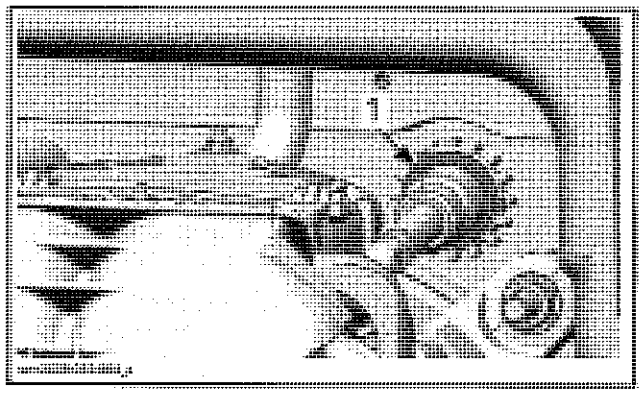


1. *Sliding shaft*
2. *Rubber boot*
3. *Clamps*

To loosen nut, use the VTS socket tool (P/N 295 000 133).



Remove sealing washer.

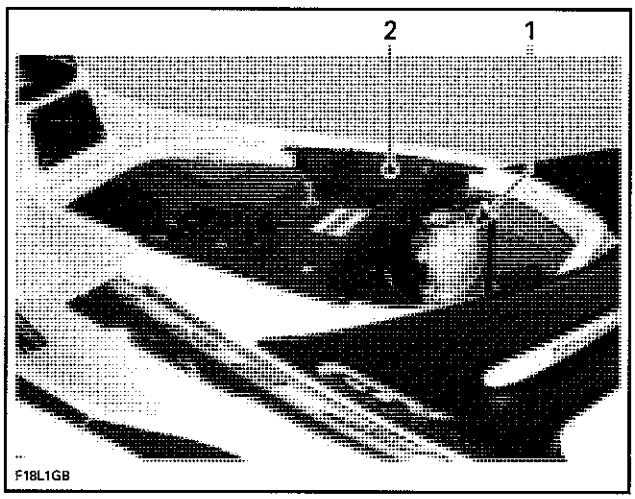


1. *Sealing washer*

Wake Models

Remove seat(s).

Detach coolant expansion reservoir from vent tube support then move away.

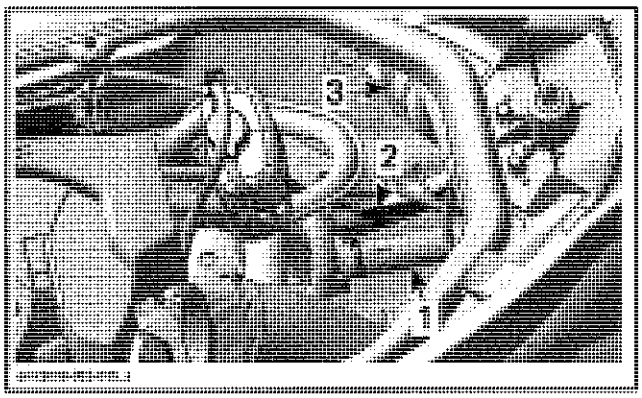


TYPICAL
1. *Detach expansion reservoir*
2. *Remove vent tube support*

Detach vent tube.

Remove vent tube support.

Unplug VTS connectors. The connector is located to the right of drive shaft and in front of resonator.



1. *Drive shaft*
2. *VTS connectors*
3. *Resonator*

Pull and remove VTS unit from vehicle.

RXP 215/255

Refer to *BODY* section to remove the following parts:
- Seat
- Engine cover.

Remove muffler hose.

On **RXP 255**, remove the air inlet hose and air outlet hose from the intercooler. Refer to *INTERCOOLER 255* section.

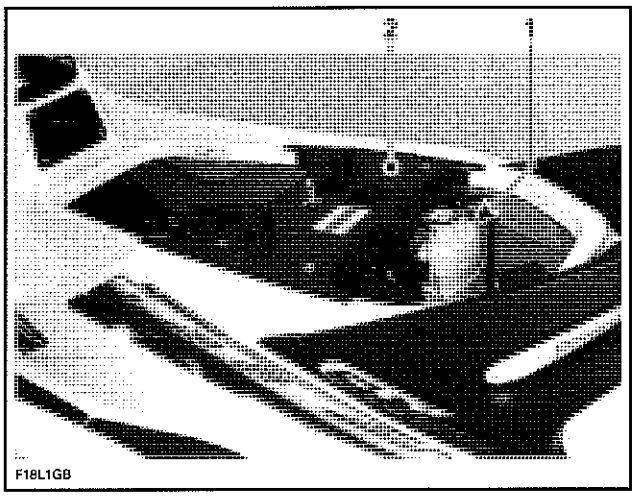
Unplug VTS connectors. The connector is located to the right of drive shaft, in front of resonator.

Pull and remove VTS unit from vehicle.

RXT 255

Refer to *BODY* section to remove the following parts:
- Seats
- Seat support
- Air vent tube.

Detach coolant expansion reservoir from vent tube support then move away.



TYPICAL
1. *Detach expansion reservoir*
2. *Remove vent tube support*

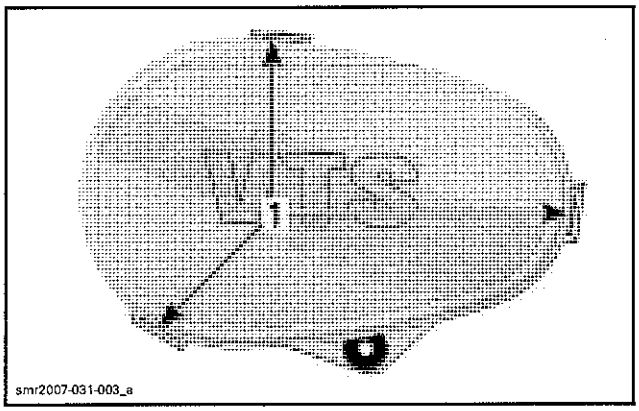
Unplug VTS connectors. The connector is located to the right of drive shaft, in front of resonator.

Pull and remove VTS unit from vehicle.

VTS Unit Disassembly

Cover

Remove VTS cover by pressing on tabs.

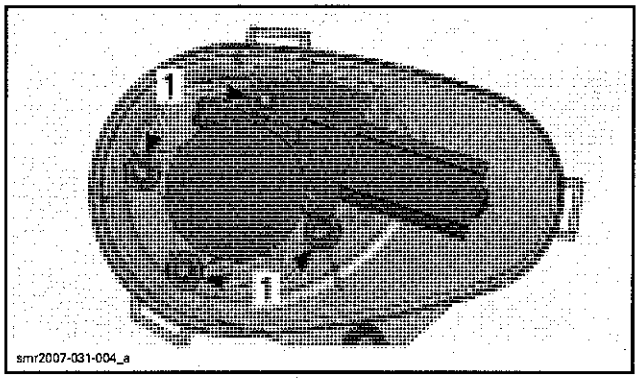


1. *Press tabs to remove cover*

Motor

Disconnect wires from motor noting their location for reinstallation.

Remove motor retaining nuts.



1. Remove these nuts

Pull on motor to remove it.

Worm and Sliding Shaft

Simply pull on worm and sliding shaft in order to remove them.

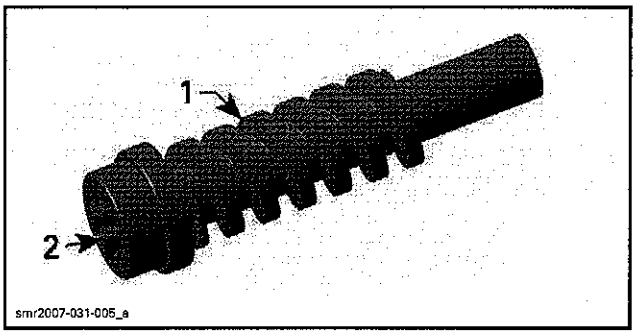
VTS Unit Inspection

Rubber Boot

Make sure rubber boot is in good condition. If it is cracked or torn, replace boot.

Worm

Inspect threads and splines of worm for wear. If worm replacement is necessary, renew also sliding shaft.



1. Threads
2. Splines

VTS Unit Reassembly

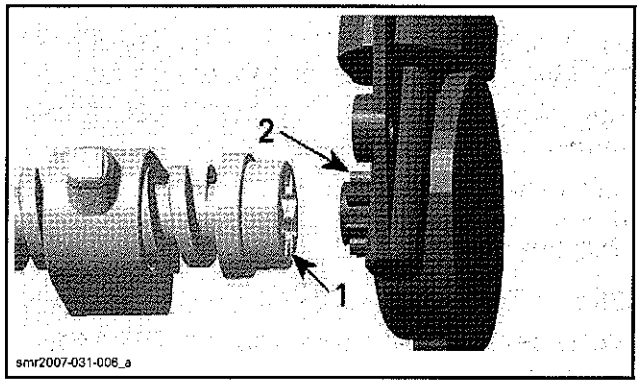
Reassembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Motor, Worm and Sliding Shaft

Apply XP-S synthetic grease (P/N 293 550 010) to worm.

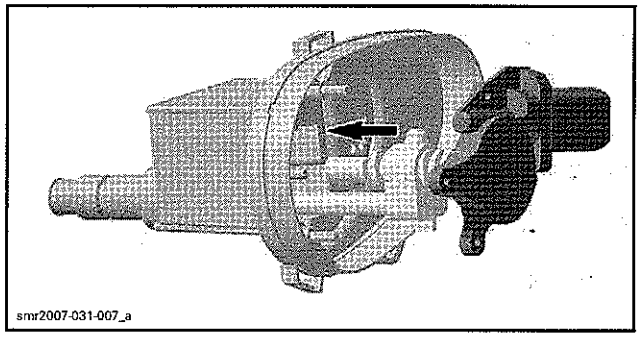
Screw worm to sliding shaft.

Mesh worm splines to gear of motor.



1. Worm splines
2. Motor gears

Install motor, worm and sliding shaft in VTS housing.



Tighten motor retaining nuts to 7 N•m (62 lbf•**in**).

Connect wires of motor.

CAUTION: Make sure wire color codes match.

Install cover.

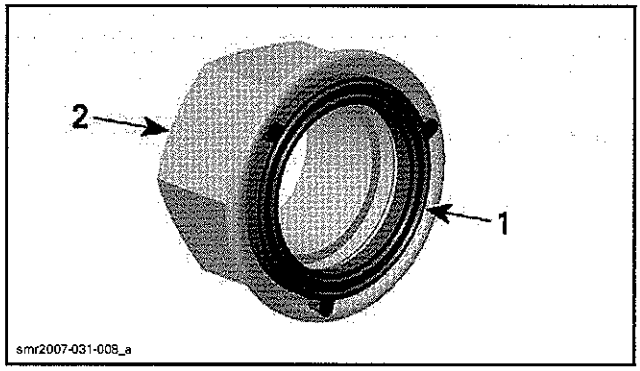
NOTE: Make sure cover seal is in place.

VTS Unit Installation

Installation is essentially the reverse of removal procedures. However pay particular attention to the following.

Nut and Sealing Washer

Place sealing washer on nut. Make sure seal lips are facing toward hull.



1. Seal lips facing hull
2. Nut

Apply Loctite Primer N (P/N 293 800 041) to threads of VTS housing, and to threads nut.

Apply Loctite 243 (blue) (P/N 293 800 060) to threads nut.

Install nut with sealing washer and torque to 6 N•m (53 lbf•**in**) using the VTS socket tool (P/N 295 000 133).

Sliding Shaft and Rubber Boot

Apply XP-S synthetic grease (P/N 293 550 010) to sliding shaft.

Install rubber boot, over sliding shaft and secure with clamps.

NOTE: 4 or 5 teeth of clamp must be engaged to obtain a good clamping.

VTS Rod

Secure the VTS rod onto the sliding shaft end.

Torque nut to 4 N•m (35 lbf•**in**).

VTS Unit Adjustment

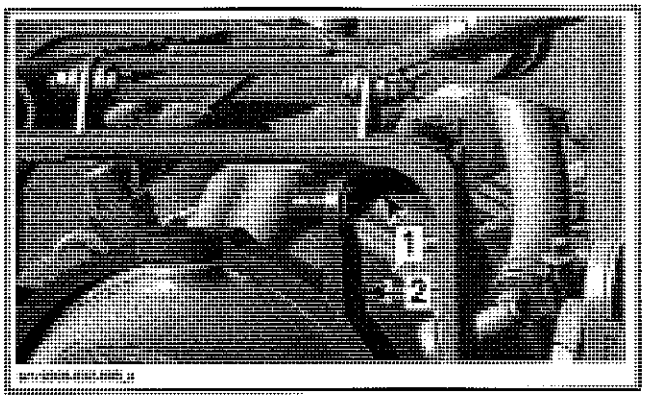
No adjustment is required.

VTS RING

VTS Ring Removal

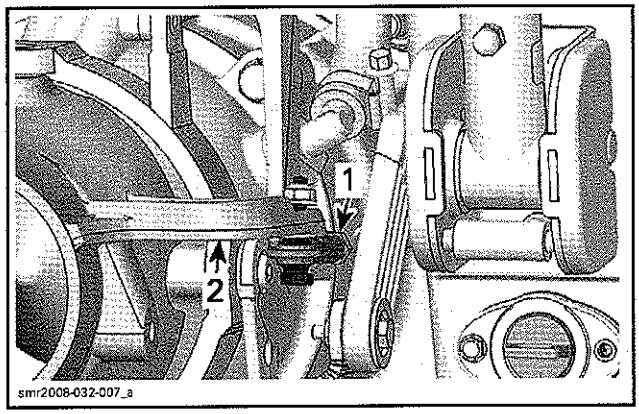
Remove the reverse gate. Refer to *REVERSE SYSTEM* section.

Disconnect VTS link rod from VTS ring.



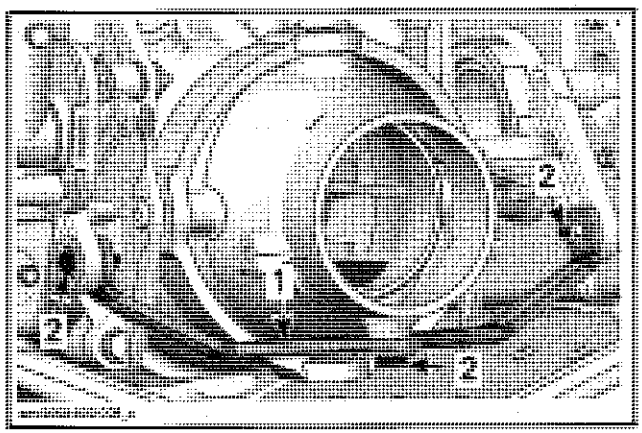
1. Link rod
2. VTS ring

Detach the steering cable from the nozzle.



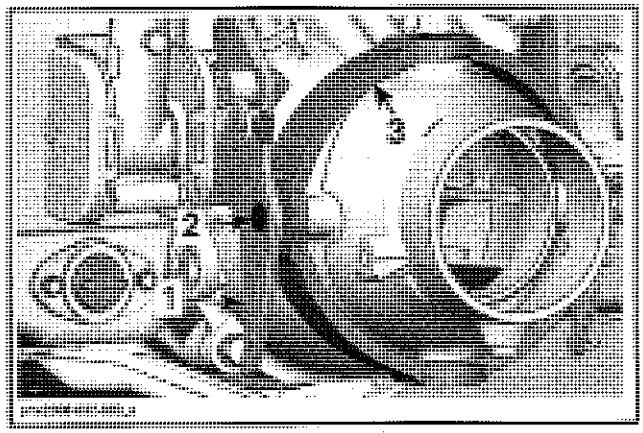
1. Steering cable
2. Nozzle

Remove the O.P.A.S. U lever.



1. O.P.A.S. U lever
2. O.P.A.S. U lever screws

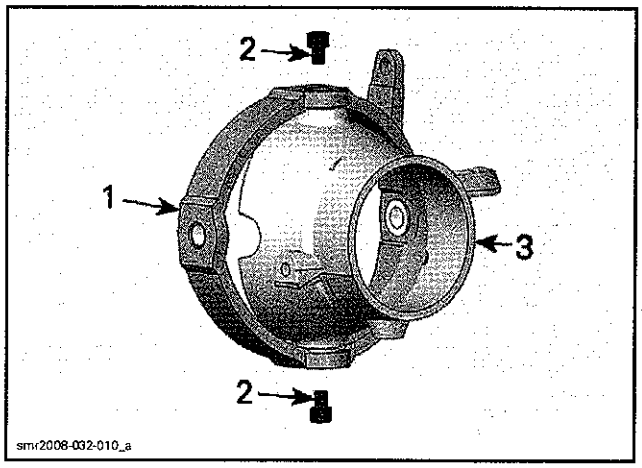
Remove screws securing pivot arm and VTS ring to venturi.



1. Pivot arm
2. Pivot arm screw
3. VTS ring

Remove nozzle and VTS ring.

Remove screws securing VTS ring to nozzle.



1. VTS ring
2. Retaining screws
3. Nozzle

VTS Ring Installation

The installation is the reverse of the removal procedure.

STEERING

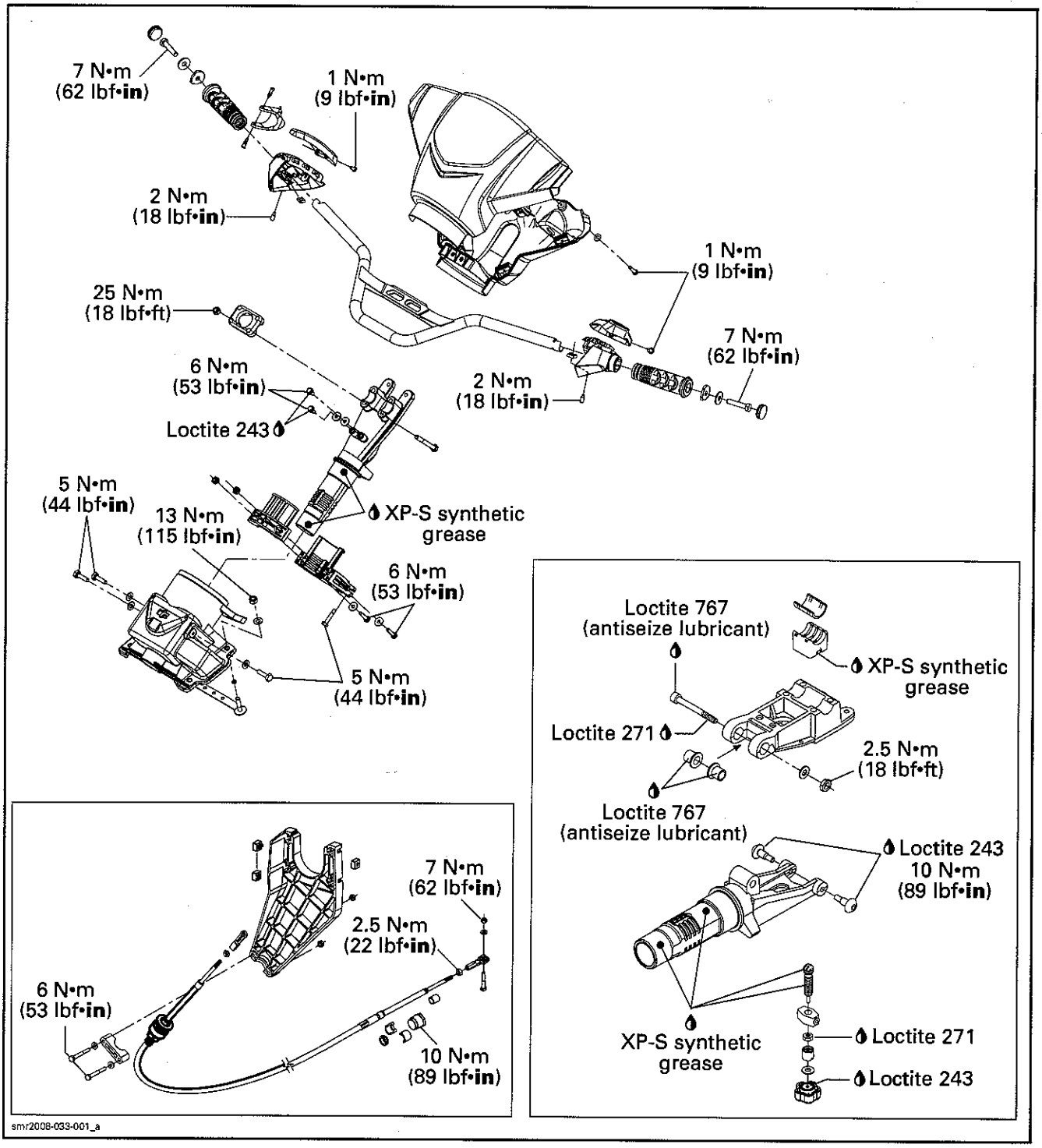
SERVICE TOOLS

Description	Part Number	Page
steering cable tool	295 000 145	415
DESS post remover	529 035 943	399, 405, 407
blind hole puller kit	529 036 117	413

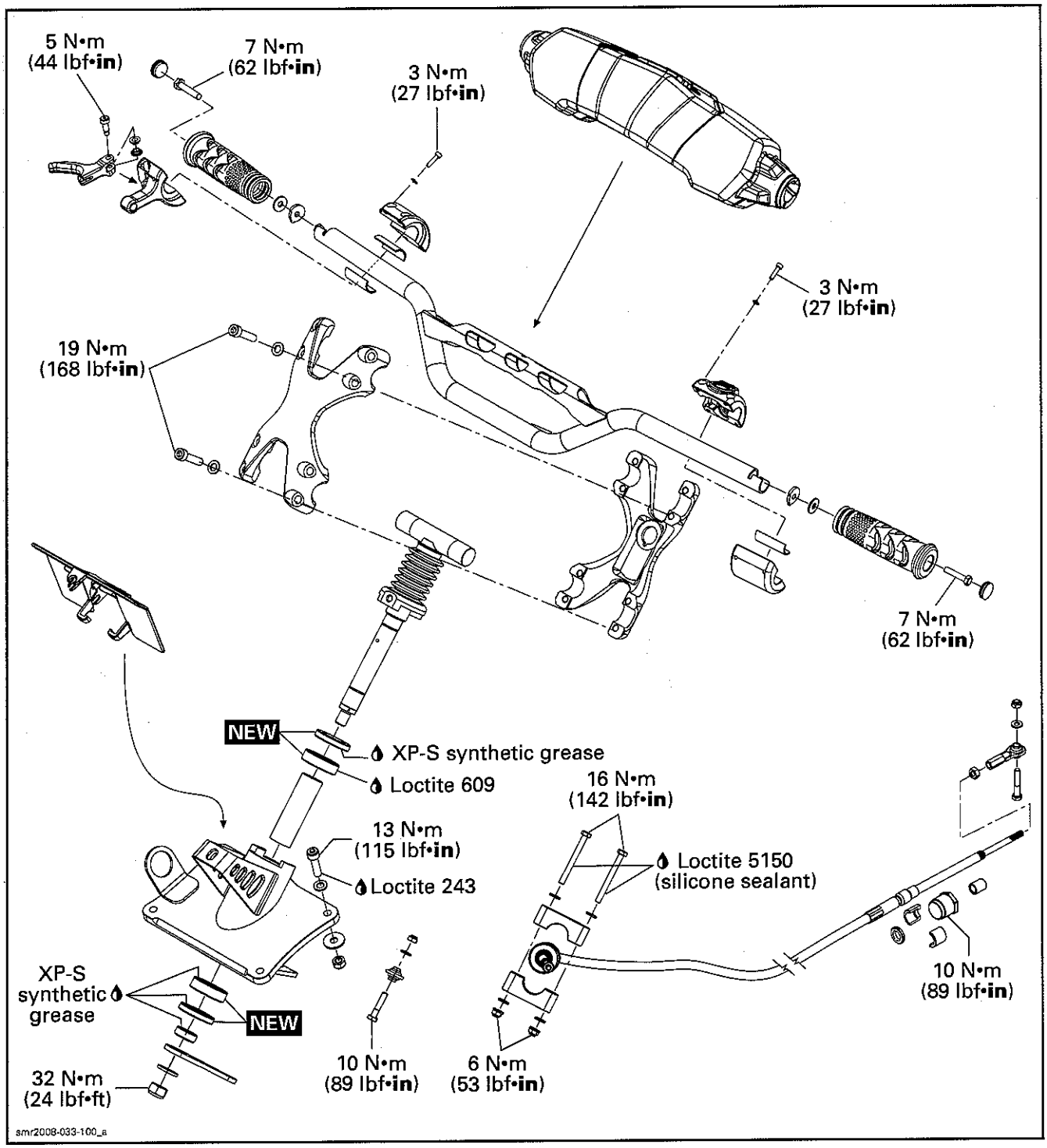
SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic grease	293 550 010	412–414
Loctite 271 (red)	293 800 005	406, 414
Loctite 243 (blue)	293 800 060	398, 414
Loctite 767 (antiseize lubricant)	293 800 070	414
Loctite 609	413 703 100	413

All Models except X Packages



X Packages



GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

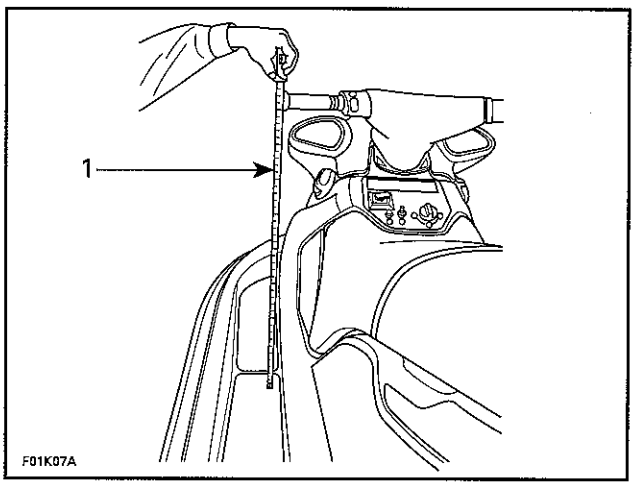
Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

ADJUSTMENT

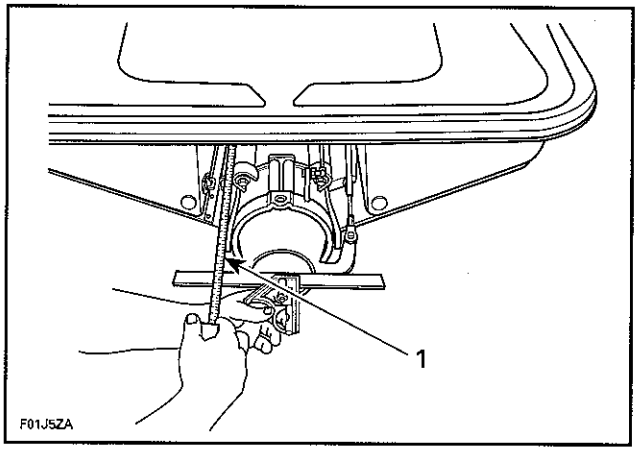
STEERING ALIGNMENT

Position handlebar in straight ahead position by measuring each side the distance from handlebar grip end to floorboard.



TYPICAL
1. Measuring handlebar grip end/floorboard distance

Check jet pump nozzle position by placing a straight edge on nozzle outer end. Measure the distance on each side of the straight edge. It must be equalled.



TYPICAL
1. Measure the distance on each side of the straight edge

If necessary, steering alignment adjustment should be performed at steering cable support.

All Models except GTI Series

Open storage compartment cover and remove basket.

On **RXP models**, remove front vent tube to allow room.

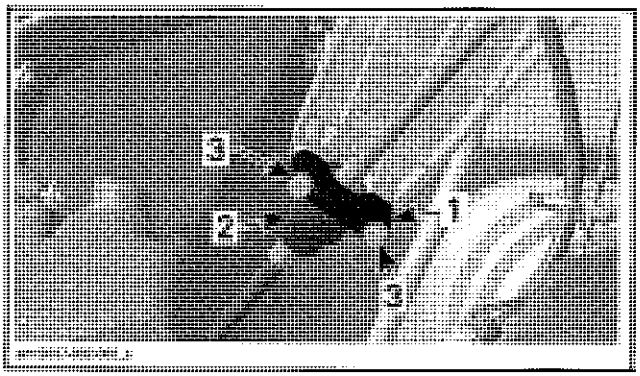
GTI Series

Remove the glove box. Refer to *BODY* section.

All Models

Loosen bolts securing the retaining block at the bottom of cable support.

Turn adjustment nut as required.



ALL MODELS
1. Retaining block
2. Adjustment nut
3. Loosen bolts

After adjustment, torque retaining block bolts to 6 N•m (53 lbf•**in**). Install NEW elastic stop nuts.

CAUTION: Verify when the handlebar is turned completely to the left or right side, that there is no interference with venturi, O.P.A.S. or VTS ring.

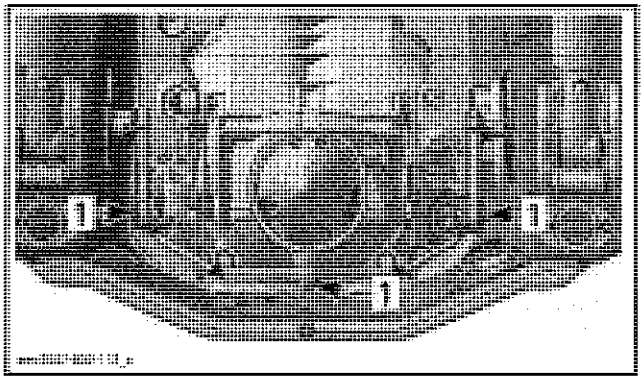
PROCEDURES

NOZZLE

Nozzle Removal

Models without VTS

Remove O.P.A.S. U lever screws and pull out lever.



TYPICAL
1. U lever screws

Remove reverse gate. Refer to *REVERSE SYSTEM* section.

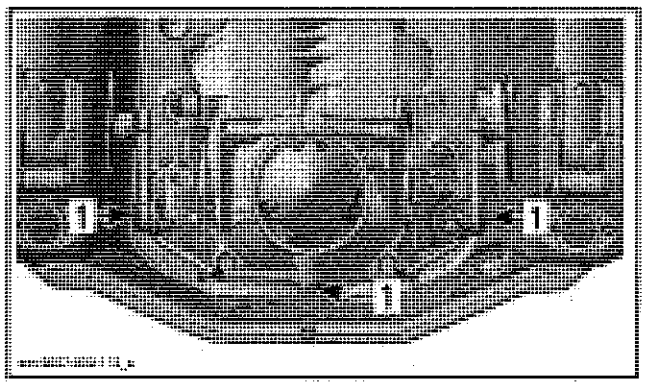
Disconnect steering cable from jet pump nozzle.

Remove retaining screws, sleeves and washers on top and underneath nozzle.

Remove nozzle.

Models with VTS

Remove O.P.A.S. U lever screws and pull out lever.

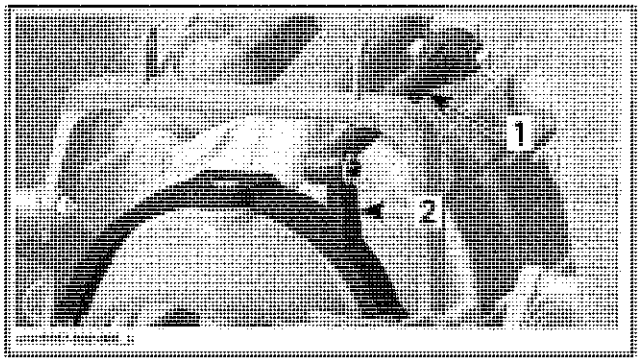


TYPICAL
1. U lever screws

Remove reverse gate. Refer to *REVERSE SYSTEM* section.

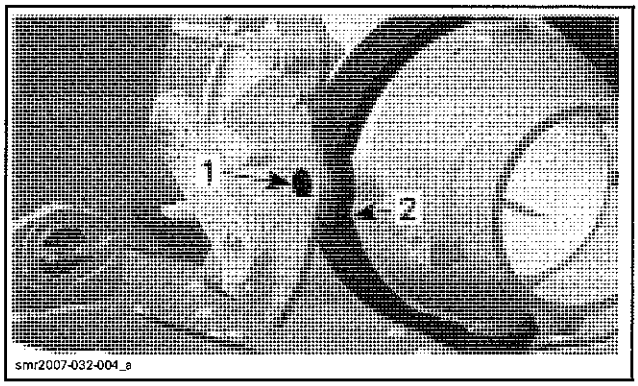
Disconnect steering cable from jet pump nozzle.

Disconnect VTS link rod from VTS ring.



1. Link rod
2. VTS ring

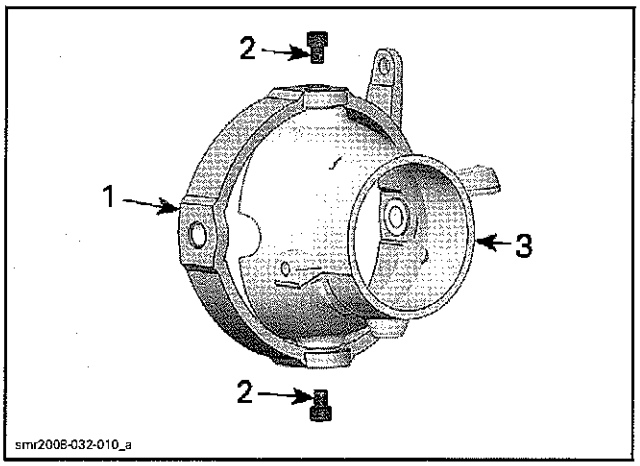
On both sides, remove screws holding VTS ring to nozzle.



1. VTS ring screw
2. VTS ring

Pull out nozzle and VTS ring.

Remove screws securing VTS ring to nozzle.



1. VTS ring
2. Retaining screws
3. Nozzle

Nozzle Installation

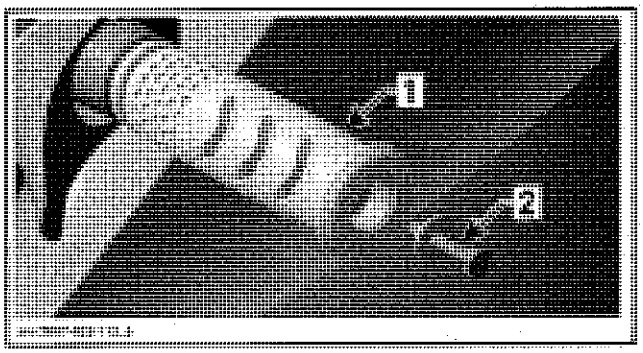
The installation is the reverse of the removal procedure. However, pay attention to the following.

Apply Loctite 243 (blue) (P/N 293 800 060) on screw threads (or use new self-locking screws).

HANDLEBAR GRIP

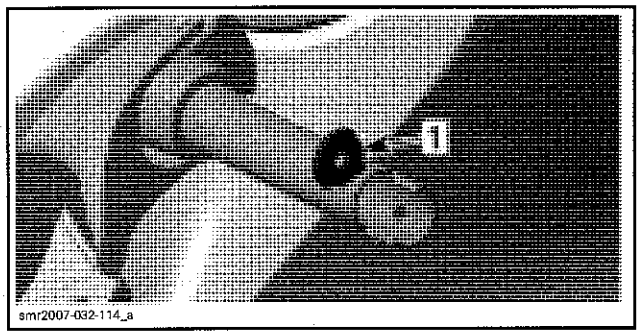
Handlebar Grip Removal

To remove handlebar grip, pull out cap and remove screw.



1. *Handlebar grip*
2. *Handlebar grip screw*

Pull out handlebar grip and remove grip insert from handlebar.

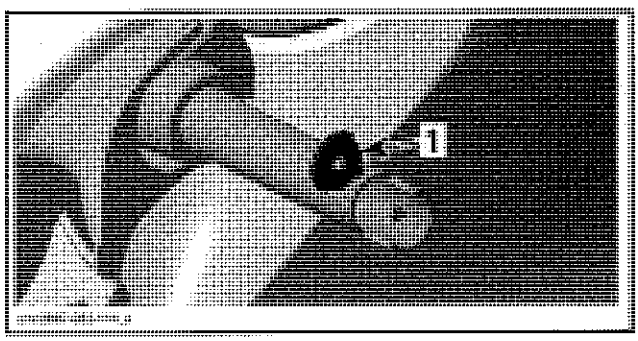


1. *Grip insert*

NOTE: Verify grip insert for damage.

Handlebar Grip Installation

When installing the grip insert in the handlebar, ensure that it is properly inserted in the slot at the end of the handlebar tubing.



1. *Grip insert*

Install handlebar grip on handlebar matching it to the notch in the handlebar.

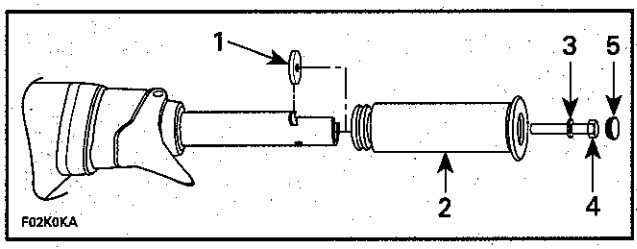
Install flat washer and handlebar grip screw.

Apply Loctite 243 (blue) (P/N 293 800 060) on screw threads.

CAUTION: Ensure to install flat washer otherwise screw will damage grip end.

Torque handlebar grip screw to 7 N•m (62 lbf•**in**).

Install cap.



1. *Grip insert*
2. *Grip*
3. *Flat washer*
4. *Screw*
5. *Cap*

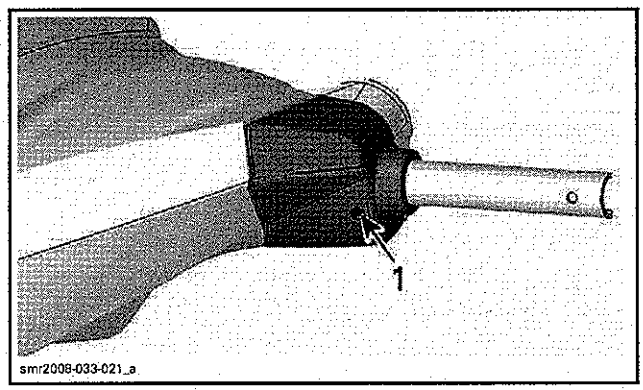
MULTIFUNCTION SWITCH

Multifunction Switch Removal

All Models except X Packages

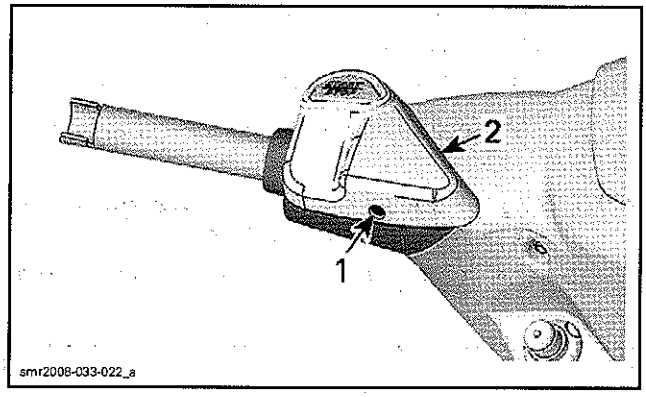
Remove handlebar grips.

Loosen screw of multifunction switch housing.



1. *Screw*

Remove tapping screw.



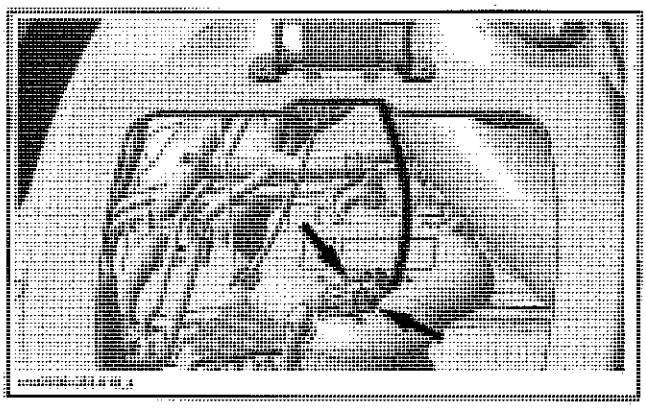
1. *Tapping screw*
2. *Multifunction switch cover*

Remove cover on multifunction switch housing.

Push housing away from steering cover.

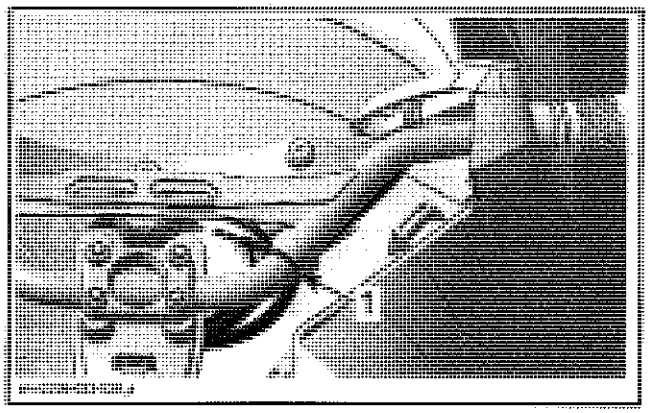
Open front storage cover and remove basket.

Unplug multifunction switch connectors.



Remove the upper steering cover, see *STEERING COVER* further in this section for the proper procedure.

Cut locking tie securing multifunction switch harness to handlebar.

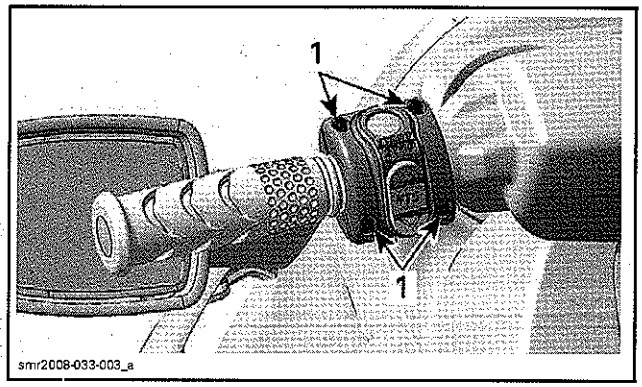


1. *Cut this locking tie*

Remove multifunction switch.

X Packages

Remove screws securing the multifunction switch.



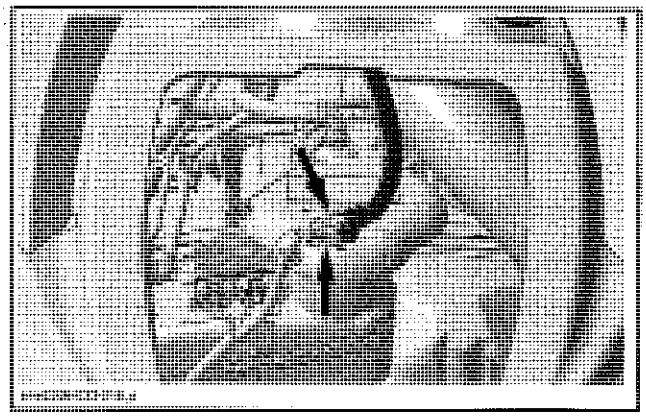
1. *Multifunction switch housing screws*

Separate multifunction switch contacts from housing.

Remove the *STEERING COVER*, see procedure further in this section.

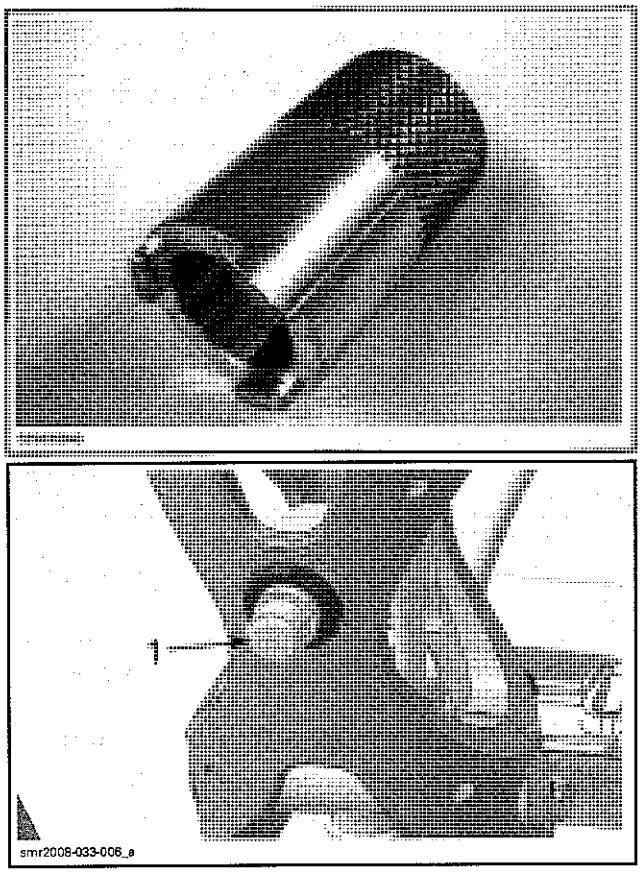
Open front storage cover and remove basket.

Unplug multifunction switch connectors.



Cut locking tie retaining multifunction switch harness to handlebar.

Unscrew DESS switch nut using the DESS post remover (P/N 529 035 943).



1. DESS post

Remove nut securing the beeper to steering support.

Remove multifunction switch harness.

Multifunction Switch Installation

The installation is the reverse of the removal procedure.

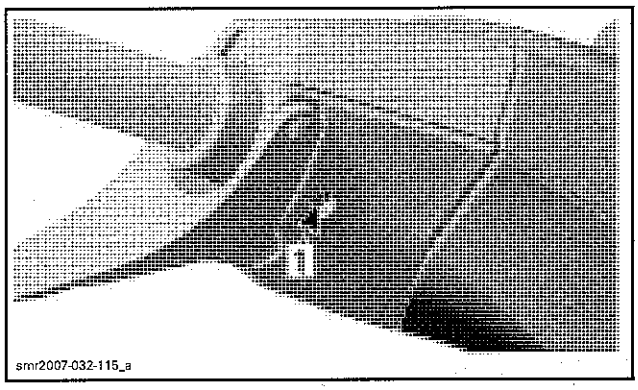
THROTTLE LEVER

Throttle Lever Removal

All Models except X Packages

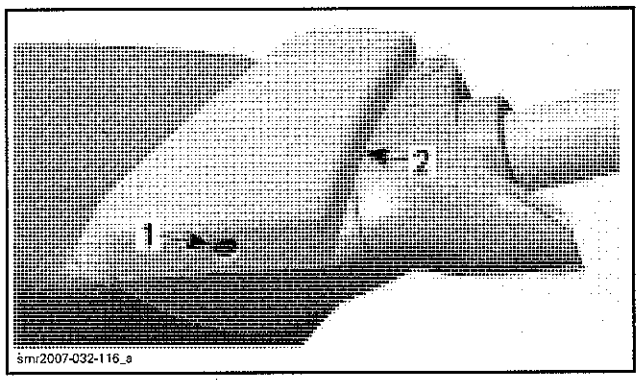
Remove handlebar grips.

Loosen screw of throttle lever housing.



1. Screw

Remove tapping screw.



1. Tapping screw
2. Throttle lever cover

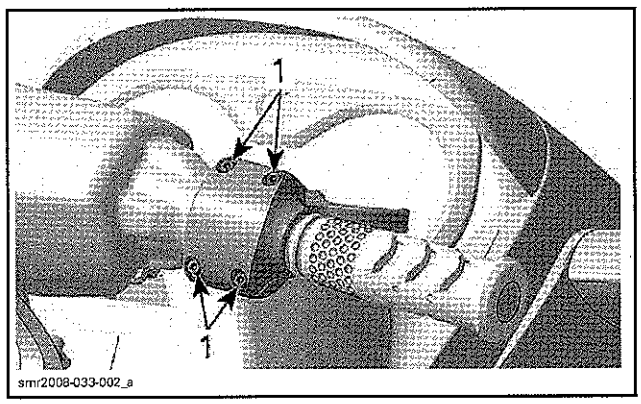
Remove cover on throttle lever housing.

Push housing away from steering cover.

Detach throttle cable from throttle lever.

X Packages

Remove screws securing the throttle lever housing.



1. Throttle lever housing screws

Remove both half housing from handlebar.

Detach throttle cable from throttle lever.

Throttle Lever Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

X Packages

Make sure both pads are installed between throttle lever housing and handlebar.

Tighten all screws equally to avoid damaging the throttle lever housing.

THROTTLE CABLE

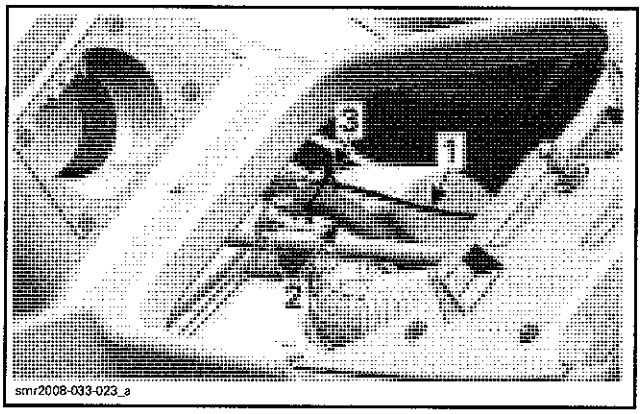
Throttle Cable Removal

All Models except X Packages

Remove seat(s).

Detach throttle cable from throttle body.

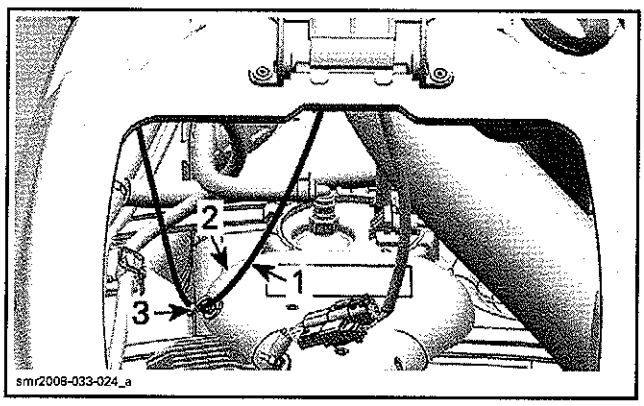
Cut locking tie(s) retaining the throttle cable and main harness.



GTX 155 SHOWN
1. *Throttle cable*
2. *Main harness*
3. *Cut this locking tie*

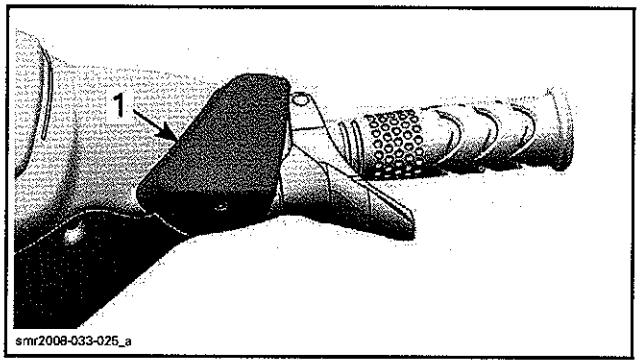
Open front storage cover and remove basket.

Cut locking tie securing the throttle cable to the air intake silencer.



GTX 155 SHOWN
1. *Throttle cable*
2. *Air intake silencer cover*
3. *Cut this locking tie*

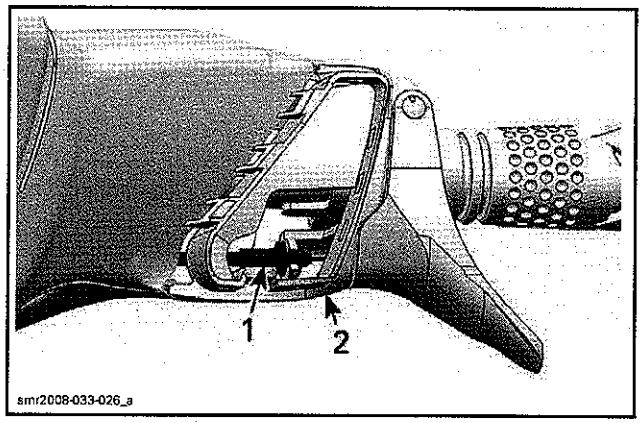
Remove the throttle lever housing cover.



1. *Throttle lever housing cover*

Press throttle lever and detach the throttle cable end.

Unclip the throttle cable from the throttle lever housing.



1. *Throttle cable*
2. *Throttle lever housing*

Attach a small rope at the end of throttle cable.

Pull throttle cable inside bilge.

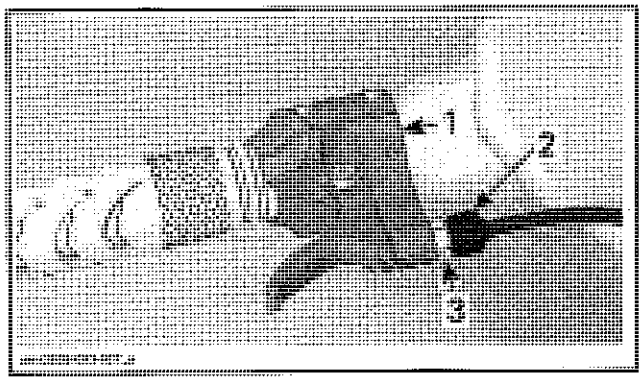
Detach rope from throttle cable end.

Remove throttle cable from vehicle.

X Packages

On throttle lever housing, loosen adjuster locking nut.

Fully tight the adjuster.



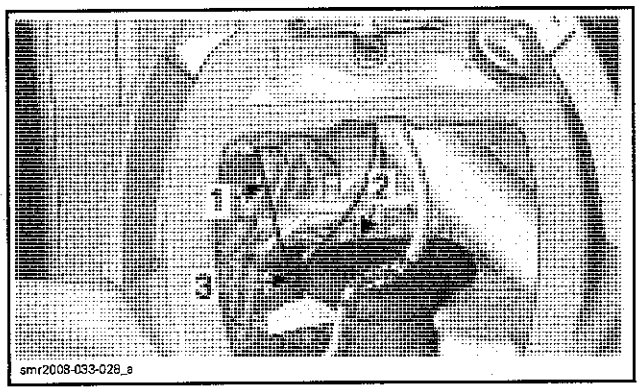
1. Throttle lever housing
2. Adjuster
3. Locking nut

Remove throttle cable end from throttle lever.

Attach a small rope at the end of throttle cable.

Open front storage cover and remove basket.

Cut locking tie retaining throttle cable to air intake silencer cover.

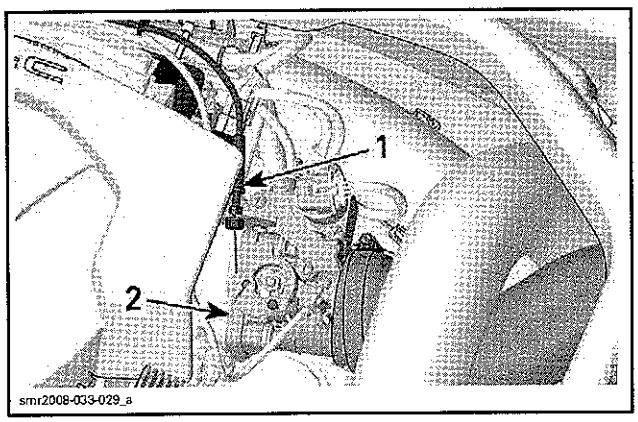


1. Throttle cable
2. Air intake silencer cover
3. Cut this locking tie

Remove seat(s).

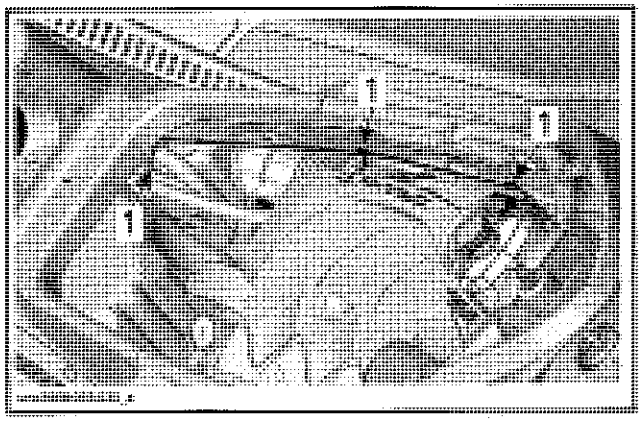
On **RTX 255 models**, remove the seat support. Refer to *BODY* section.

At the rear of engine, detach throttle cable end from throttle body.



1. Throttle cable
2. Throttle body

Cut all locking ties retaining the throttle cable. Note their locations for reinstallation.



RXT 255 SHOWN
1. Locking ties to cut

Pull throttle cable inside bilge.

Detach the rope and remove throttle cable from vehicle.

Throttle Cable Installation

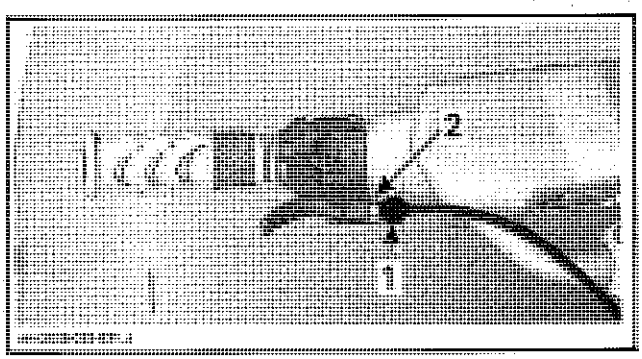
The installation is the reverse of the removal procedure.

When installation is completed, perform the throttle cable adjustment.

Throttle Cable Adjustment

X Packages

Tighten the throttle lever adjuster halfway and secure locking nut.

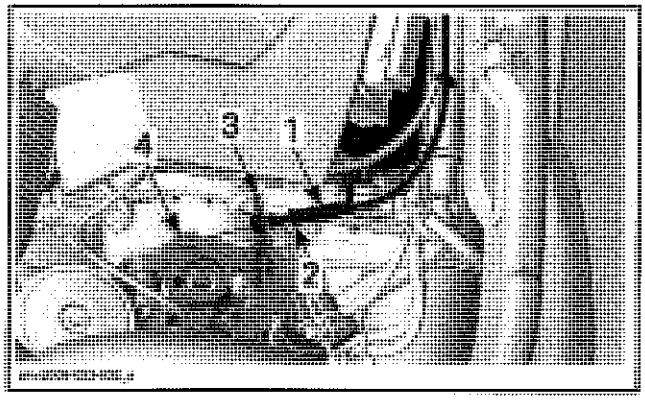


1. Throttle cable adjuster at midway
2. Locking nut

All Models

On throttle body side, loosen locking nut

Turn the throttle cable adjuster as necessary.

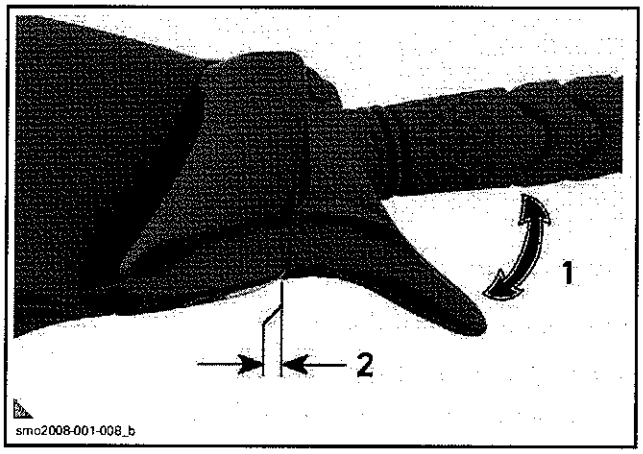


1. *Throttle cable adjuster*
2. *Locking nut*
3. *Throttle cable support*
4. *Throttle body cam*

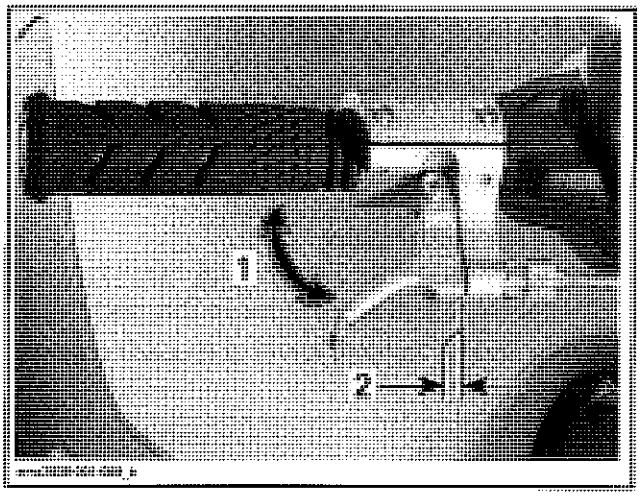
Tighten locking nut and check the throttle cable free play.

When throttle is released, cable must have the following free play.

THROTTLE CABLE FREE PLAY
1 - 3 mm (3/64 - 1/8 in)

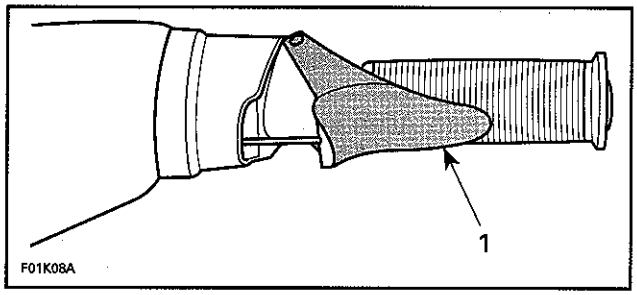


ALL MODELS EXCEPT X PACKAGES
1. *Should move freely*
2. *Throttle cable free play*



X PACKAGES
1. *Should move freely*
2. *Throttle cable free play*

Throttle lever must reach handlebar grip without causing strain to cable or brackets. Ensure throttle lever fully closes on it's stopper.



TYPICAL
1. *Must touch handlebar grip*

Ensure throttle body is fully open at full throttle position. At this position, throttle lever stopper is almost in contact with throttle body.

NOTE: Apply a light pressure on the throttle plate, a slight play should be obtained.

CAUTION: If there is no free-play at idle position, it may cause poor idling and hard starting. Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar. Do not alter throttle cable routing.

⚠ WARNING

Make sure idle speed stopper contacts throttle cam when throttle lever is fully released at handlebar.

Readjust throttle cable if necessary.

STEERING COVER

Steering Cover Removal

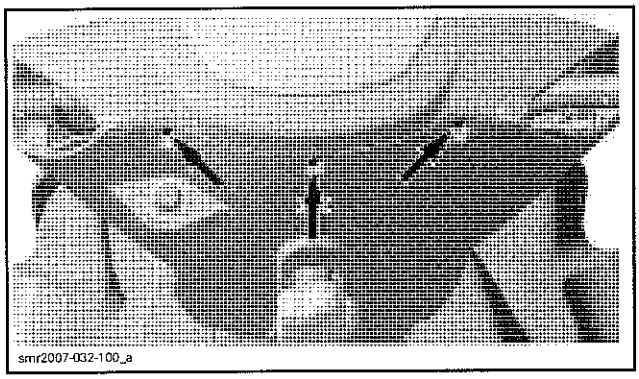
All Models except X Packages

Upper Steering Cover

Remove handlebar grips.

Remove *THROTTLE LEVER* and *MULTIFUNCTION SWITCH*, see procedures in this section.

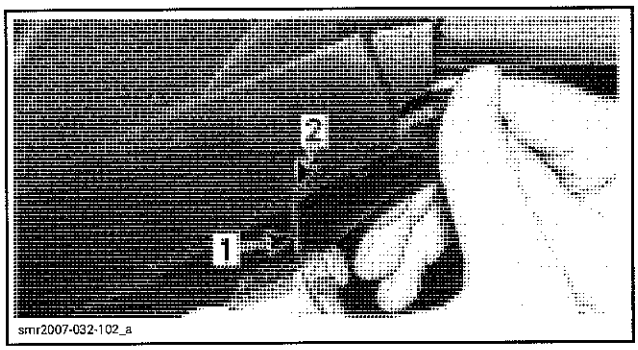
Remove screws holding lower and upper steering cover together.



Using a 1.5 mm Allen key, release the five tabs retaining both parts of steering cover.

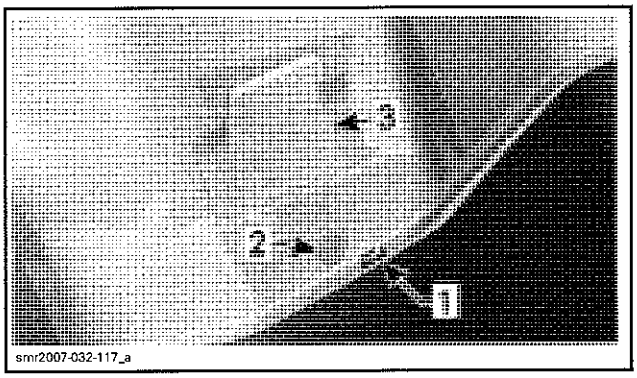
To release tabs correctly, proceed as follows:

- Insert the Allen key in the groove hole. Pay attention to avoid damaging steering cover.



1. *Allen key*
2. *Groove hole*

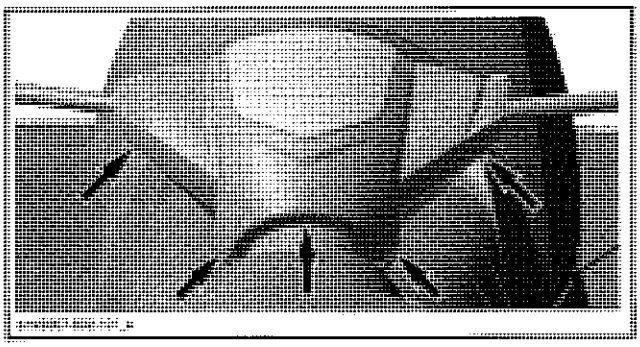
- Push Allen key through the inner hole.



1. *Groove hole*
2. *Inner hole*
3. *Tab*

- Lean the key against tab and push tab with care. Do not force tabs.
- Gently, lift the upper steering cover to disengage the tab.

Repeat the procedure for all tabs. Unlock side tabs first and finish with the center one.



TABS LOCATION

Remove upper steering cover.

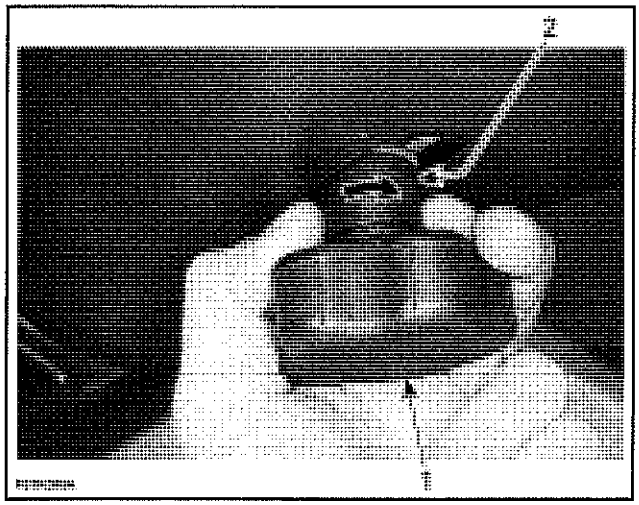
Lower Steering Cover

Remove the upper steering cover.

Models with Adjustable Handlebar

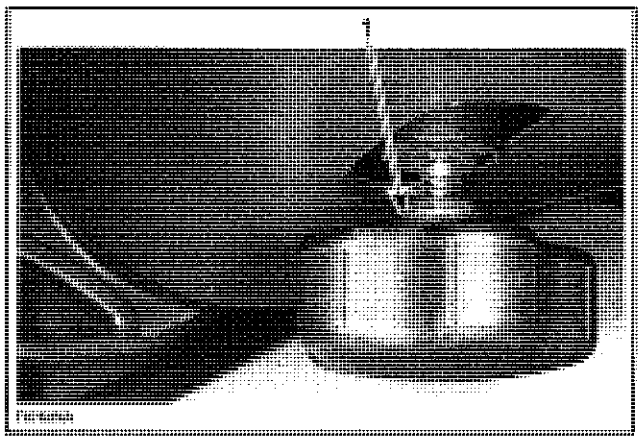
Set handlebar to its lowest position by turning adjustment knob counterclockwise.

While holding adjustment knob, turn support bushing clockwise.



TYPICAL
1. Adjustment knob
2. Support bushing

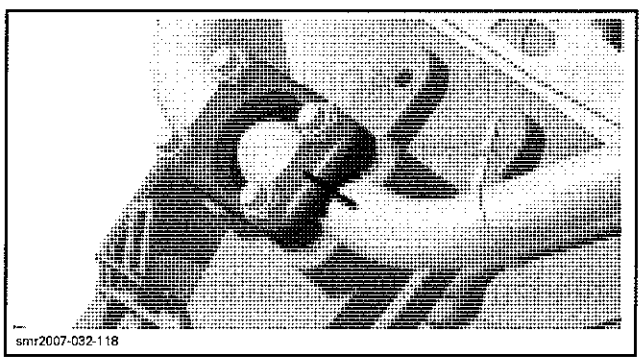
Hold jam nut and unscrew adjustment knob from adjuster screw.



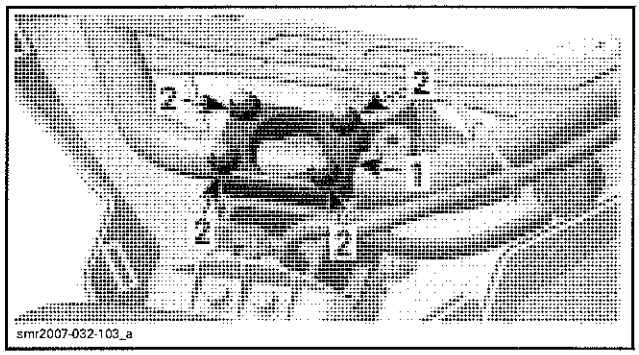
TYPICAL
1. Loosen jam nut

All Models

Using a marker, mark handlebar and steering clamp to reinstall handlebar at the same position.



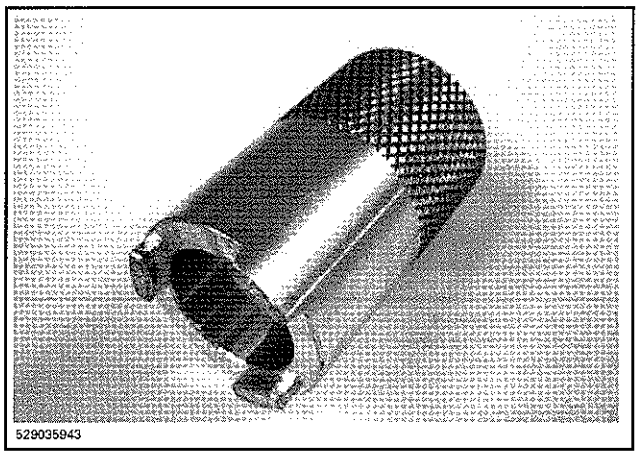
Unscrew nuts securing steering clamp then remove handlebar. Remove throttle lever housing and multifunction switch housing from handlebar.

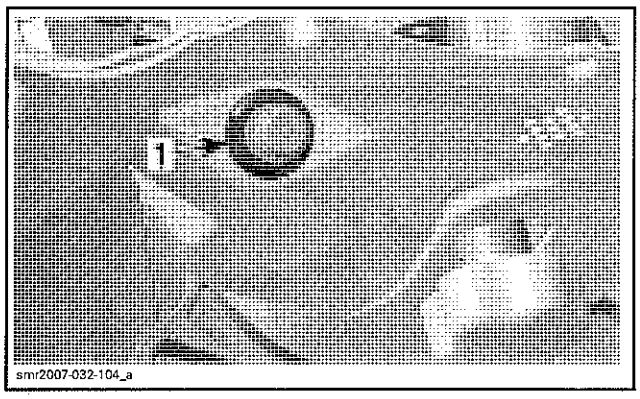


1. Steering clamp
2. Elastic stop nuts

Cut locking ties retaining wiring harness on steering stem.

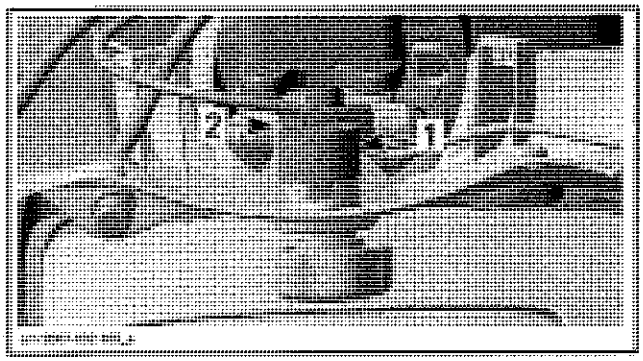
Unscrew DESS switch nut using DESS post remover (P/N 529 035 943).





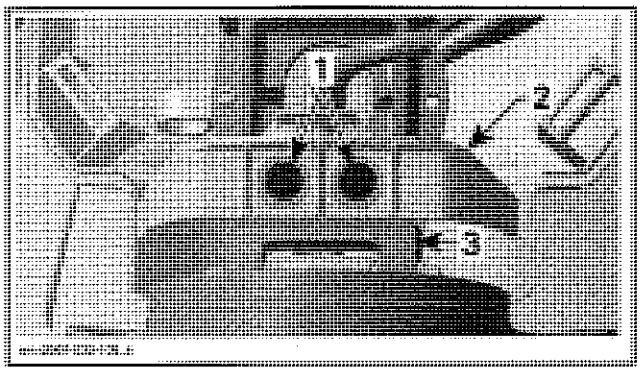
1. DESS switch nut

Unlock beeper from lower steering cover.



1. *Beeper*
2. *Locking tab*

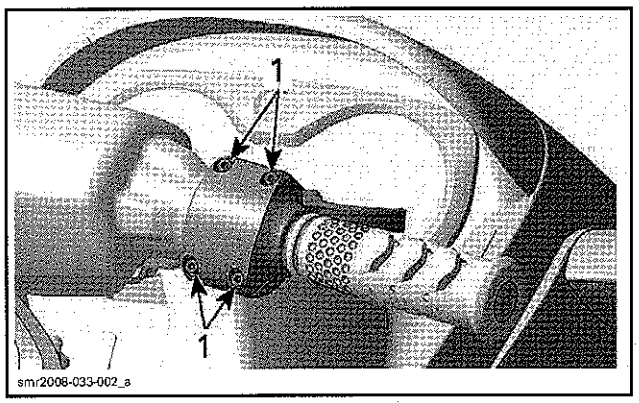
Remove screws holding lower steering cover to steering stem then slide cover over steering stem.



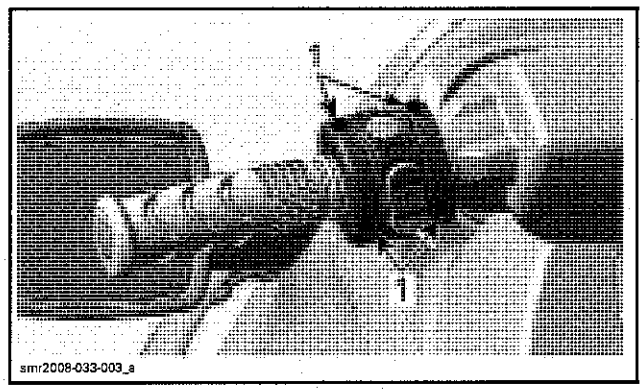
1. *Retaining screws*
2. *Lower steering cover*
3. *Steering stem*

X Packages

Loosen screws securing throttle lever housing and multifunction switch housing.

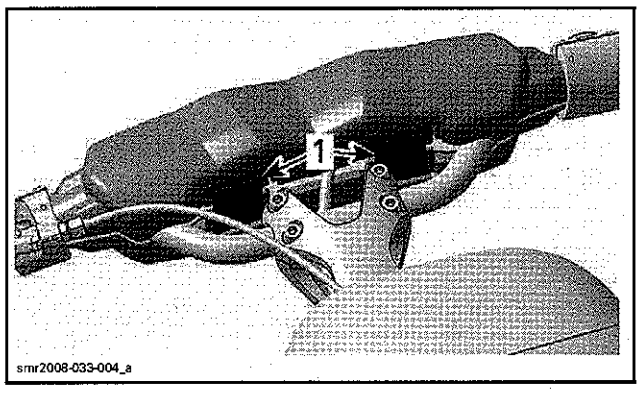


1. *Throttle lever housing screws*



1. *Multifunction switch housing screws*

Detach retaining straps under steering cover.



1. *Retaining straps*

Pull steering cover to remove it from handlebar.

Steering Cover Installation

For installation, reverse the removal procedure. However, pay attention to the following.

All Models except X Packages

Align all tabs before closing steering cover.

Torque screws to 1 N•m (9 lbf•**in**).

Models with Adjustable Handlebar

Apply Loctite 271 (red) (P/N 293 800 005) on threads of jam nut.

STEERING PADDING

Steering Padding Removal

Remove steering cover as mentioned above.

Push steering padding inside to remove it.

Steering Padding Installation

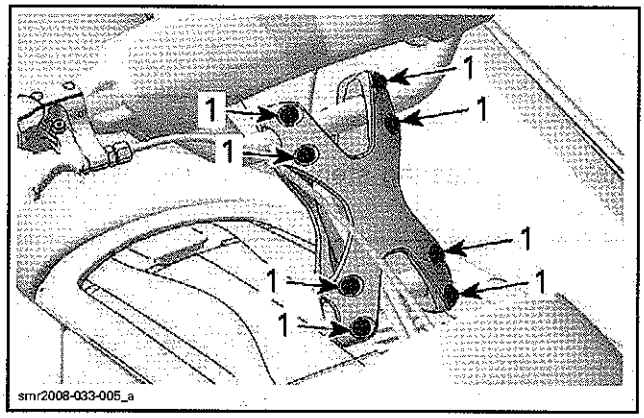
The installation is the reverse of the removal procedure.

HANDLEBAR EXTENSION

X Packages

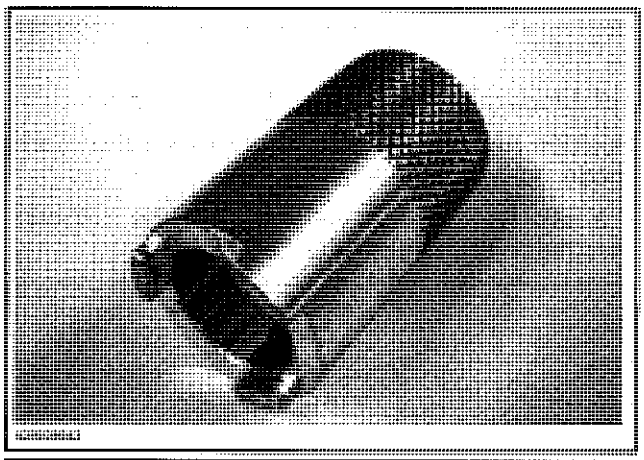
Handlebar Extension Removal

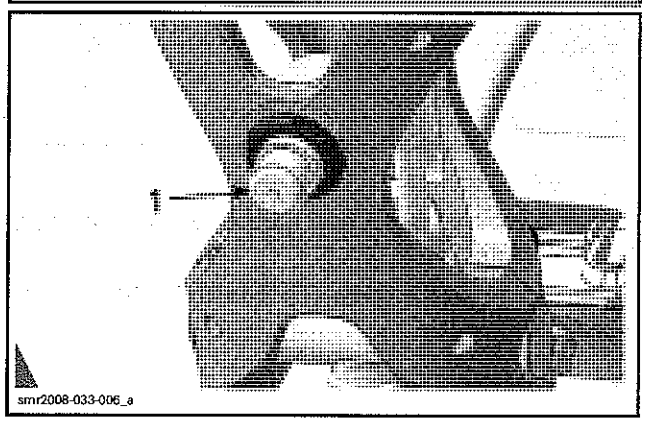
Remove all screws securing both parts of handlebar extension.



1. Handlebar extension screws

If necessary, unscrew DESS switch nut using the DESS post remover (P/N 529 035 943).



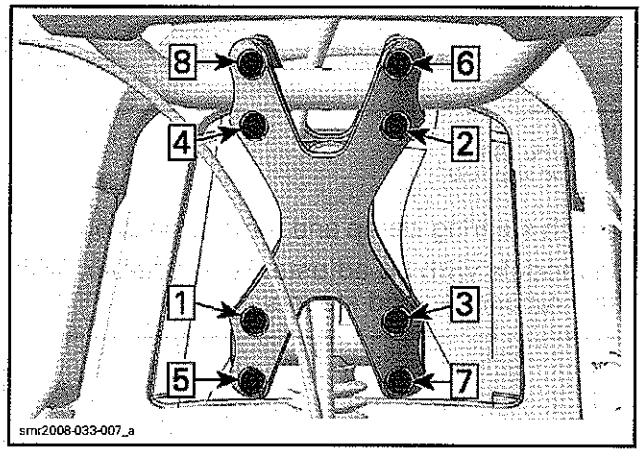


1. DESS post

Handlebar Extension Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Tighten handlebar extension screws first to 3 N•m (27 lbf•**in**) then finish to 19 N•m (168 lbf•**in**) into the following sequence.



HANDLEBAR

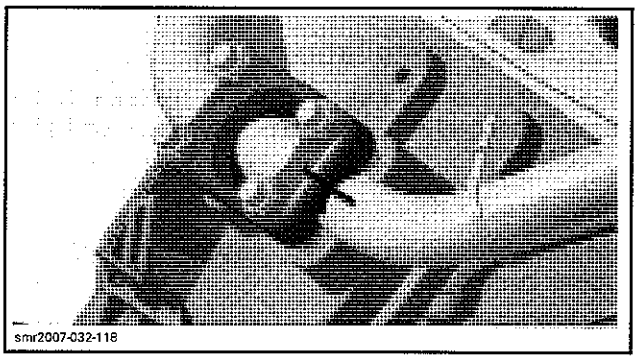
Handlebar Removal

NOTE: If the handlebar must be changed, remove all components (handlebar grip, steering cover, throttle lever housing and multifunction switch) before removing it from vehicle.

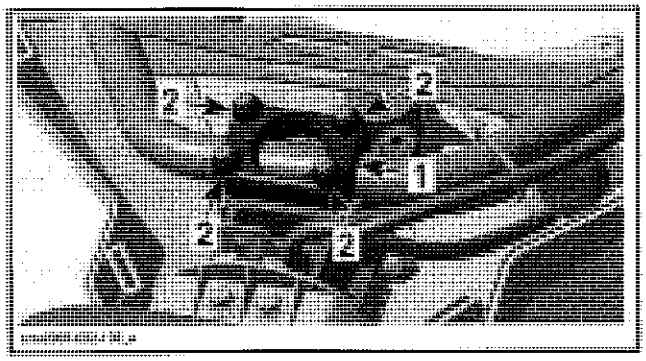
All Models except X Packages

Remove upper steering cover as mentioned above.

Using a marker, mark handlebar and steering clamp to reinstall handlebar at the same position.



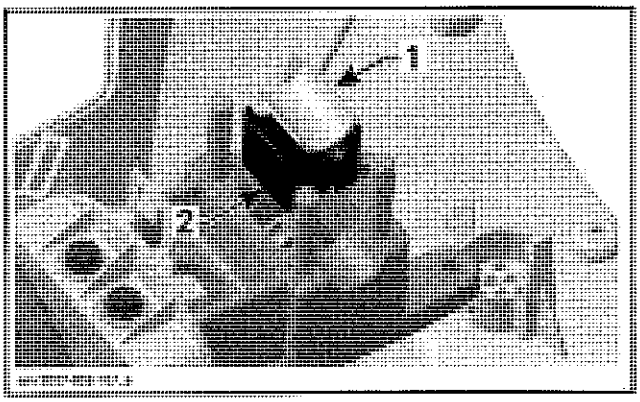
Remove 4 elastic stop nuts retaining steering clamp. Discard elastic stop nuts.



TYPICAL
1. Steering clamp
2. Elastic stop nuts

Detach steering clamp and remove handlebar.

On **models with an adjustable handlebar**, withdraw rubber pad and stopper.



TYPICAL
1. Rubber pad
2. Stopper

X Packages

Remove *HANDLEBAR EXTENSION*, see procedure above in this section.

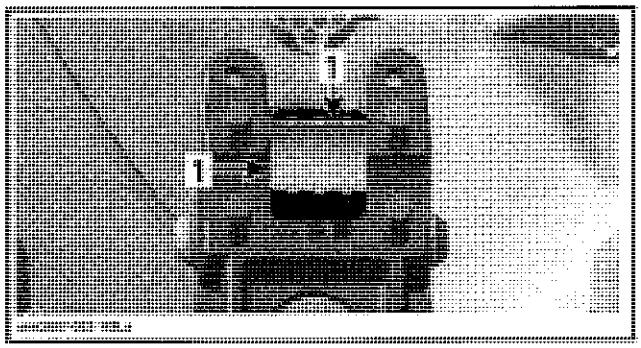
Handlebar Installation

The installation is essentially the reverse of the removal procedure. However, pay attention to the following.

Models with Adjustable Handlebar

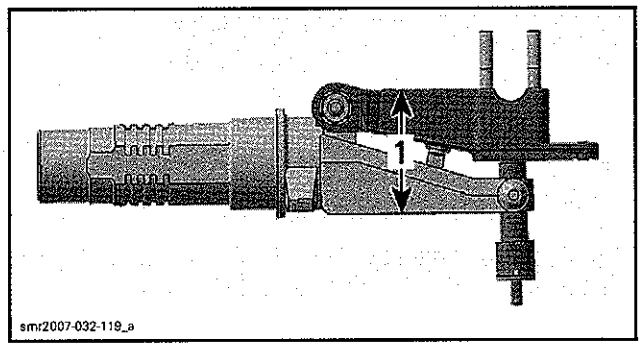
Before installing handlebar, position stopper and rubber pad.

CAUTION: Rubber pad must not exceed stopper.



1. Pad must not exceed stopper

Make sure steering stem and handlebar support are parallel.

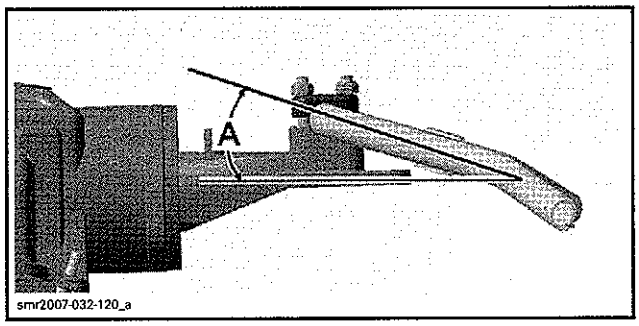


1. Parallel

All Models

Position handlebar in accordance with the marks made during removal.

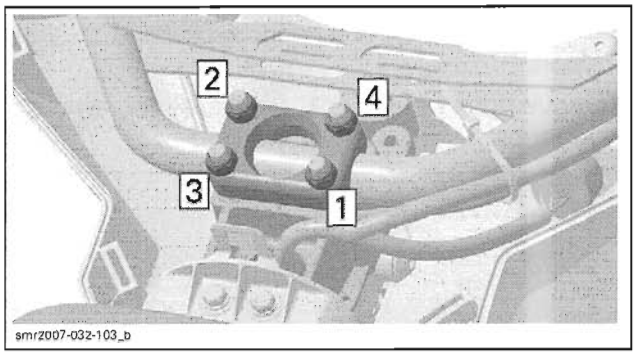
If a new handlebar is installed, use the following illustration to position it correctly.



A. 17° ± 1°

Install steering clamp and secure with **NEW** elastic stop nuts.

Torque nuts to 26 N•m (19 lbf•ft) as per the following sequence.



STEERING CABLE SUPPORT

Cable Support Removal

All Models except GTI Series and X Packages

Open front storage cover and remove basket.

Remove glove box. Refer to *BODY* section.

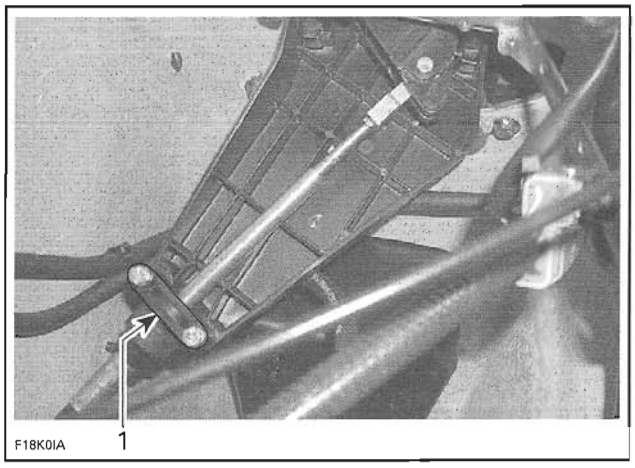
On **RXP models**, remove front vent tube.

GTI Series

Remove glove box and console. Refer to *BODY* section.

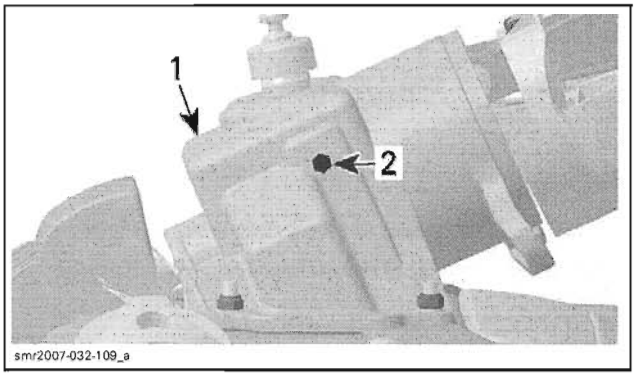
All Models except 255 HP

Unscrew bolts securing retaining block then remove it from steering cable support.

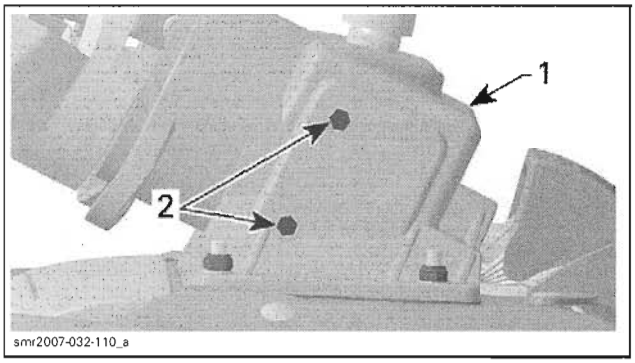


1. Retaining block

Loosen screws each side of steering support.

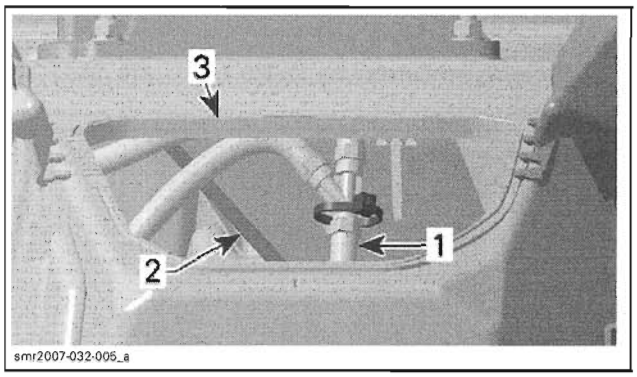


RIGHT SIDE
1. Steering support
2. Screw



LEFT SIDE
1. Steering support
2. Screws

Detach fuel lines from steering cable support.



TYPICAL
1. Fuel line
2. Steering cable support
3. Glove box location

Remove steering cable support.

Cable Support Installation

For installation, reverse the removal procedure.

STEERING SUPPORT

Steering Support Removal

GTI Series

Remove console. Refer to *BODY* section.

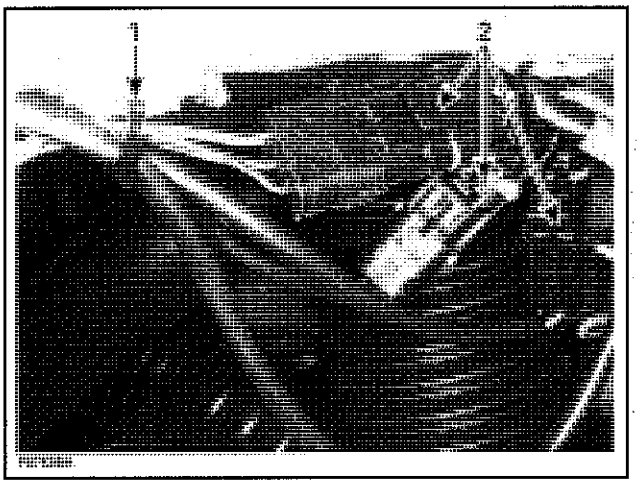
All Models except GTI Series and X Packages

Open front storage cover and remove basket.

All Models except X Packages

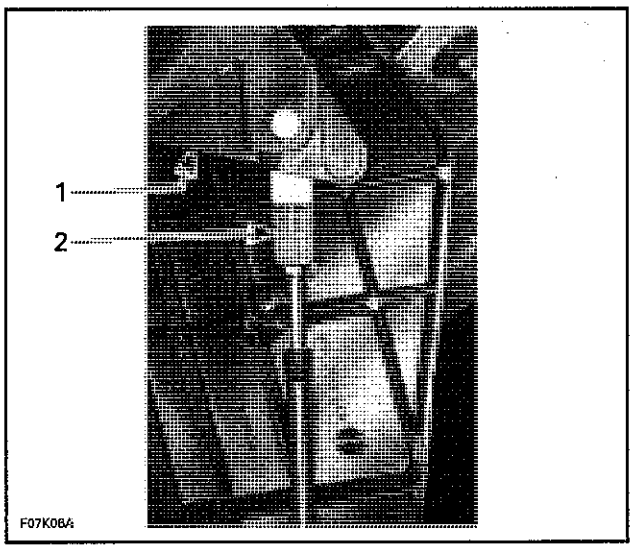
Disconnect the throttle cable from throttle body.

Disconnect the wiring harnesses leading out of steering stem and cut locking tie.



TYPICAL
1. *Tie rap*
2. *Connectors*

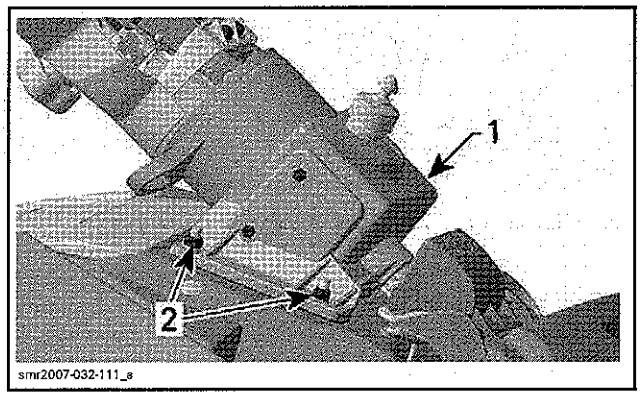
Disconnect the steering cable from the steering stem arm.



TYPICAL
1. *Steering stem arm*
2. *Steering cable*

Remove bolts retaining cable support to steering support.

Remove bolts or lock nuts from steering retaining strip studs.



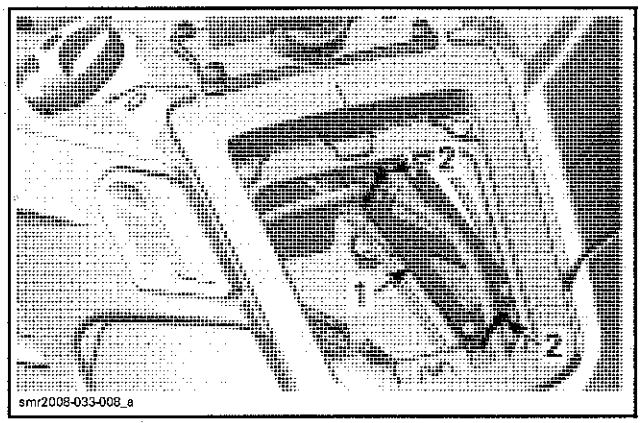
TYPICAL
1. *Steering support*
2. *Retaining strip studs*

Remove steering support with handlebar, wiring harnesses and cables.

X Packages

Remove the glove box. Refer to *BODY* section.

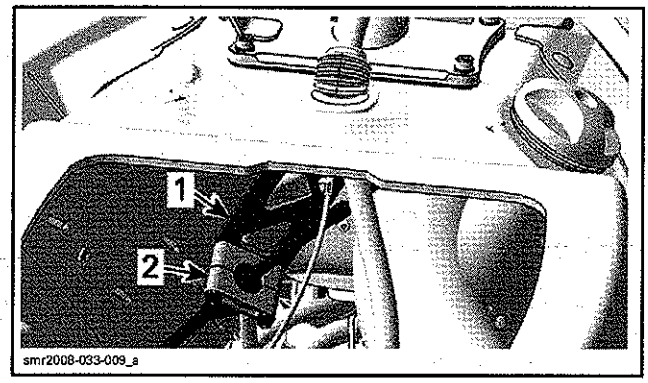
Cut locking ties securing hoses to steering support.



1. *Steering support*
2. *Locking ties*

Remove the *STEERING STEM*, see the procedure further in this section.

Unscrew throttle cable holder bolts to separate throttle cable from the bottom of steering support.



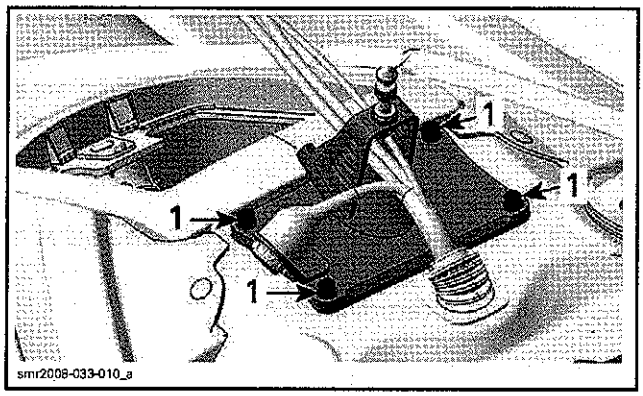
1. *Steering support*
2. *Throttle cable holder*

Detach throttle cable from throttle lever.

Remove the DESS post from the handlebar extension.

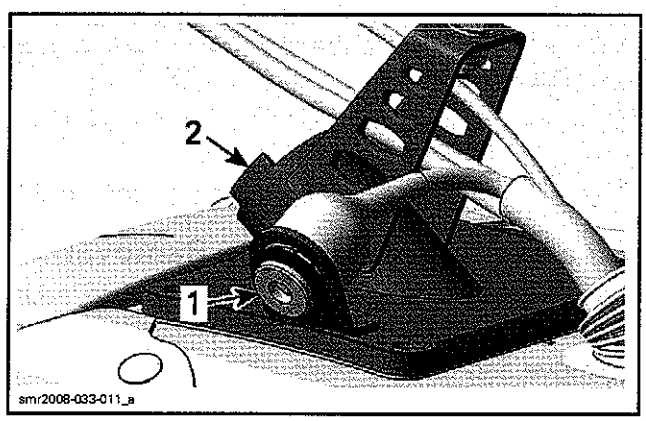
Separate multifunction switch contacts and housing.

Unscrew steering support bolts.



1. *Remove these bolts*

Remove nut securing the beeper to steering support.



1. *Beeper*
2. *Steering support*

Remove the steering support.

Steering Support Installation

The installation is the reverse of the removal procedure.

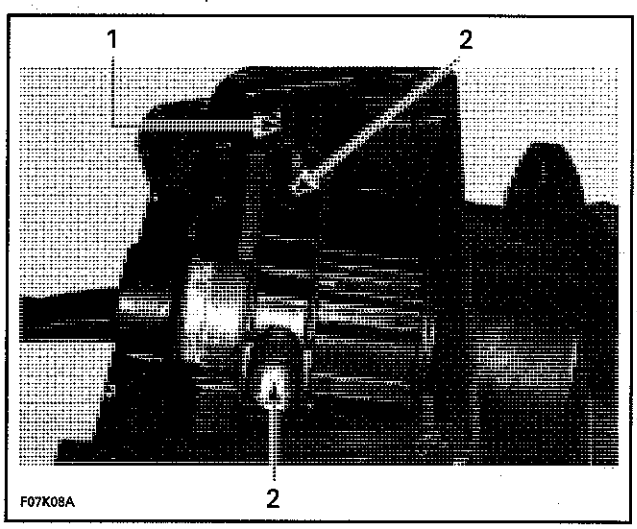
STEERING STEM

Steering Stem Removal

All Models except X Packages

Remove steering support. Refer to *STEERING SUPPORT* above.

Unscrew steering stem arm support bolts and discard elastic stop nuts.



1. *Steering stem arm*
2. *Steering stem arm support bolts*

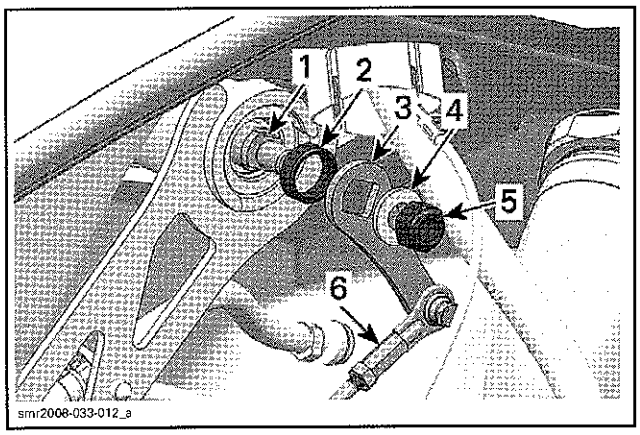
Pull steering stem out of steering support.

X Packages

Open storage cover and remove basket.

Remove the *HANDLEBAR EXTENSION*, see procedure above in this section.

Remove nut securing steering pivot lever to the end of steering stem.



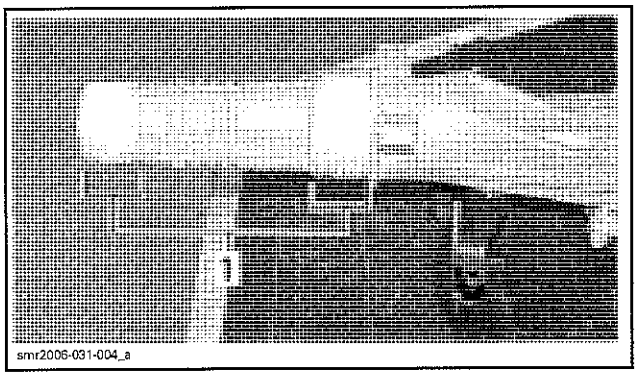
1. *Steering stem end*
2. *Spacer*
3. *Steering pivot lever*
4. *Washer*
5. *Steering pivot lever nut*
6. *Steering cable*

Pull steering stem out of steering support.

Steering Stem Installation

All Models except X Packages

Apply XP-S synthetic grease (P/N 293 550 010) on contact surfaces of steering stem before installing it into steering support.

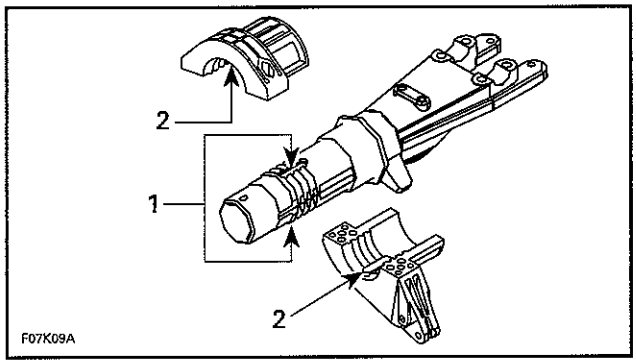


1. *Apply grease here*

Position steering stem arm onto steering stem.

⚠ WARNING

Make sure the integrated flat keys of the steering stem arm and support are properly seated in steering stem keyways. Steering stem arm must be locked in place before torquing the bolts.



1. *Keyways*
2. *Integrated flat key*

Using **NEW** elastic stop nuts, tighten steering stem arm to 6 N•m (53 lbf•**in**).

Install all other removed parts.

X Packages

The installation is the reverse of the removal procedures. However, pay attention to the following.

Apply XP-S synthetic grease (P/N 293 550 010) inside spacer.

Using a finger, position the spacer between steering bearings while inserting steering stem into steering support.

Install the spacer.

Match the end of steering stem with the steering pivot lever.

Install all other removed parts.

STEERING SUPPORT BEARING

X Packages

Steering Support Bearing Inspection

To check bearing condition, turn steering fully to the right then fully to the left. The steering must turn smoothly.

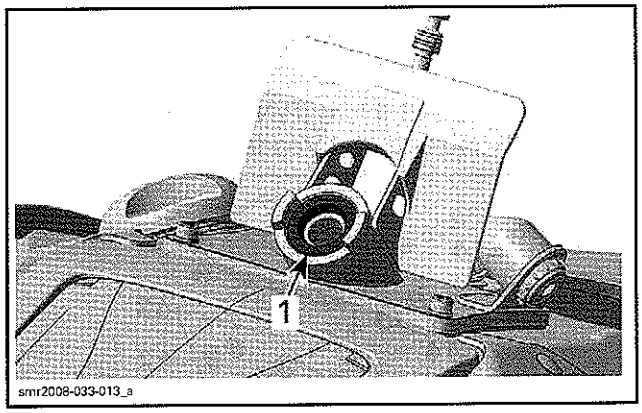
Try to move the steering up and down. No noticeable play should be felt.

Replace both bearings if a problem is detected.

Steering Support Bearing Removal

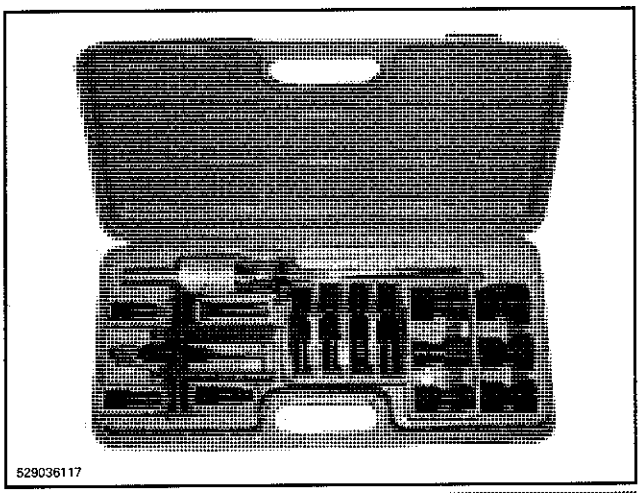
Remove the *STEERING STEM*, see procedure above in this section.

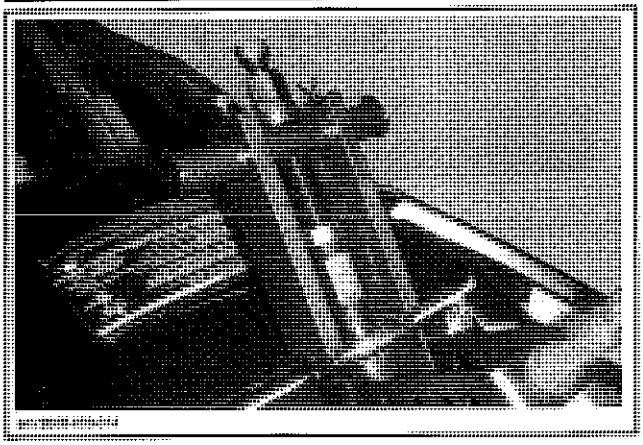
Remove and discard seals.



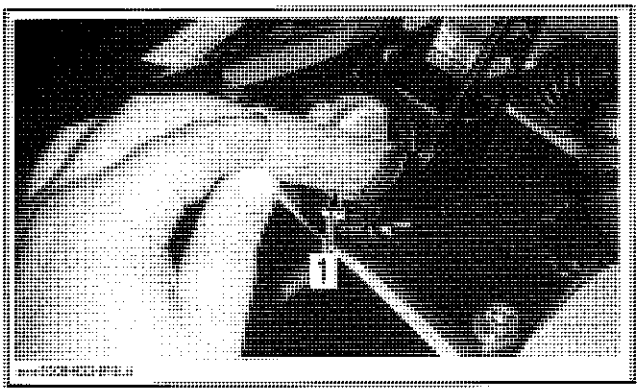
1. Upper seal

Using the blind hole puller kit (P/N 529 036 117), remove and discard the upper bearing.





Remove the inner spacer.



1. Inner spacer

From the bilge, remove and discard the other bearing.

Steering Support Bearing Installation

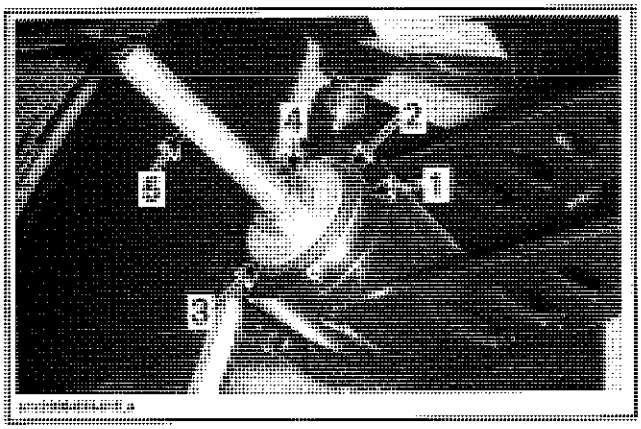
To install NEW bearings, use the following parts (purchased locally):

STEERING SUPPORT BEARING INSTALLER	
QTY	DESCRIPTION
1	Threaded bar
2	Flat washer with the same diameter than the bearing outer race
2	Nuts

Apply Loctite 609 (P/N 413 703 100) ONLY on the outer race of the UPPER bearing.

Apply XP-S synthetic grease (P/N 293 550 010) inside the bottom of steering support. Do not apply grease on top.

Position all parts and the installer.



1. Bearing
2. Flat washer
3. Small flat washer (optional)
4. Nut
5. Threaded bar

Drive bearings into steering support by tightening the installer nuts.

CAUTION: To avoid steering support damages, make sure all parts are perfectly aligned before tightening the installer nuts.

Tighten installer nuts until bearings are properly seat into steering support.

Remove the installer.

Apply XP-S synthetic grease (P/N 293 550 010) into seal lips.

Install NEW seals.

Install all other removed parts.

HANDLEBAR SUPPORT

All Models except X Packages

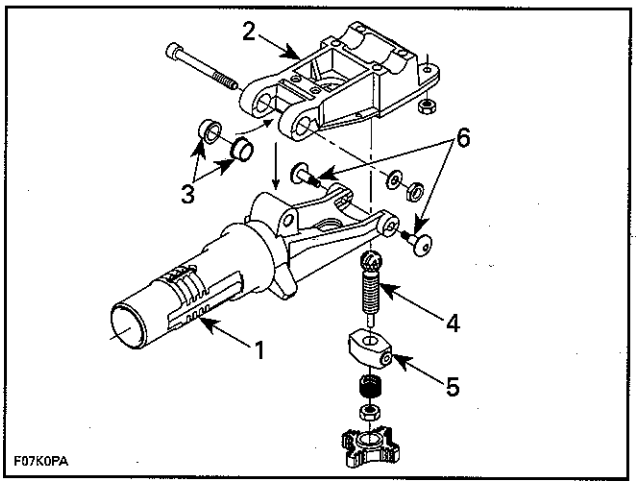
Handlebar Support Removal

Models with Adjustable Handlebar

Remove steering stem from vehicle. See procedure above.

Unscrew nut and remove pivot bolt retaining handlebar support to steering stem.

Unscrew threaded pivots to remove threaded block from steering stem.



1. *Steering stem*
2. *Handlebar support*
3. *Support bushing*
4. *Adjuster screw*
5. *Threaded block*
6. *Threaded pivots*

Handlebar Support Installation

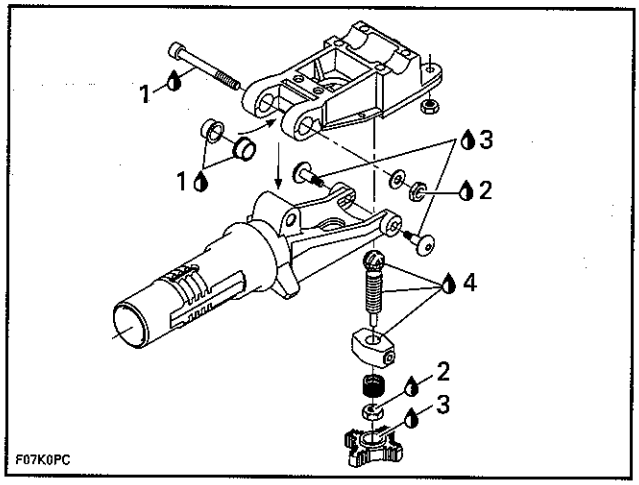
Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) then install support bushings on handlebar support.

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on pivot bolt.

CAUTION: Make sure antiseize lubricant does not come in contact with threads of bolt.

Apply Loctite 271 (red) (P/N 293 800 005) on threads of pivot bolt.

Apply Loctite 243 (blue) (P/N 293 800 060) in adjustment knob and on threaded pivots.

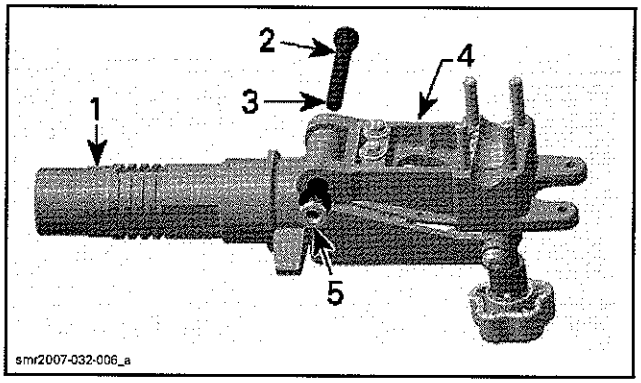


1. *Loctite 767 (antiseize lubricant)*
2. *Loctite 271 (red)*
3. *Loctite 243 (blue)*
4. *XP-S synthetic grease*

Apply Loctite 271 (red) (P/N 293 800 005) on threads of pivot bolt.

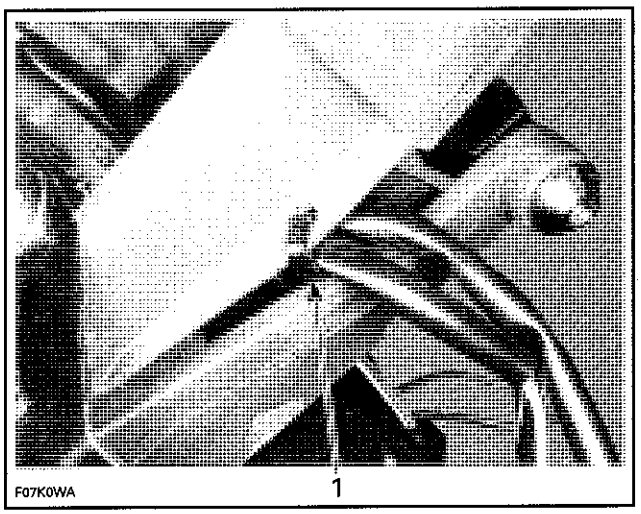
Install handlebar support to steering stem and secure with pivot bolt.

Torque nut to 26 N•m (19 lbf•ft).



1. *Steering stem*
2. *Pivot bolt*
3. *Apply Loctite 271 (red) here*
4. *Handlebar support*
5. *Nut*

Ensure wire harness is properly secured to handlebar support with a locking tie.



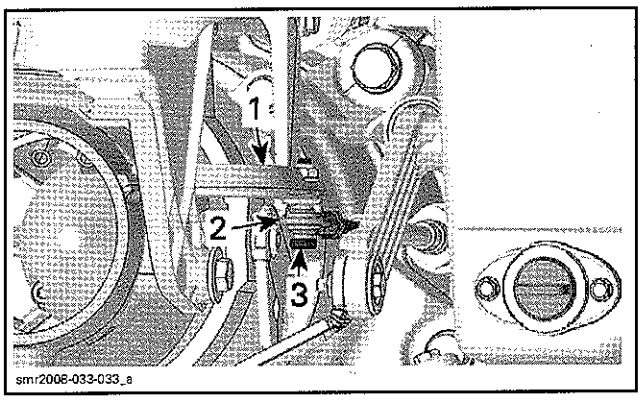
1. Locking tie holding harness to handlebar support

STEERING CABLE

Steering Cable Removal

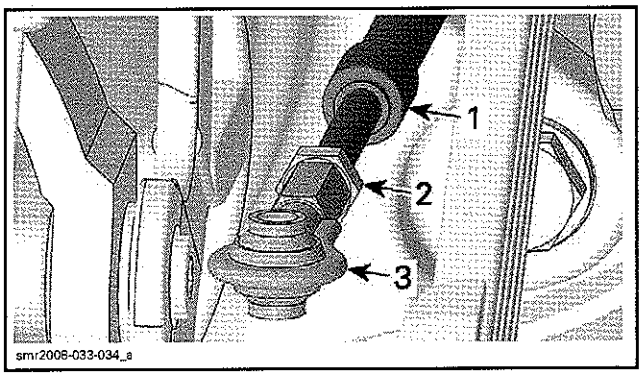
Jet Pump Side

Disconnect ball joint from jet pump nozzle.



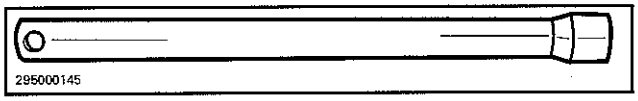
1. Jet pump nozzle
2. Ball joint
3. Ball joint bolt

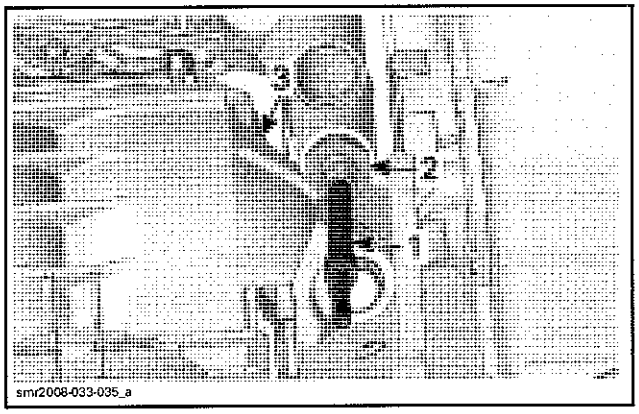
Remove ball joint and jam nut from cable.



1. Steering cable
2. Jam nut
3. Ball joint

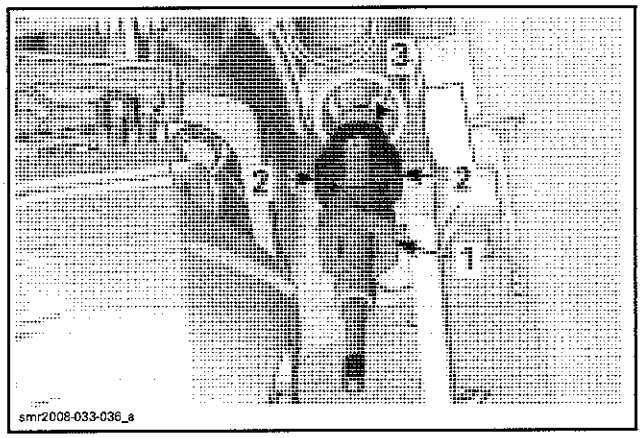
Using the steering cable tool (P/N 295 000 145), loosen steering cable nut.





1. Steering cable
2. Steering cable nut
3. Reverse gate

Remove steering cable nut, half rings and rubber washer.



1. Steering cable nut
2. Half rings
3. Rubber washer

Inside Hull

All Models

Remove seat(s).

X Packages

Remove air inlet and air outlet hoses from intercooler as well as muffler hose from resonator.

All Models except GTI Series

Open storage compartment cover and remove basket.

On **RXP models**, remove front vent tube to allow room.

GTI Series

Remove the glove box. Refer to *BODY* section.

All Models

Remove bolts securing the retaining block at the bottom of cable support.

Remove retaining block.

Securely fasten a small rope to the end of cable (pump side) to ease installation.

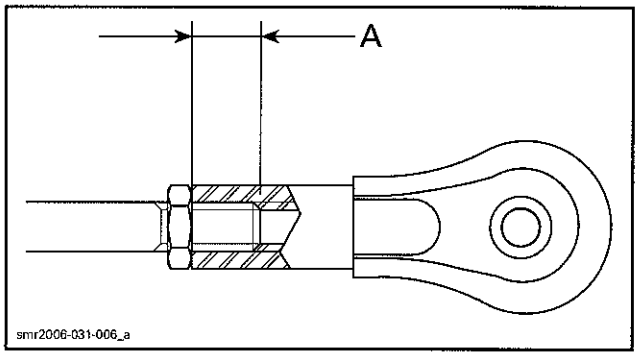
Pull cable inside hull and detach rope. Remove it from watercraft.

Steering Cable Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Using the small rope, pull cable through engine compartment.

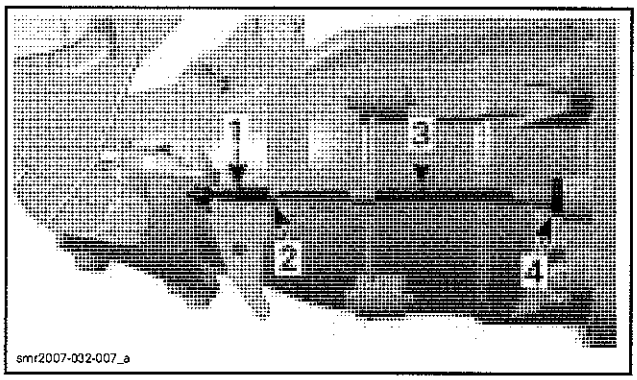
The threaded portion of steering cable inserts into ball joint should have between 8 and 10 mm (5/16 and 25/64 in).



A. 8 to 10 mm (5/16 to 25/64 in)

Position the steering cable ball joint to the nozzle as per following illustration.

CAUTION: Ensure the ball joint is parallel (± 10°) to the nozzle arm.



TYPICAL
1. *Ball joint under nozzle arm*
2. *Ball joint jam nut*
3. *Steering cable*
4. *Steering cable nut*

Check steering alignment.

OFF-POWER ASSISTED STEERING (O.P.A.S.)

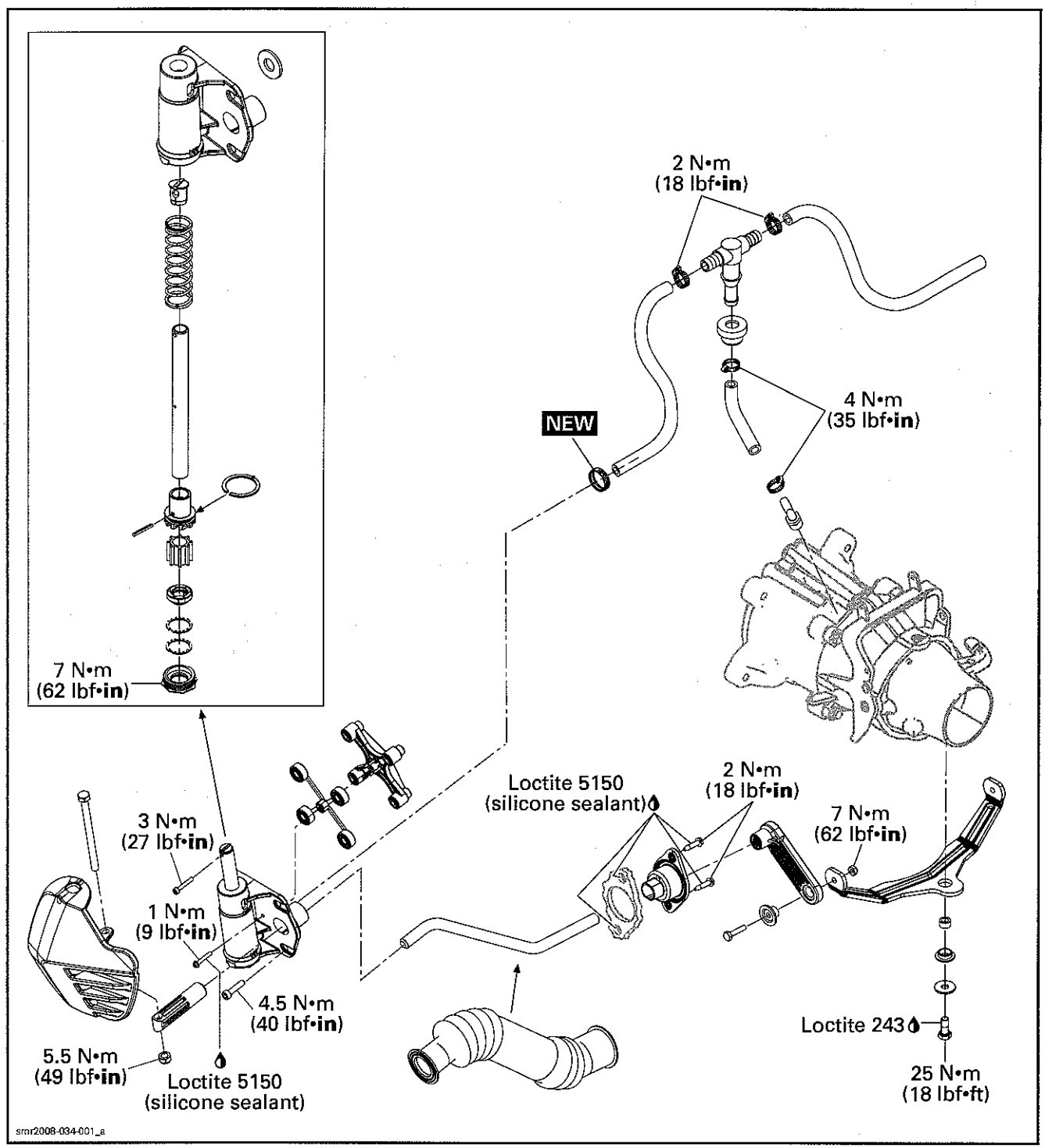
SERVICE TOOLS

Description	Part Number	Page
O.P.A.S. cylinder nut wrench	529 035 840	424–425

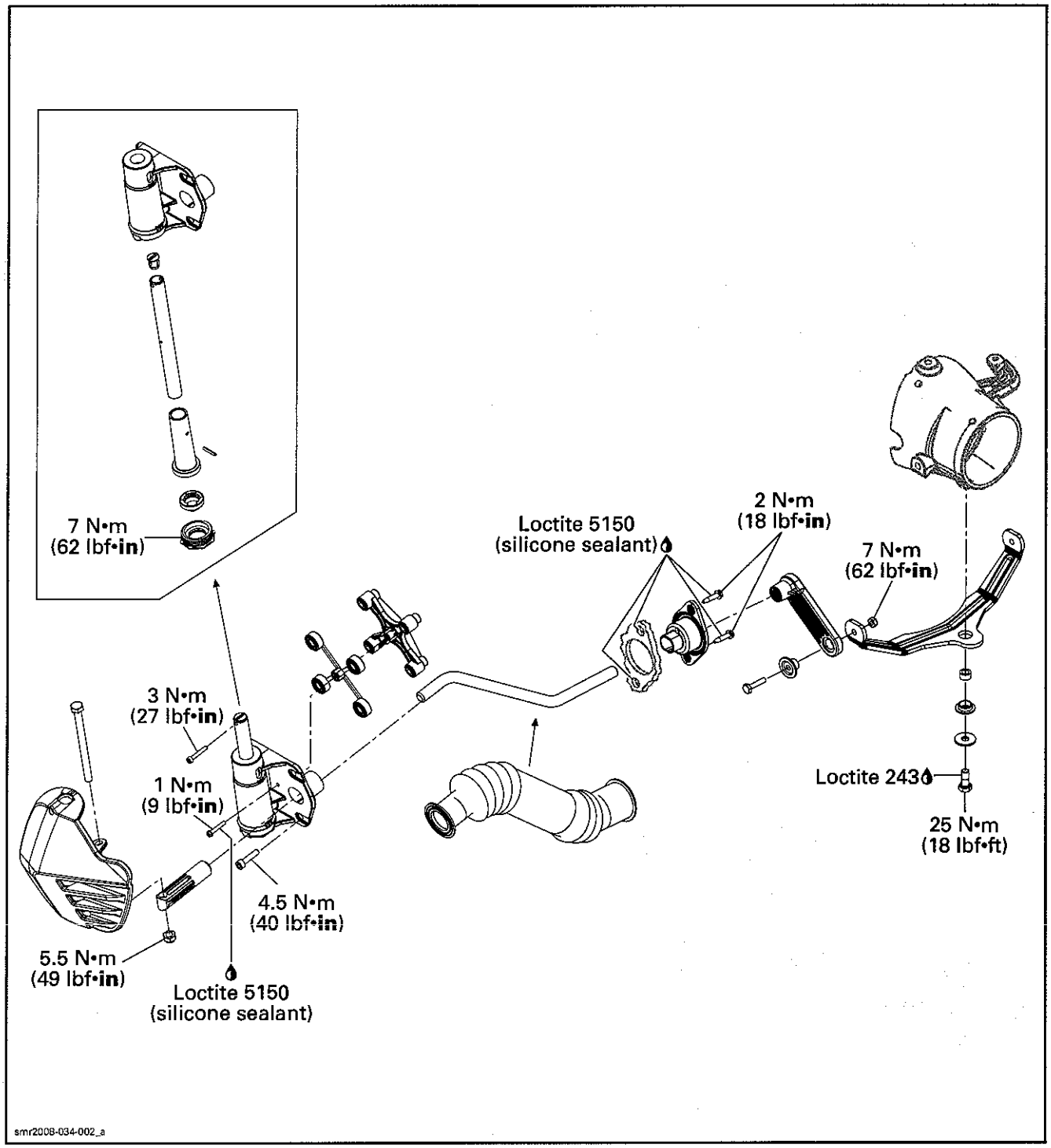
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 5150 (silicone sealant)	293 800 086	427–428

GTX and RXT Series



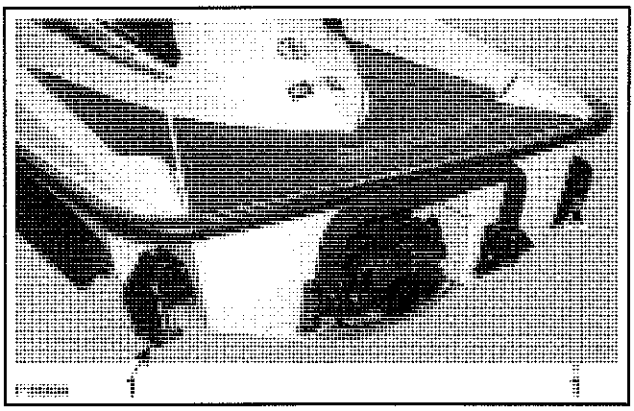
GTI and RXP Series



GENERAL

The Off-Power Assisted Steering (O.P.A.S.) uses a dual side vanes design that assists the watercraft steering in deceleration, to redirect watercraft path when steering is turned after throttle has been released or engine stopped.

The side vanes on the rear sides of the hull, turn as the steering is turned to assist the watercraft turning.

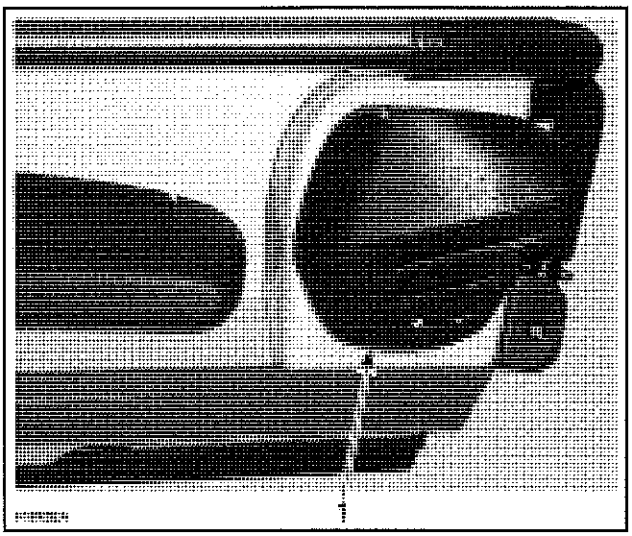


1. *Side vanes turn following steering movement*

GTX and RXT Series

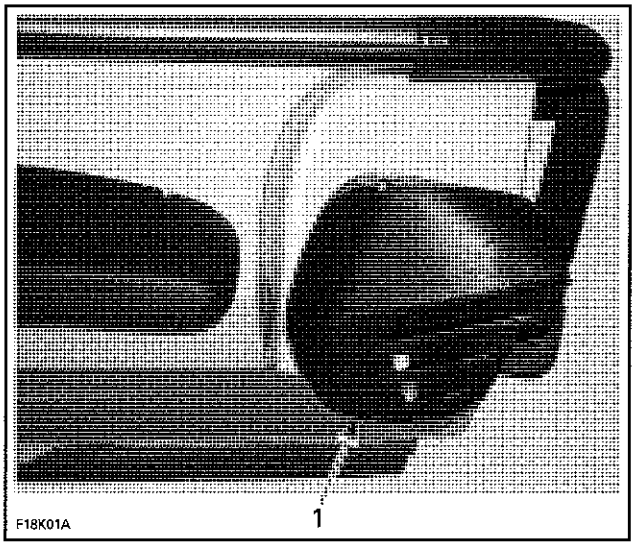
When engine is running at approximately 75% or more RPM, the side vanes are automatically raised to upper position since they are not required at that vehicle speed range.

Between 30% and 75% engine RPM, side vanes are gradually raised from lower position to upper position.



1. *Side vane in upper position*

When throttle is released and engine RPM drops, the side vanes are automatically lowered thus assisting steering control.



1. *Side vane in lower position*

GTI and RXP Series

These models do not have any vertical travel.

PROCEDURES

PLASTIC ELBOW

GTX and RXT Series

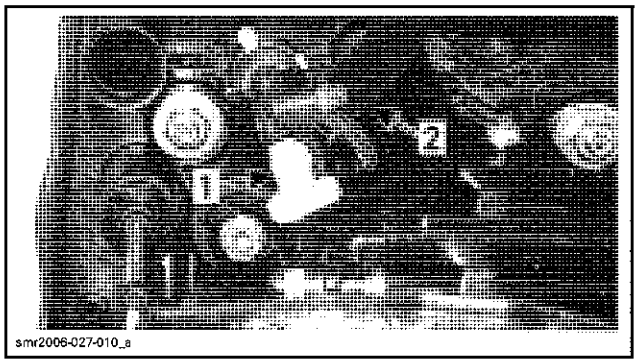
Plastic Elbow Inspection

Check plastic elbow cleanliness as per the maintenance chart recommendations. Replace or clean it as necessary.

Plastic Elbow Removal

Unplug O.P.A.S. hose from plastic elbow.

Unscrew plastic elbow.

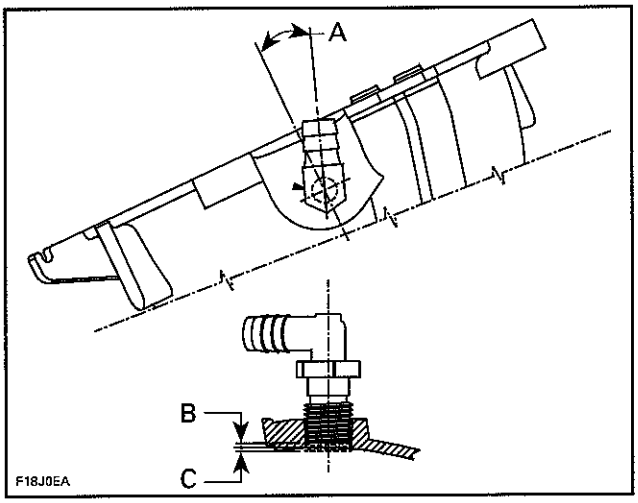


1. *Plastic elbow*
2. *O.P.A.S. hose*

Plastic Elbow Installation

Install plastic elbow at 23° ± 3° angle to the right.

It may exceed inside housing by 2.5 mm (.098 in). It may be positioned up to 2.0 mm (.078 in) from housing edge.



A. 23° ± 3°
B. 2.0 mm (.078 in)
C. 2.5 mm (.098 in)

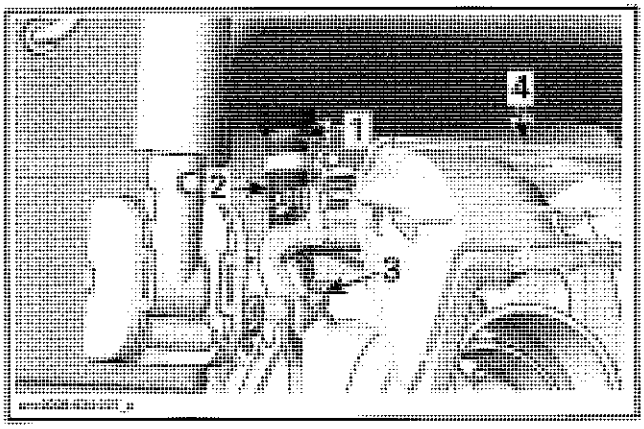
Plug O.P.A.S. hose to plastic elbow.

T-FITTING

GTX and RXT Series

T-Fitting Removal

Disconnect O.P.A.S. hose from T-fitting.



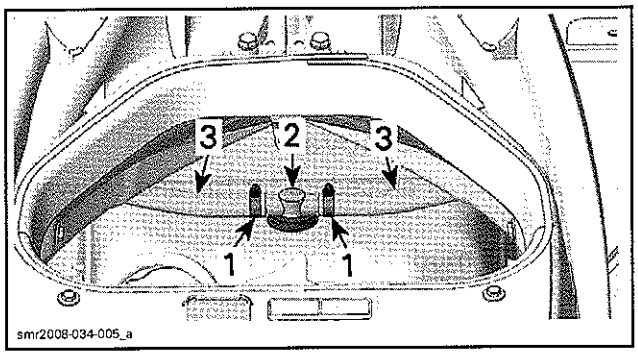
1. T-fitting
2. O.P.A.S. hose
3. Plastic elbow
4. Reverse gate

On **RXT 255 models**, remove the intercooler. Refer to *INTERCOOLER 255 ENGINE* section.

On **GTX models**, remove the muffler hose. Refer to *EXHAUST SYSTEM* section.

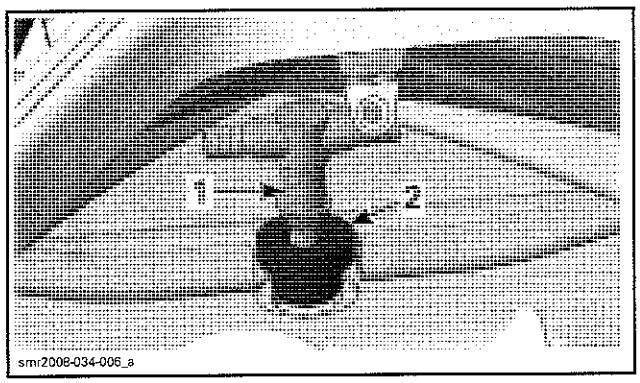
Loosen gear clamps securing water hoses on T-fitting.

Remove water hoses from T-fitting.



1. Gear clamps
2. T-fitting
3. Water hoses

Pull T-fitting and rubber grommet in the bilge.



1. T-fitting
2. Rubber grommet

T-Fitting Inspection

Check T-fitting for cracks or other damages. Replace if necessary.

Check the condition of:

- O.P.A.S. hose
- Water hoses.

Replace defective part.

T-Fitting Installation

Installation is the reverse process of removal. However, pay attention to the following.

Install the rubber grommet first.

Push the T-fitting through rubber grommet.

Install and tighten water hoses on T-fitting.

Install and tighten O.P.A.S. hose.

Install all other removed parts.

WATER HOSE

GTX and RXT Series

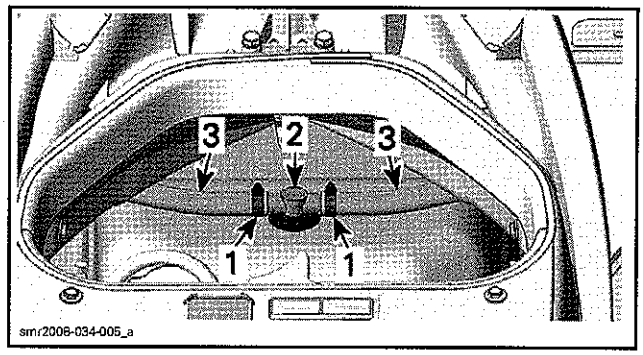
Water Hose Removal

NOTE: Removal procedure for RH and LH water hose is same.

On **RXT 255 models**, remove the intercooler. Refer to *INTERCOOLER 255 ENGINE* section.

Loosen gear clamps securing water hoses on T-fitting.

Remove water hoses from T-fitting.



1. *Gear clamps*
2. *T-fitting*
3. *Water hoses*

Remove *CYLINDER*, see further in this section for the procedure.

Pull out the water hose from exterior.

Water Hose Installation

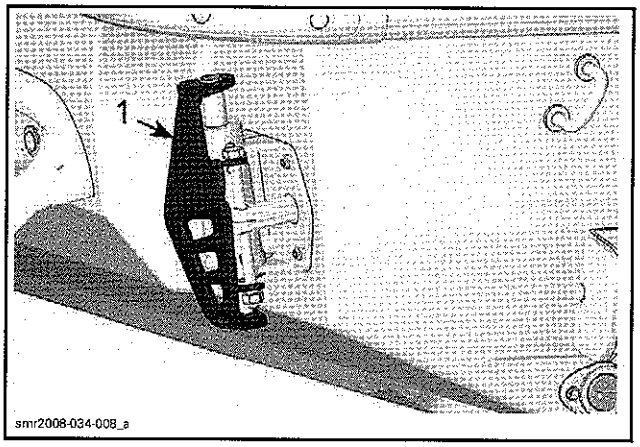
Installation is the reverse process of removal. However, pay attention to the following.

Install water hose on cylinder using a **NEW** Oetiker clamp.

Install the cylinder.

Install water hose to T-fitting and tighten gear clamp to 1.5 N•m (13 lbf•**in**).

SIDE VANE

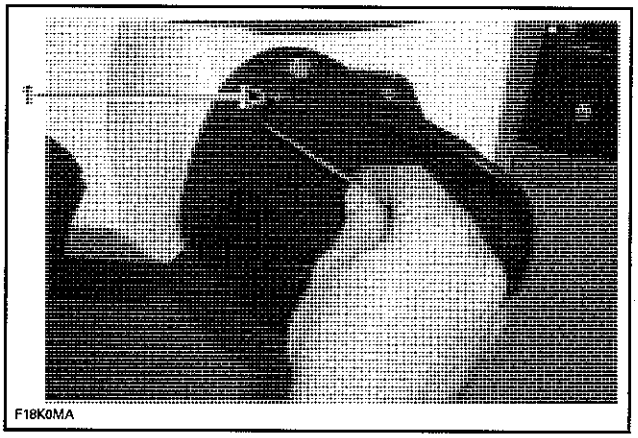


1. *LH side vane*

Side Vane Removal

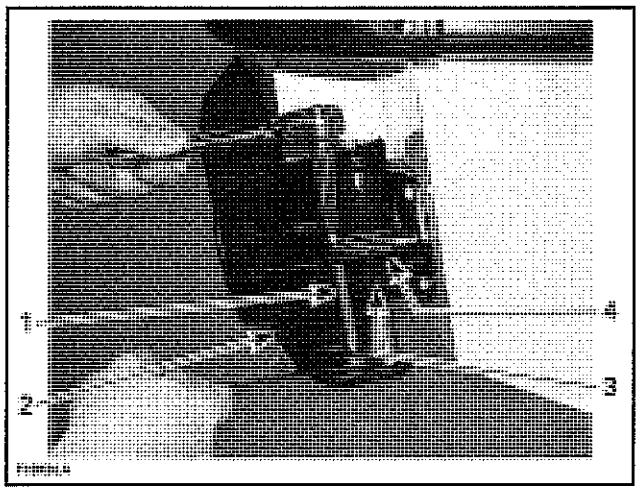
NOTE: Removal procedure for RH and LH side vane is same.

Remove socket screw.



1. *Socket screw*

Remove the tie-rod screw.



1. Tie rod screw
2. Side vane
3. Cylinder support
4. Tie rod fitting

Lift the pivot shaft to disengage the bottom of the side vane.

Disengage the top of side vane to remove it.

Side Vane Installation

Installation is the reverse process of removal.

Install the tie-rod screw. Do not torque yet.

Perform the tie-rod fitting adjustment as described below.

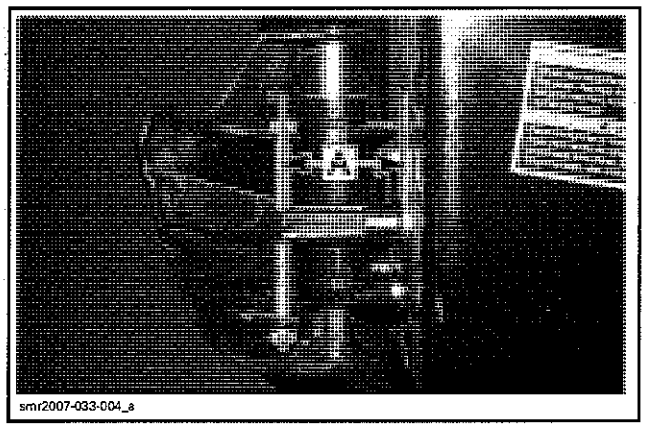
Side Vane Adjustment

During tie-rod fitting adjustment, tie-rod screw must be loose and socket screw removed.

Put the steering in straight ahead position.

Measure the portion of tie rod fitting exceeding from cylinder support.

The exceeding distance of tie rod fitting from the cylinder support should be 38 ± 1 mm (1.50 ± .04 in).



A. 38 ± 1 mm (1.50 ± .04 in)

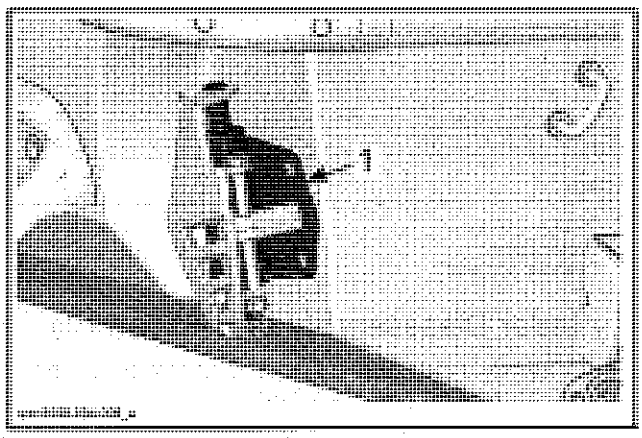
To adjust the tie-rod fitting, remove tie-rod screw and turn tie-rod fitting. Place tie-rod screw in its place and measure again. Repeat the procedure until the distance is reached.

When the adjustment is done, torque the tie-rod screw to 5.5 N•m (49 lbf•**in**).

Install socket screw and torque it to 3 N•m (27 lbf•**in**).

NOTE: The socket screw should be turned 2-3 turns before using a tool.

CYLINDER



1. LH cylinder

Cylinder Removal

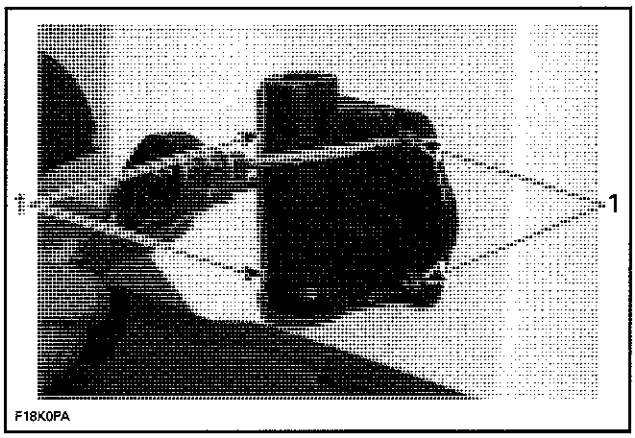
NOTE: To disassemble the cylinder, it is not required to remove it from vehicle. See *CYLINDER DISASSEMBLY AND ASSEMBLY* procedure.

Removal procedure for RH and LH cylinder assembly is the same.

Remove side vane as mentioned above.

Unscrew tie rod fitting from tie rod.

Unscrew 4 socket screws. Discard them.

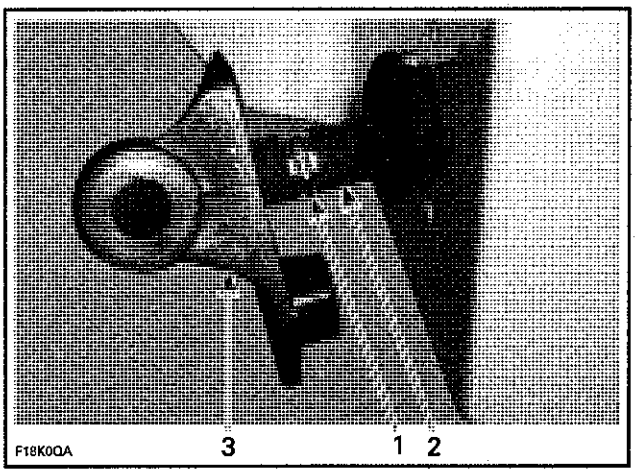


1. Socket screws

Pull cylinder to remove it.

GTX and RXT Series

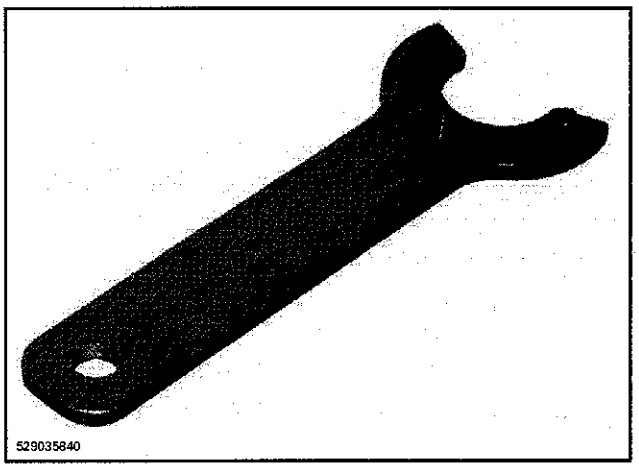
Remove Oetiker clamp to remove water hose from the cylinder.

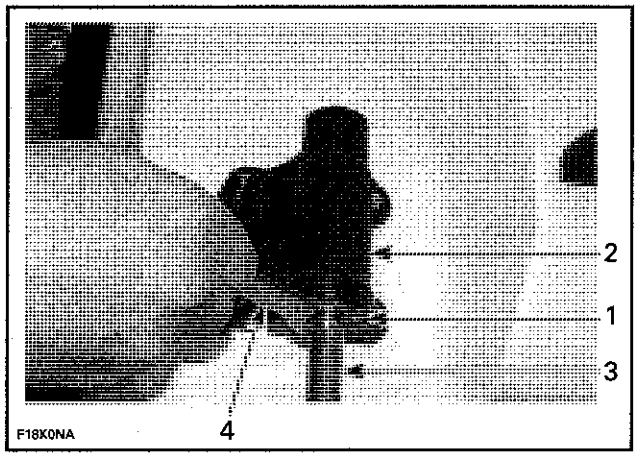


1. *Oetiker clamp*
2. *Water hose*
3. *Cylinder support*

Cylinder Disassembly and Assembly

Unscrew cylinder cap using the O.P.A.S. cylinder nut wrench (P/N 529 035 840).

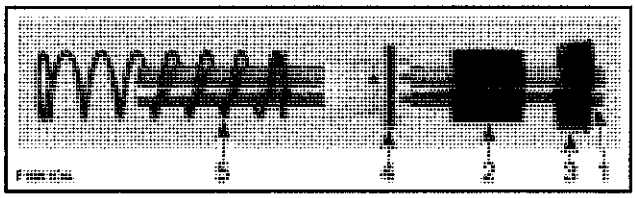




1. *Cylinder cap*
2. *Cylinder support*
3. *Pivot rod*
4. *O.P.A.S. cylinder nut wrench*

Remove cylinder assembly out of cylinder support.

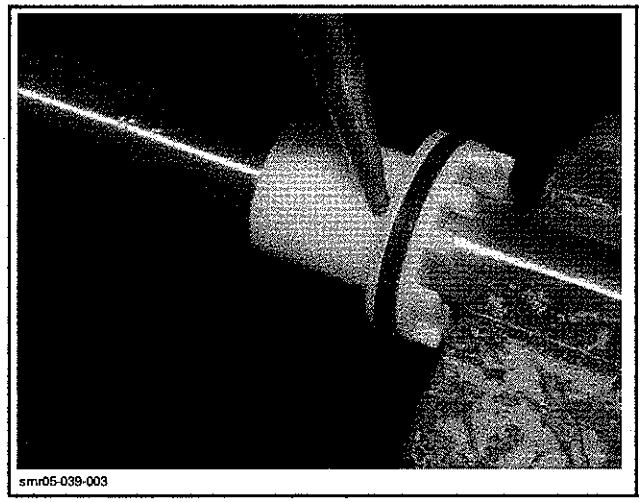
GTX and RXT Series



1. *Pivot rod*
2. *Spacer*
3. *Cylinder cap*
4. *Piston*
5. *Spring*

Remove the spring.

Remove the spring pin from piston and pivot rod.



Remove the piston. Discard it.

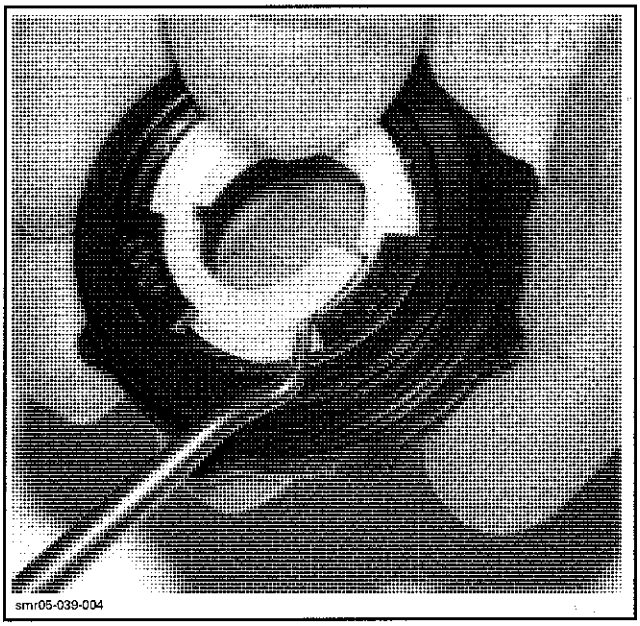
NOTE: Due to the presence of split rings around the piston, it must be replaced each time when removed for proper cylinder functionality.

Check pivot rod for cracks or scratches. Replace it, if necessary.

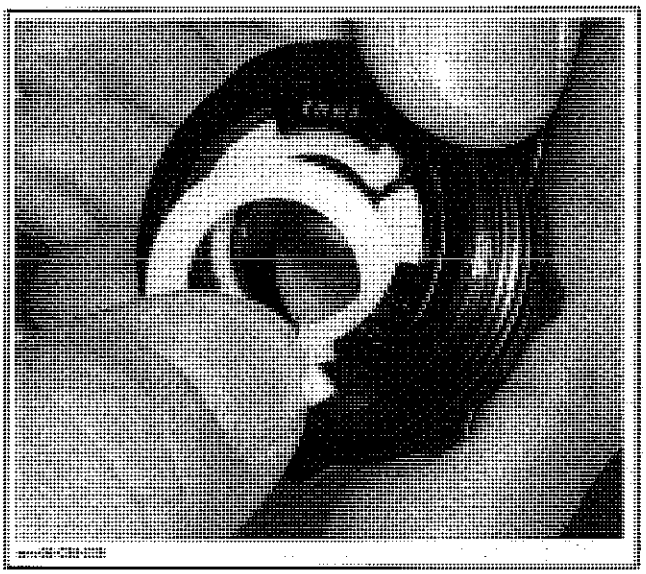
Install a new piston with a new spring pin.

Before assembly, it will be necessary to change the split rings inside cylinder cap. Do the following:

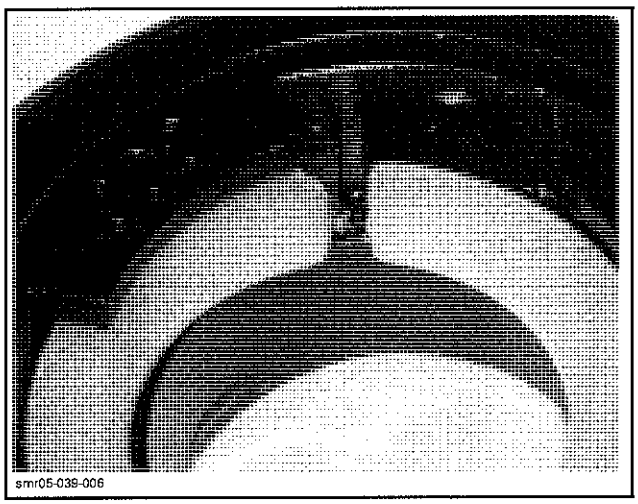
– To remove the upper split ring, lift one end over the cap tab.



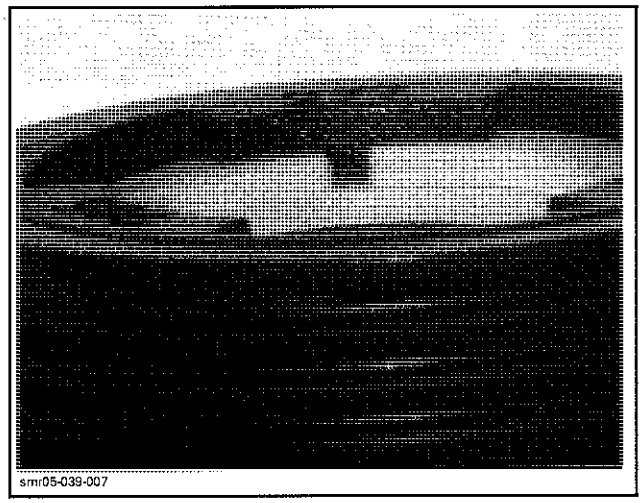
– Turn the split ring to remove it from cap.



– Repeat the same procedure for the lower split ring.
– Install new split rings into cylinder cap. The opening of each split ring must be aligned with the appropriate lock inside cap.



LOWER SPLIT RING



UPPER SPLIT RING

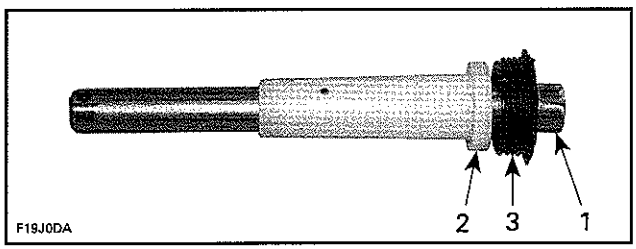
Install removed parts in the cylinder.

Using the O.P.A.S. cylinder nut wrench (P/N 529 035 840) torque the cylinder cap to 7 N•m (62 lbf•**in**). After tightening, keep turning the cap until the locking tab goes over the stopper.

GTI and RXP Series

The cylinder disassembly is not necessary for these models.

Check pivot rod for cracks or scratches. Replace pivot rod, if necessary.



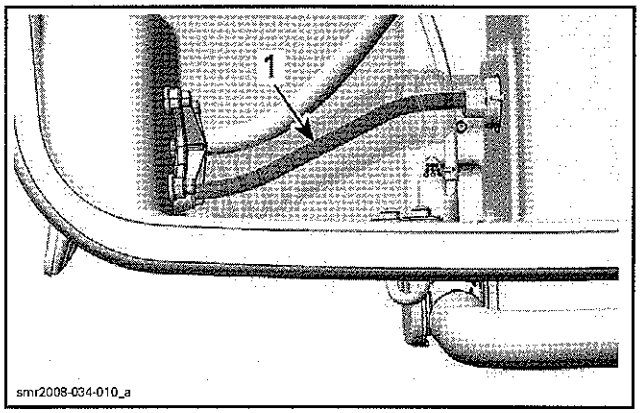
1. *Pivot rod*
2. *Spacer*
3. *Cylinder cap assembly*

Cylinder Installation

The installation is the reverse of the removal procedure. However, pay attention to the following detail.

Perform the tie-rod fitting adjustment. See above.

TIE ROD



UNDER DECK (REMOVED FOR CLARITY)
1. LH tie-rod (inside sealed tube)

Tie Rod Removal

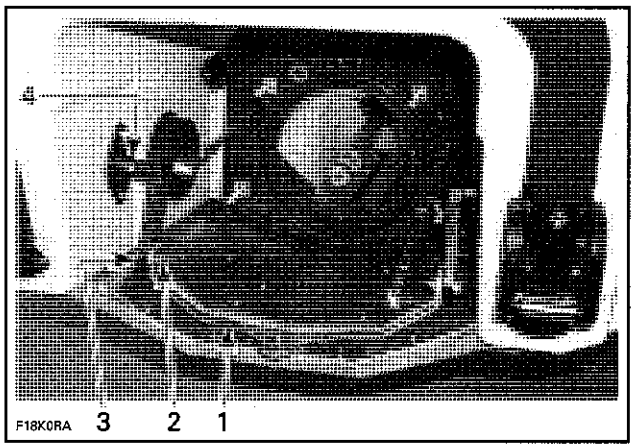
NOTE: Removal procedure for RH and LH tie rod is same.

Remove side vane and cylinder support as mentioned above.

Remove O.P.A.S. U lever screw, flat washer, bushing and venturi bushing from nozzle.

Remove jet pump. Refer to *JET PUMP* section.

Remove screw securing the O.P.A.S. U lever to tie rod connecting lever.



TYPICAL
1. U lever
2. Screw
3. Tie rod connecting lever
4. Tie rod

Pull tie rod out from jet pump side with the sealed tube.

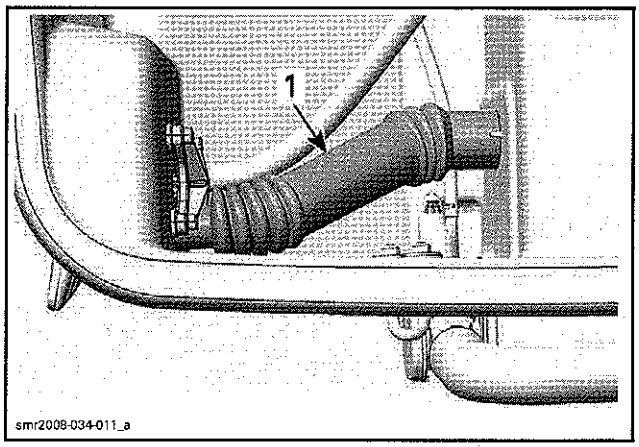
Unscrew lever from the tie rod.

Tie Rod Installation

Installation is the reverse process of removal. However, pay attention to the following.

Install all screws before tighten them.

SEALED TUBE



1. LH sealed tube

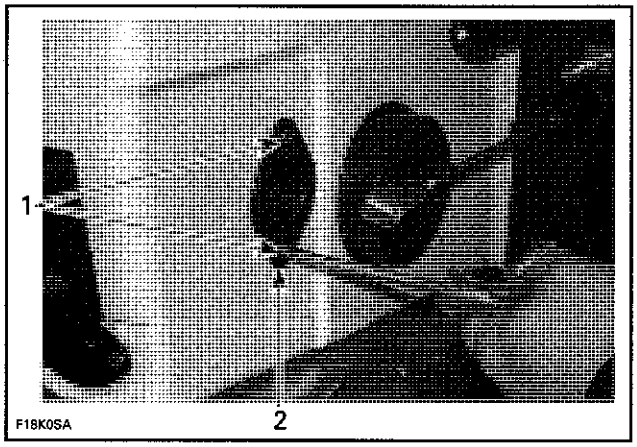
Sealed Tube Removal

Removal procedure for RH and LH sealed tube is same.

Remove side van, cylinder housing and O.P.A.S. U lever as mentioned above.

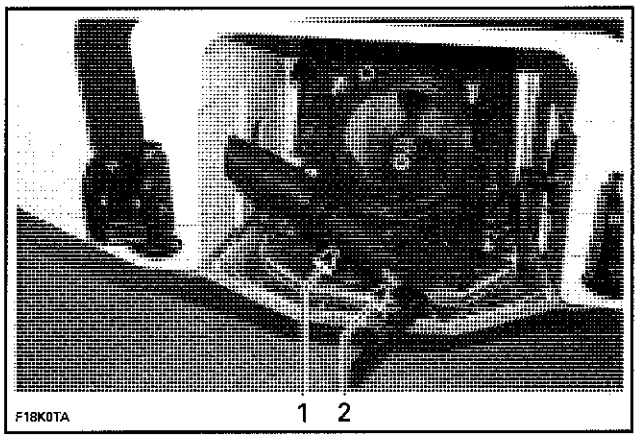
Remove jet pump (refer to *JET PUMP*) section.

Remove Phillips screws and remove rod grommet.



1. Phillips screws
2. Rod grommet

Pull sealed tube out with tie rod from inside of bilge towards jet pump side.



TYPICAL
1. Sealed tube
2. Tie rod

Remove old silicone sealant around screws holes.

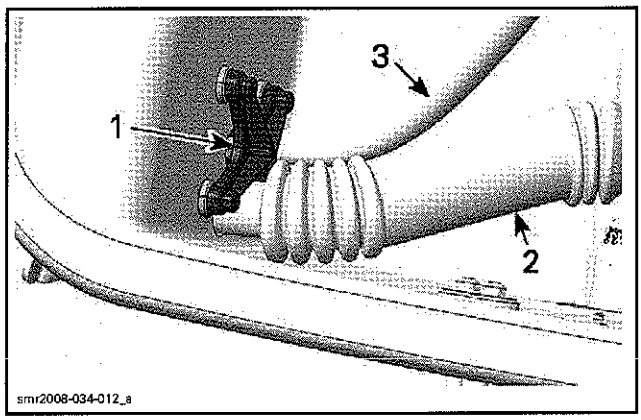
Sealed Tube Installation

Installation is the reverse process of removal.

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on the screws before installing and, inside the hull, around screw holes after torquing.

Torque Phillips screws to 2 N•m (18 lbf•**in**).

CROSS SUPPORT PLATE



1. LH cross plate support
2. Sealed tube
3. Water hose

Plate Removal

For LH Side Cross Support Plate

Remove inlet hose, exhaust pipe and muffler (refer to *EXHAUST SYSTEM*).

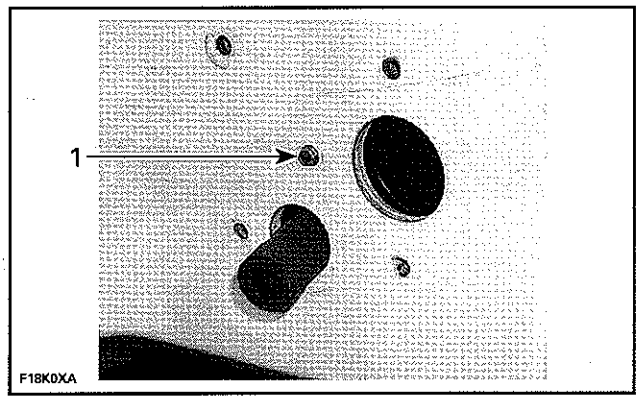
For RH Side Cross Support Plate

Remove resonator (refer to *EXHAUST SYSTEM*).

NOTE: Use the same procedure for the RH or the LH cross support plate.

Remove side vane and cylinder support as mentioned above.

Unscrew the screw retaining cross support plate to hull.



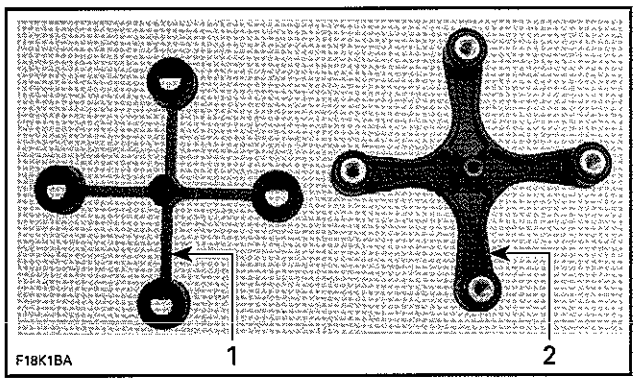
TYPICAL — GTX MODEL SHOWN
1. Remove screw

Remove cross support plate from the inside of bilge.

Plate Inspection

Check for cracks and deterioration of screw threads on cross support plate, replace if necessary.

Verify the condition of gasket before installation, replace if necessary.

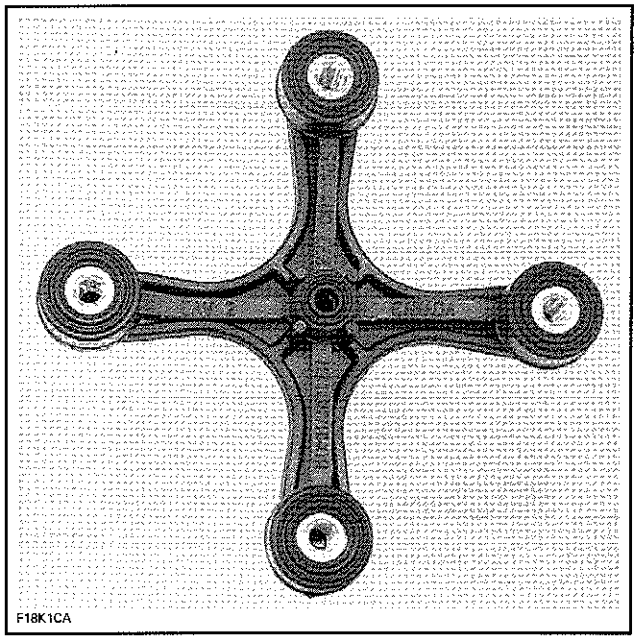


1. Gasket
2. Support plate

Plate Installation

Installation is the reverse process of removal procedure, however pay attention to the following:

Install the gasket on the cross support plate.



GASKET INSTALLED ON SUPPORT PLATE

From inside the bilge, install the cross support plate. Place the gasket against the hull then align the holes.

Apply Loctite 5150 (silicone sealant (P/N 293 800 086) on cross plate support screw.

Install the screw and tighten it to 1 N•m (9 lbf•**in**).

Install all other removed parts.

BODY

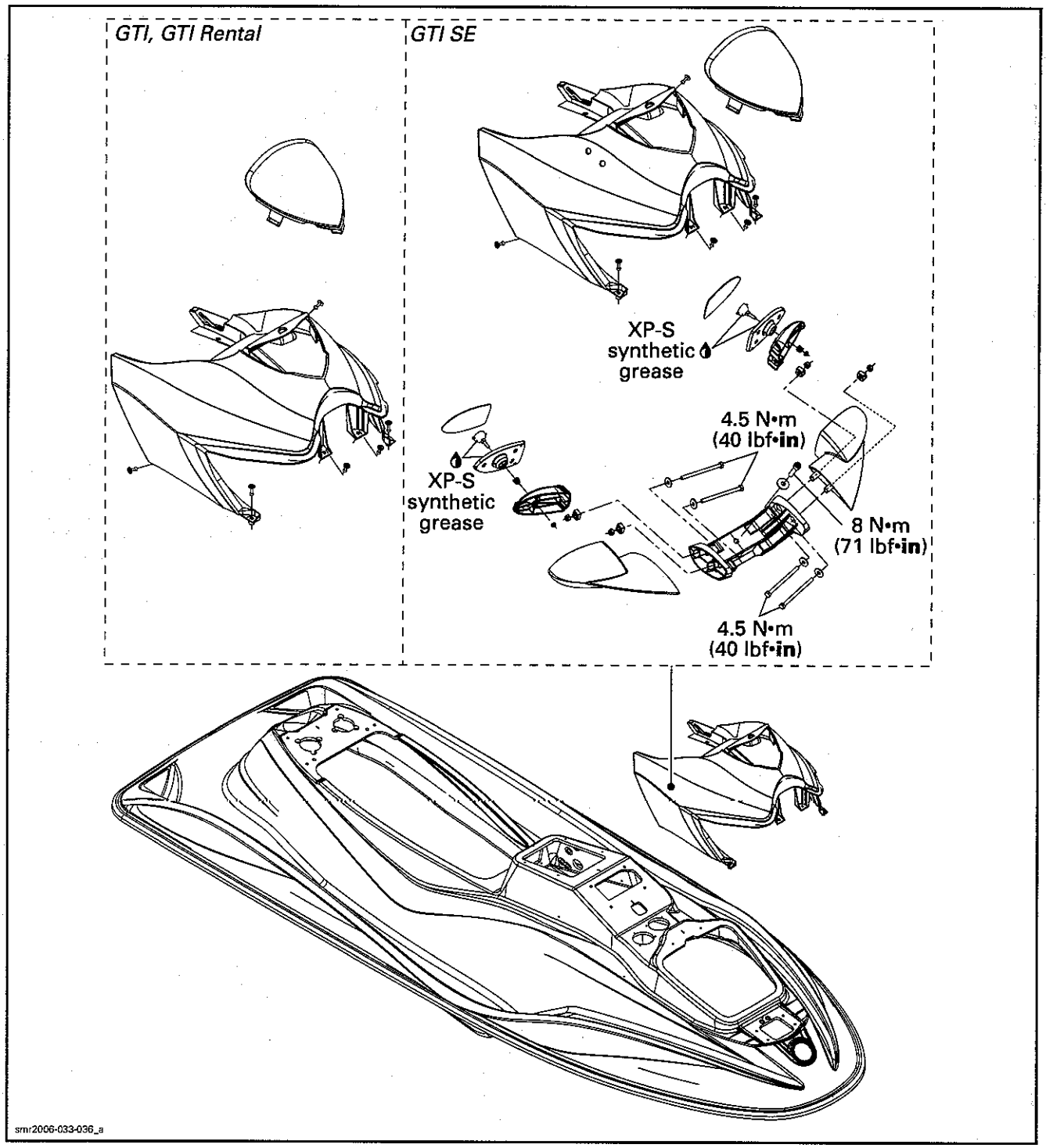
SERVICE TOOLS

Description	Part Number	Page
Supertanium™ drill bit	529 031 800	451, 464

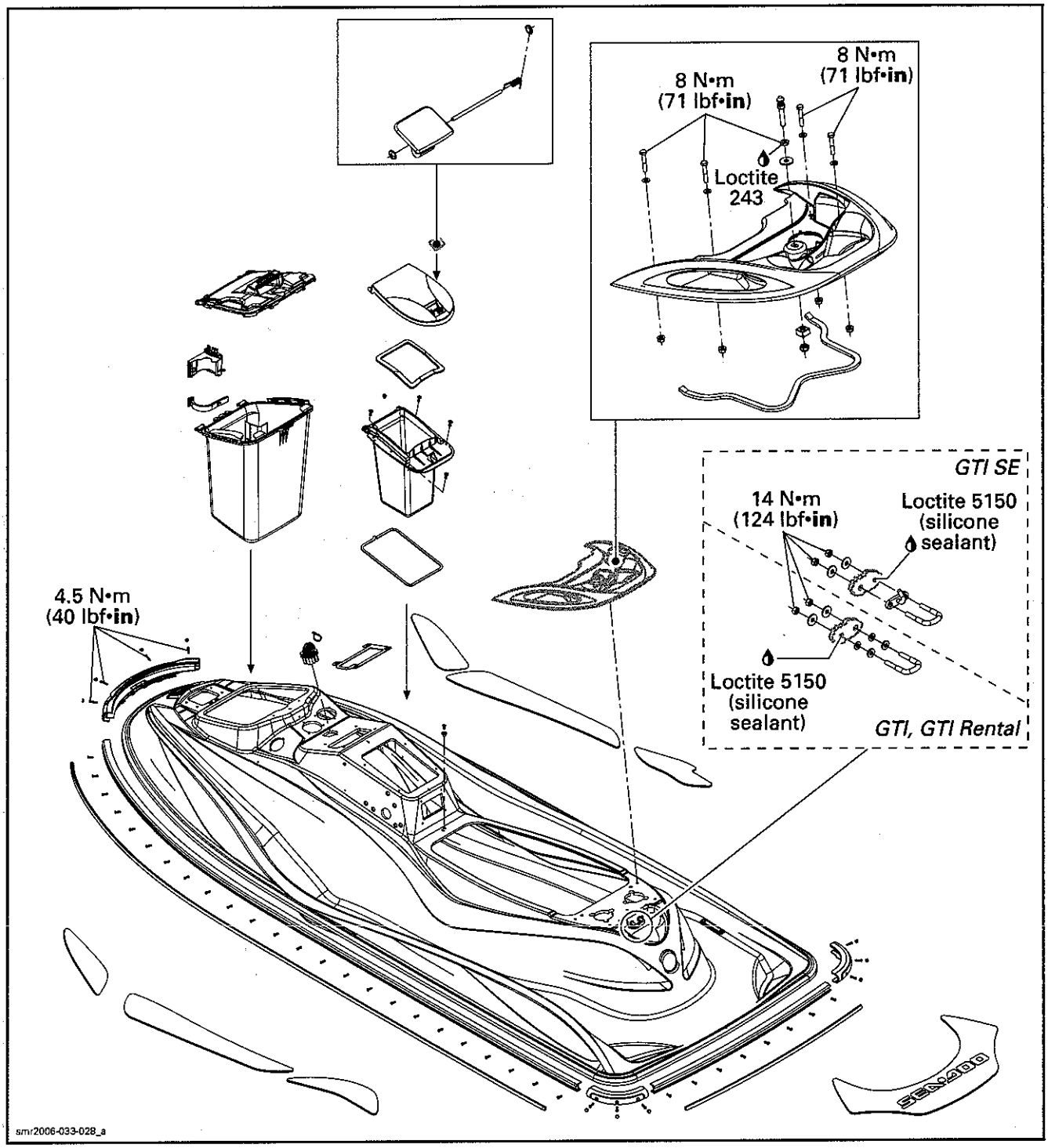
SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic grease	293 550 010	468–469
Loctite 243 (blue)	293 800 060	454
BRP Plastic & Vinyl Cleaner	413 711 200	453

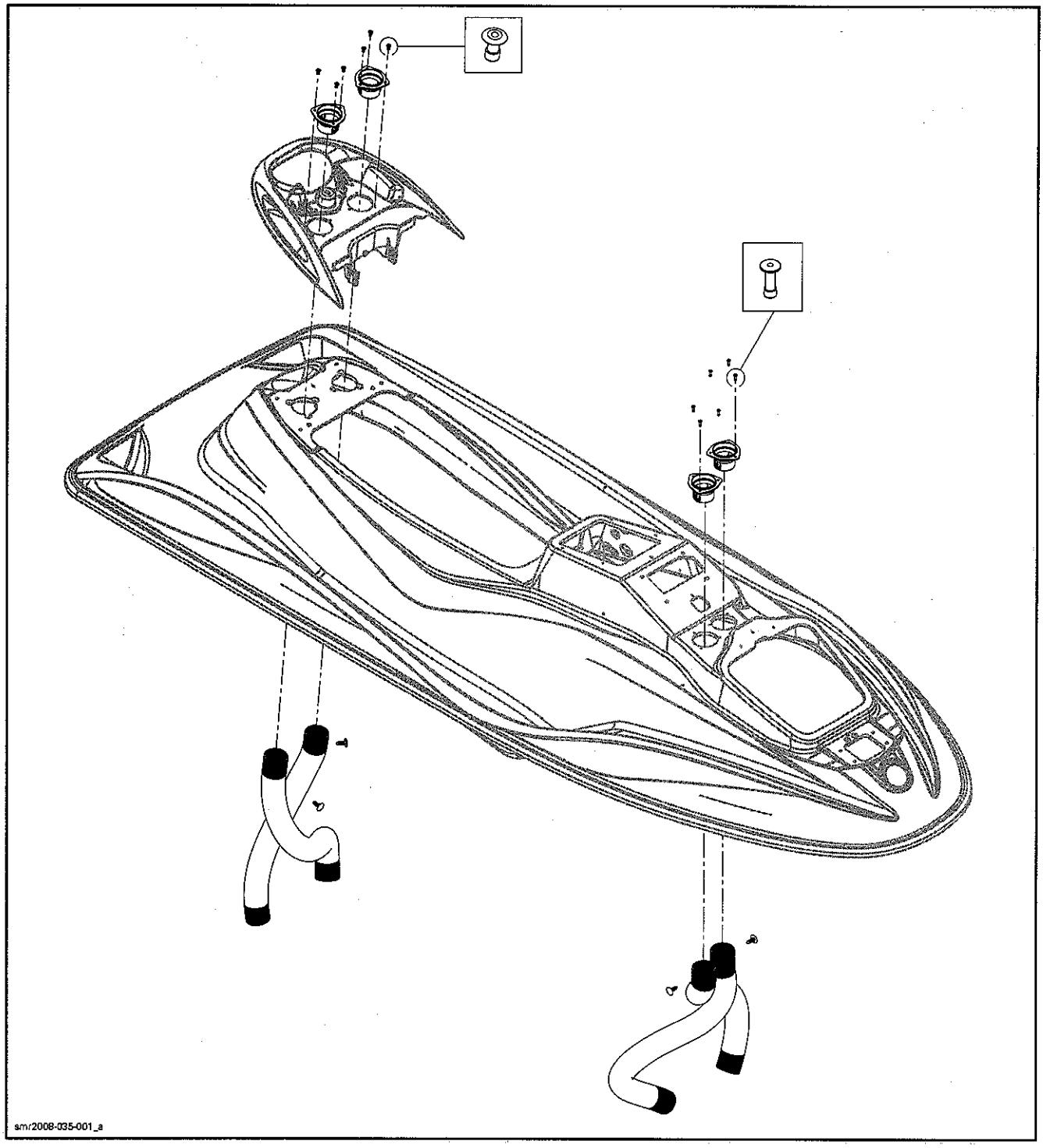
GTI Models (Body Front View)



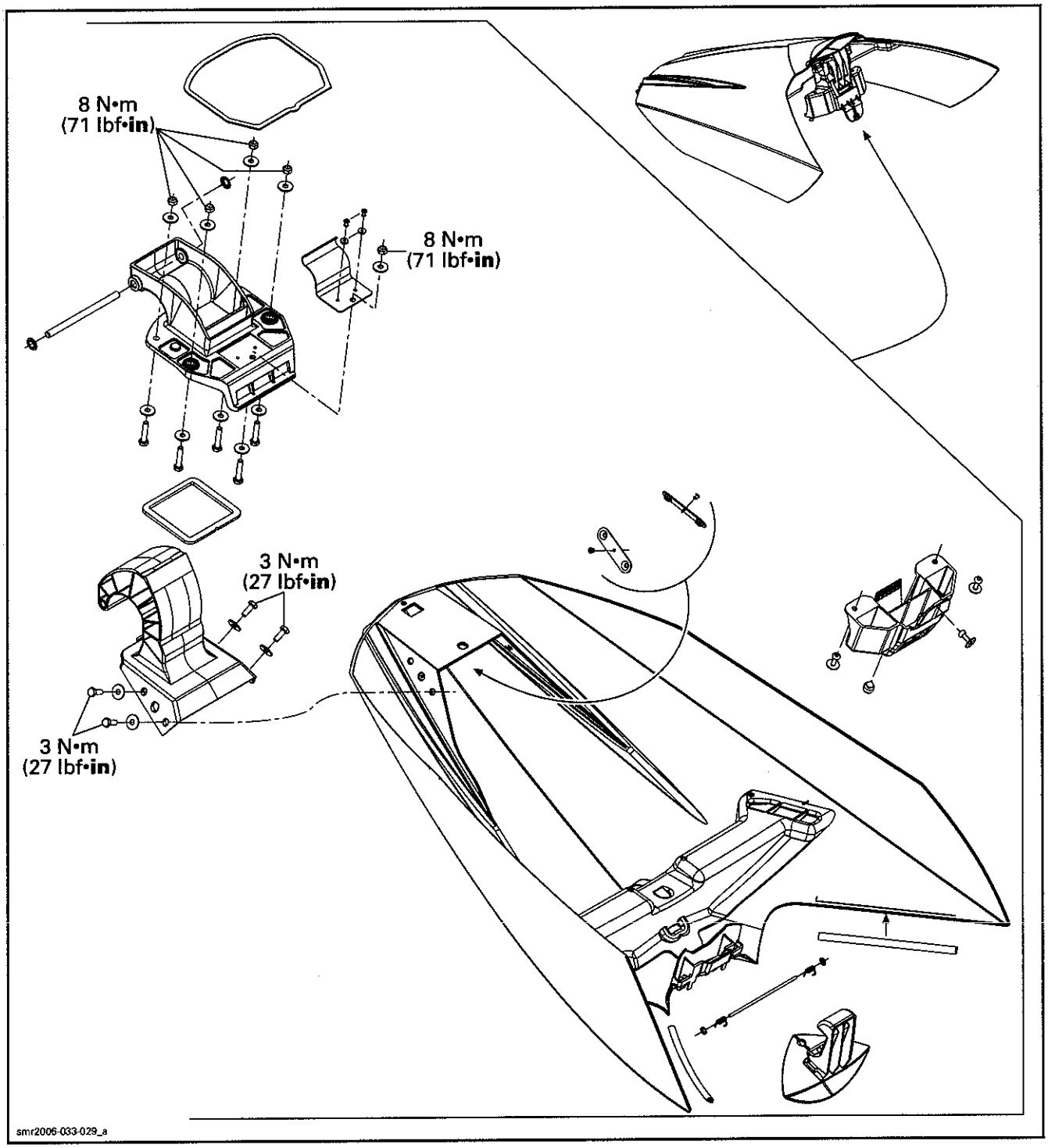
GTI Models (Body Rear View)



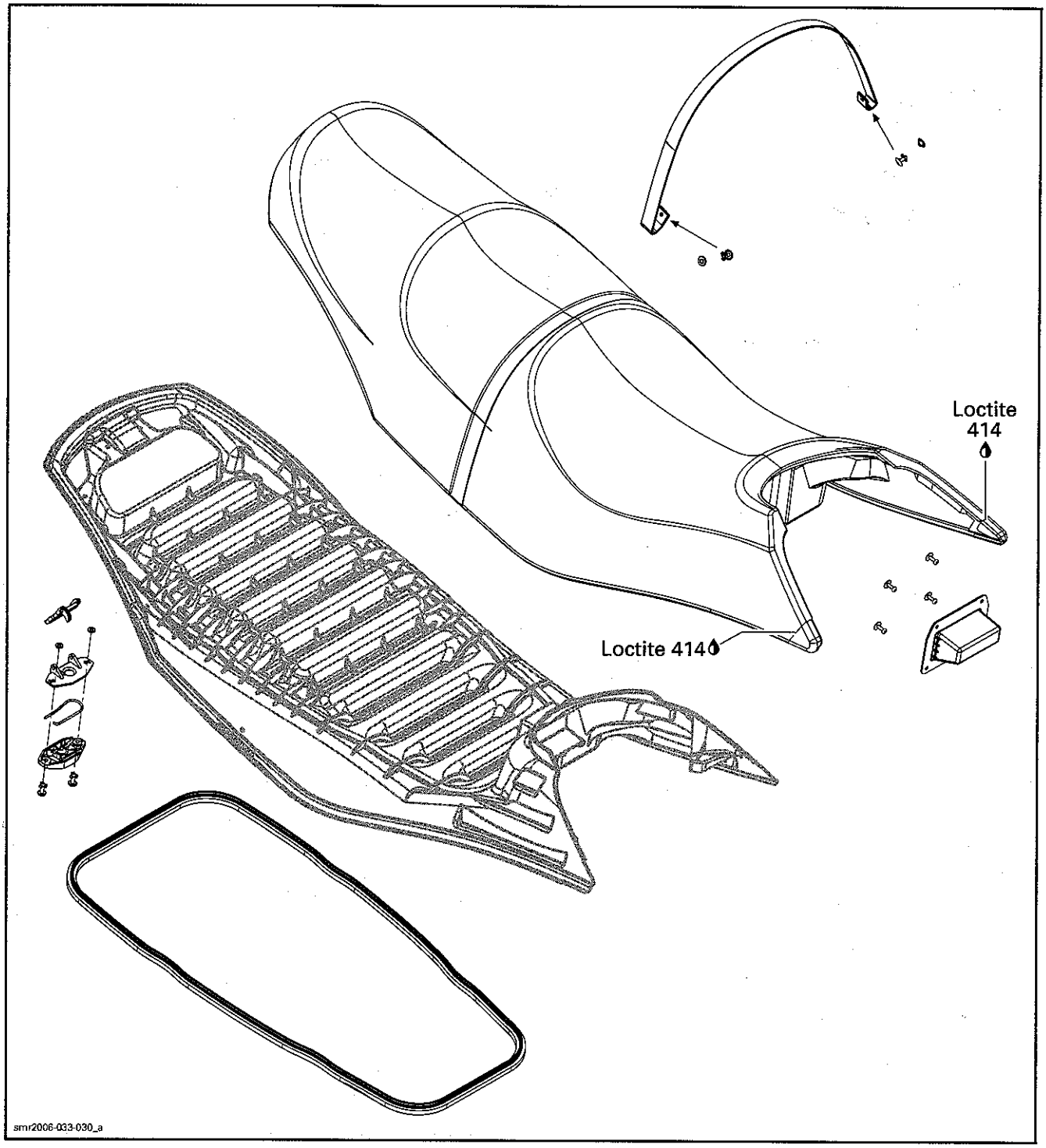
GTI Models (Ventilation)



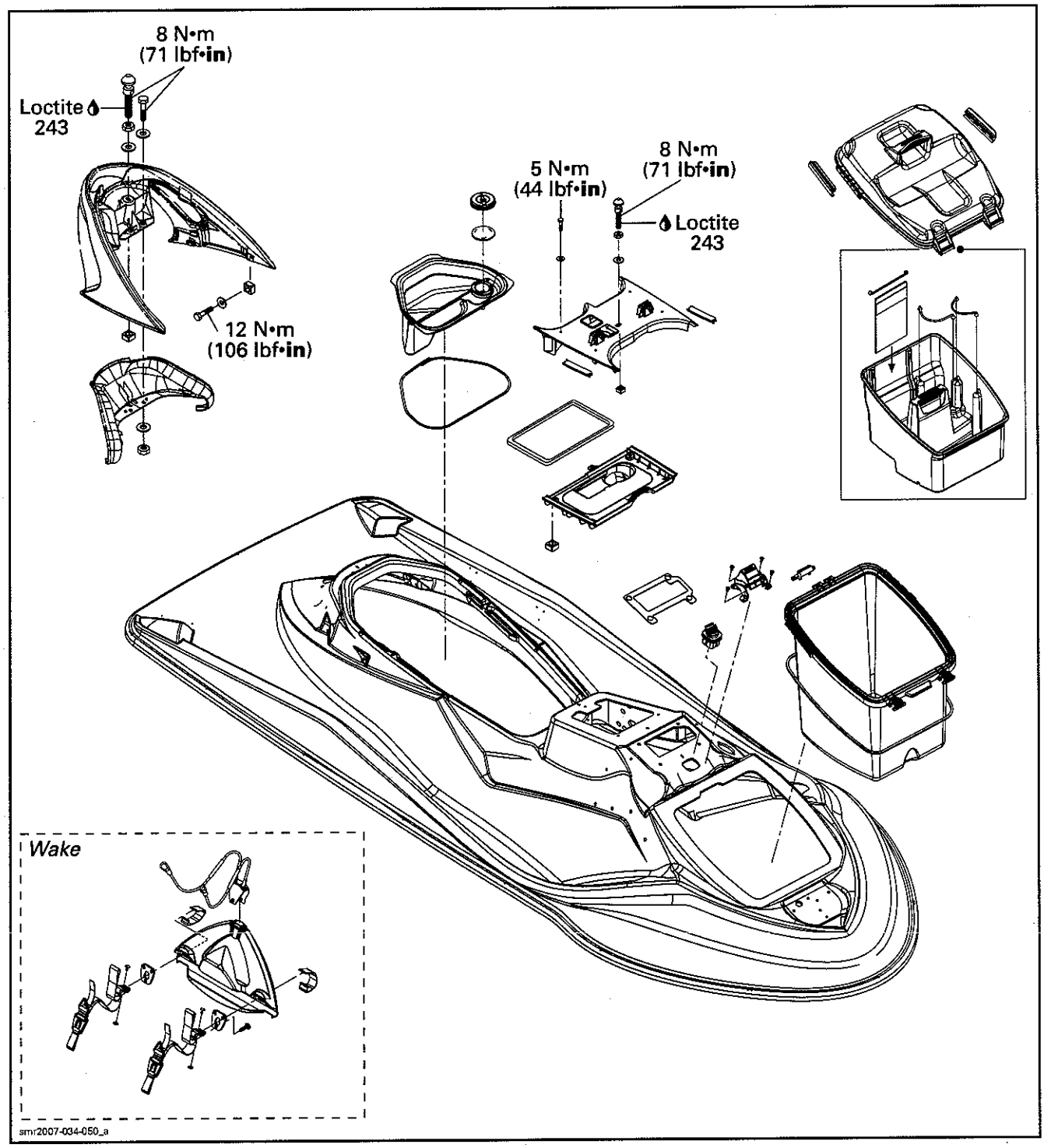
GTI Models (Front Storage Compartment)



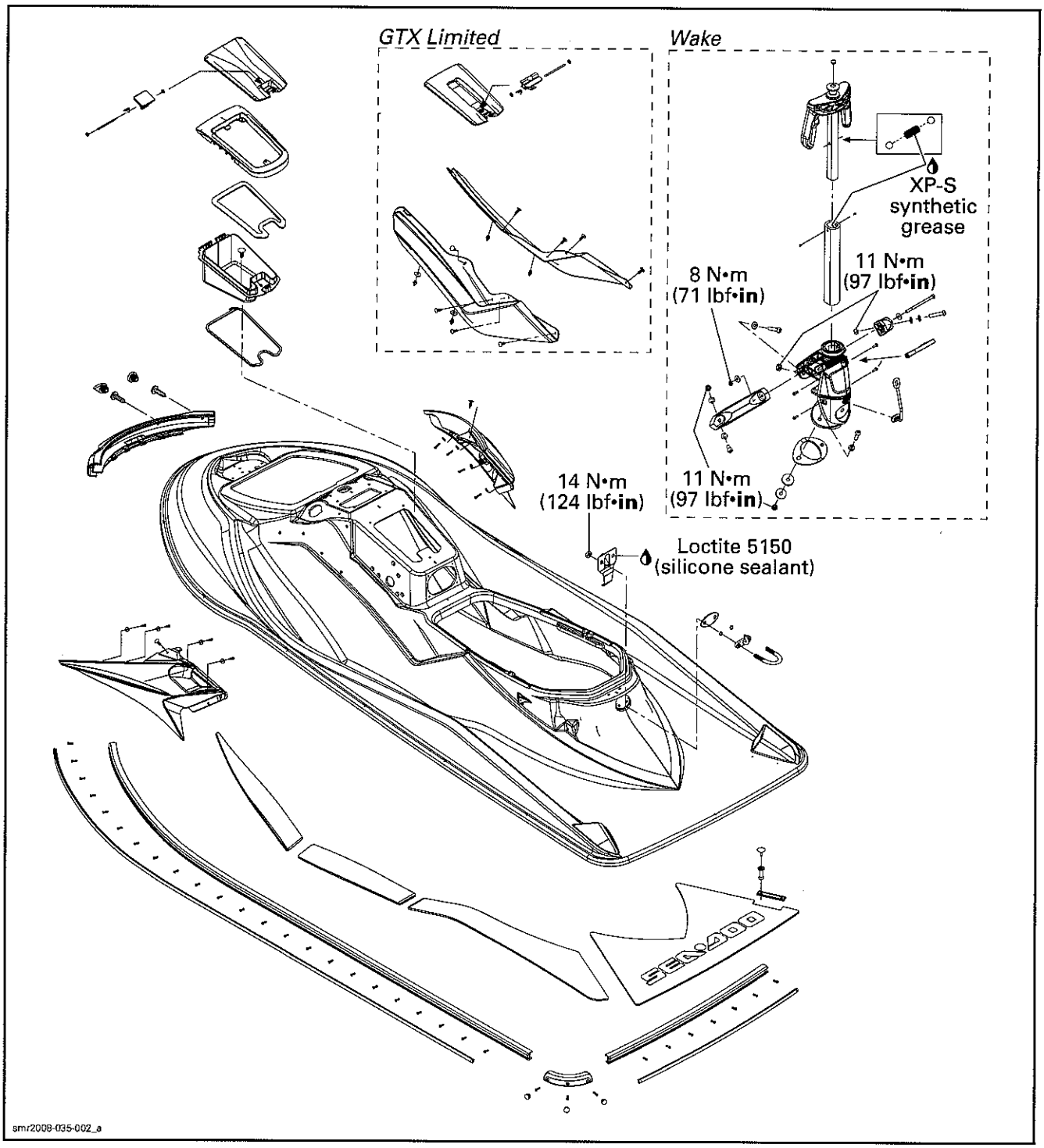
GTI Models (Seats)



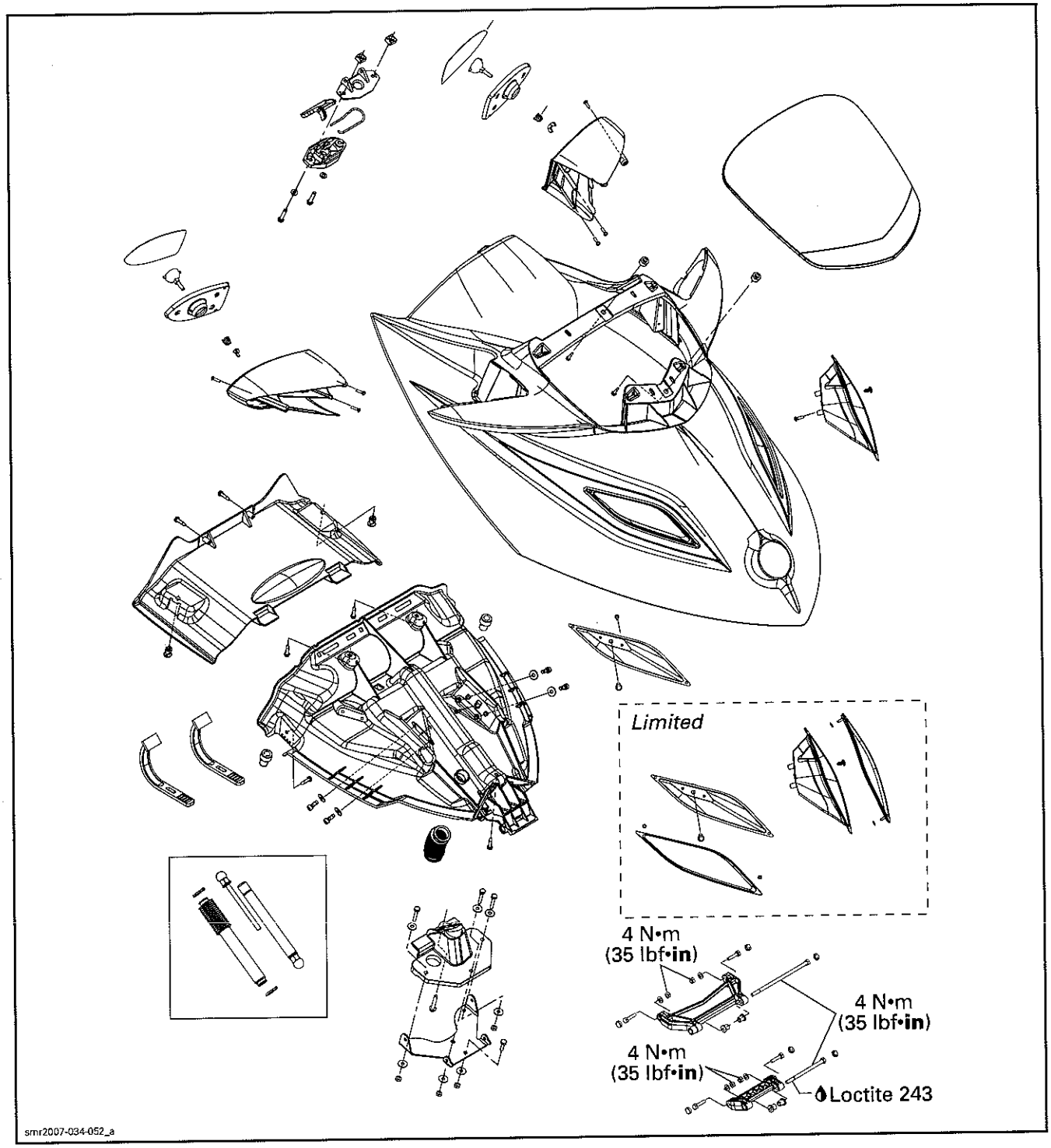
GTX and WAKE Models (Body Front View)



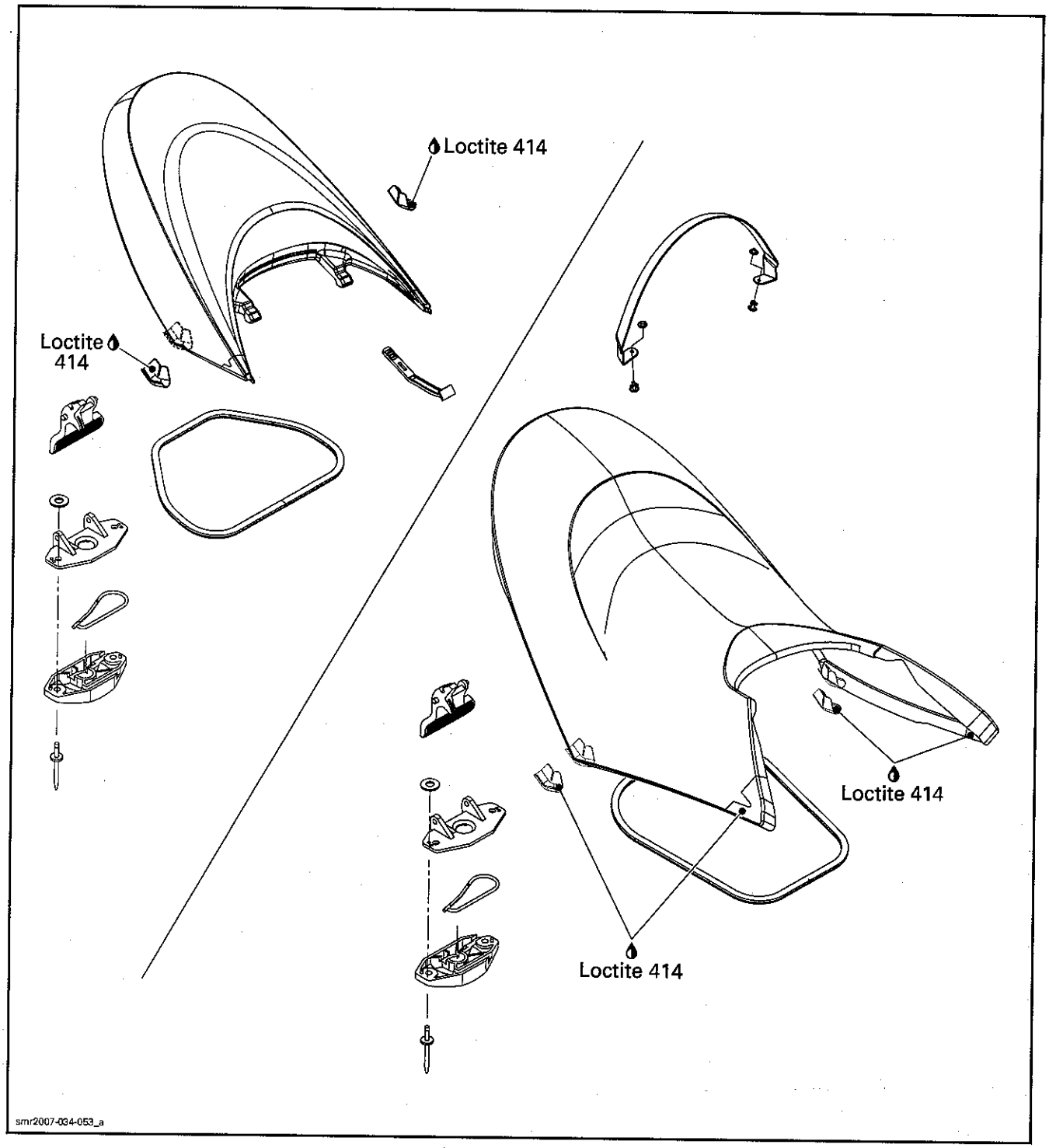
GTX and WAKE Models (Body Rear View)



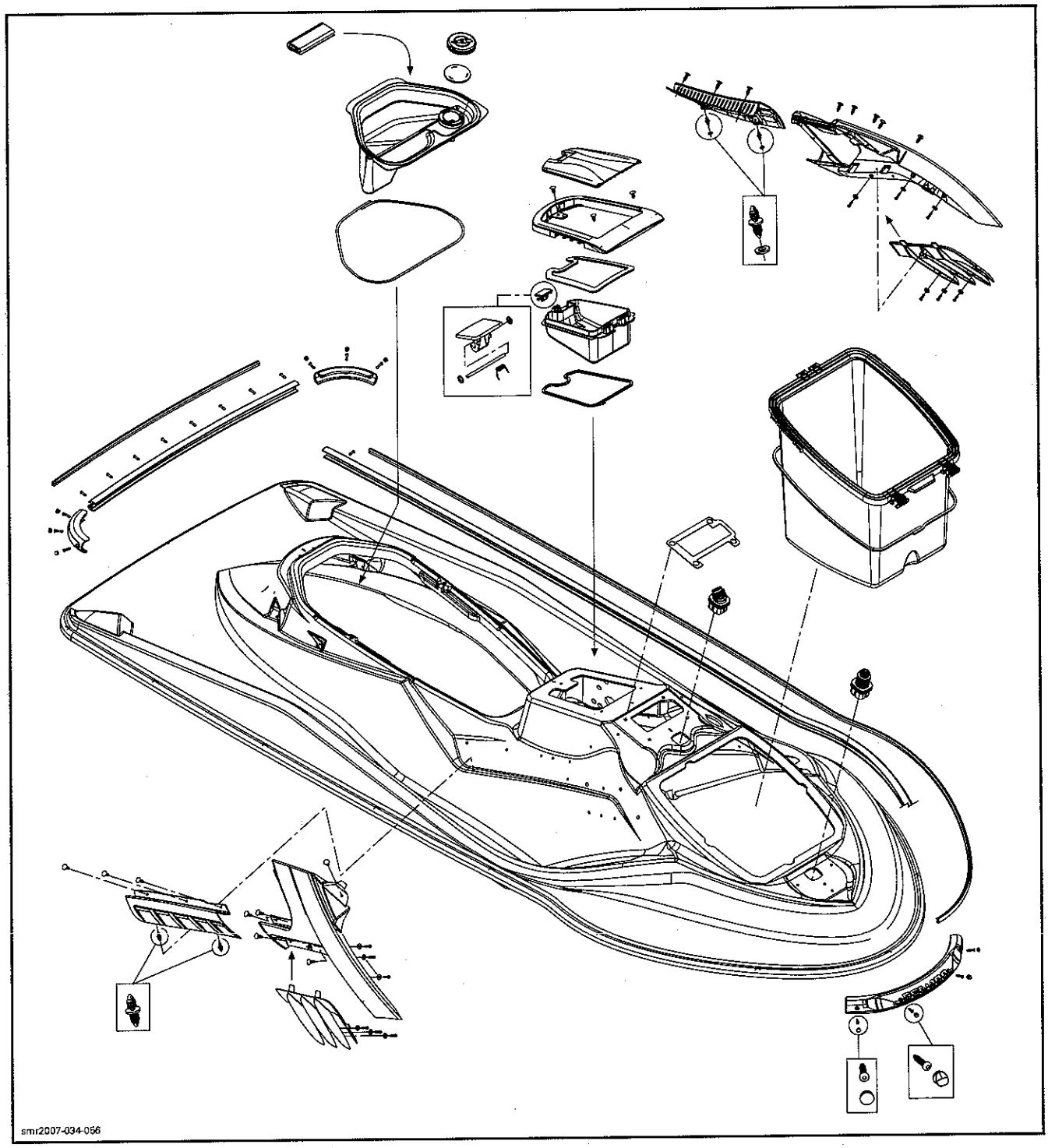
GTX and WAKE Models (Storage Compartment Cover)



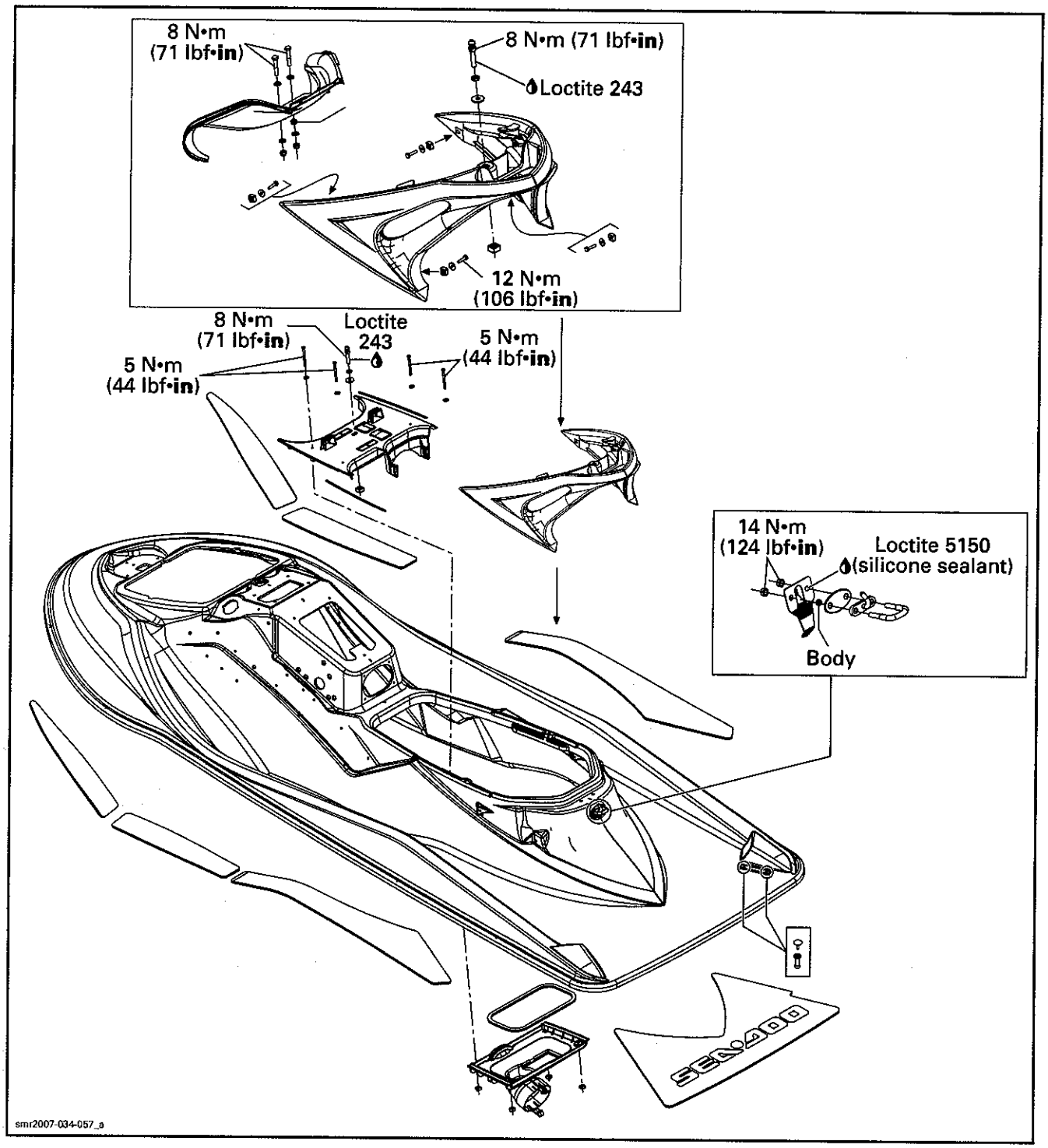
GTX and GTX Limited (Seats)



RXT Models (Body Front View)



RXT Models (Body Rear View)



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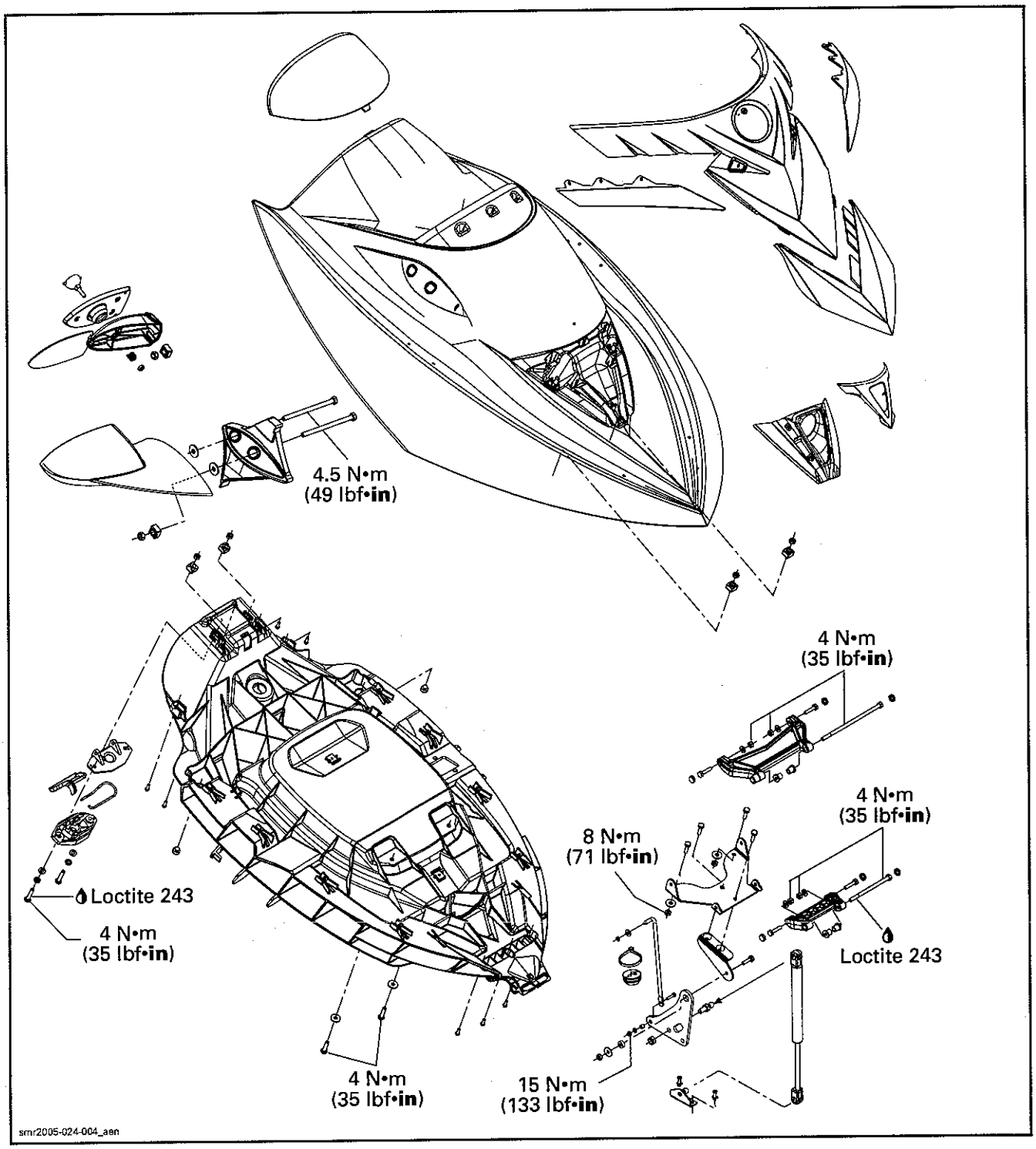
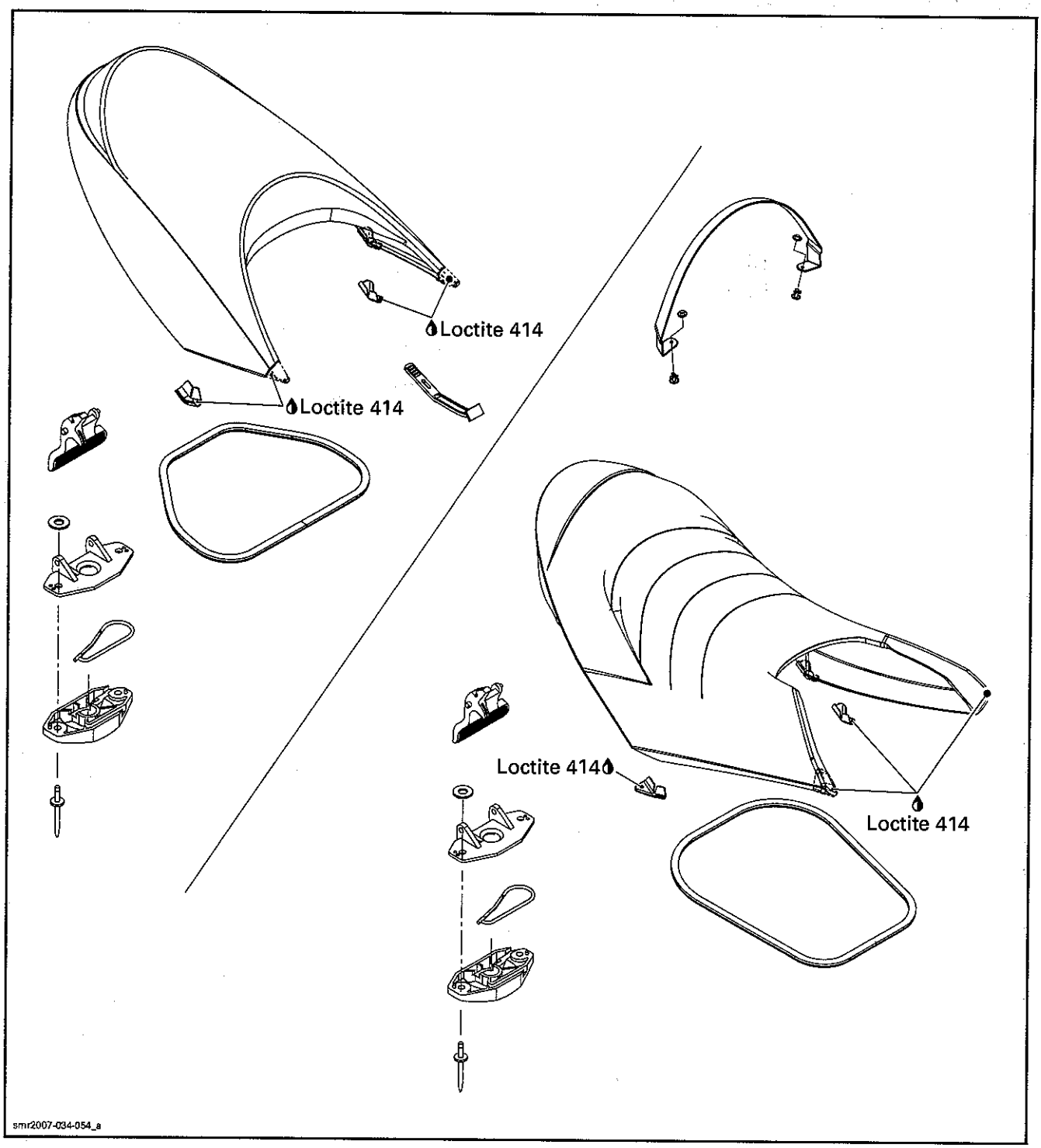
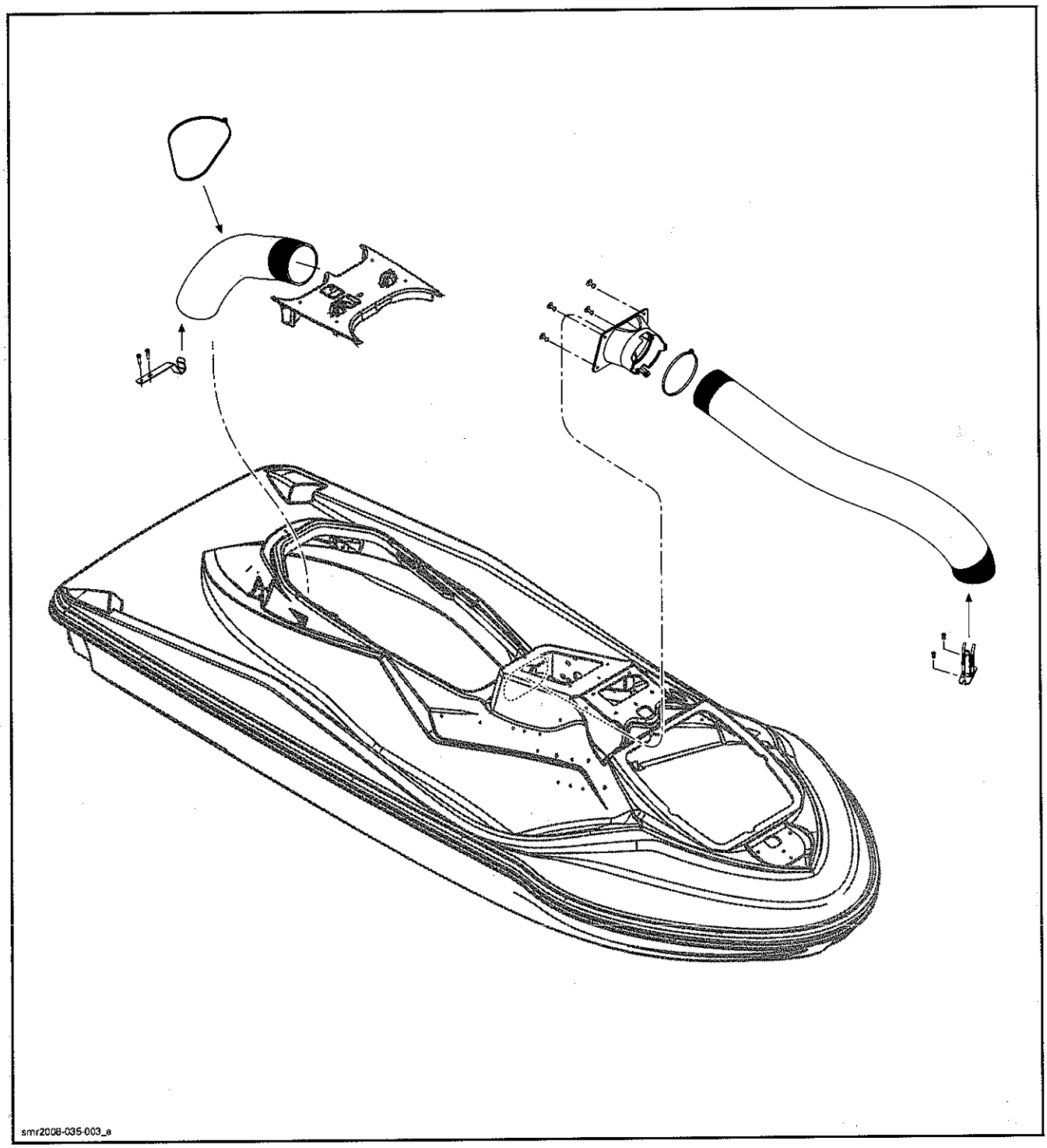
RXT Models (Storage Compartment Cover)



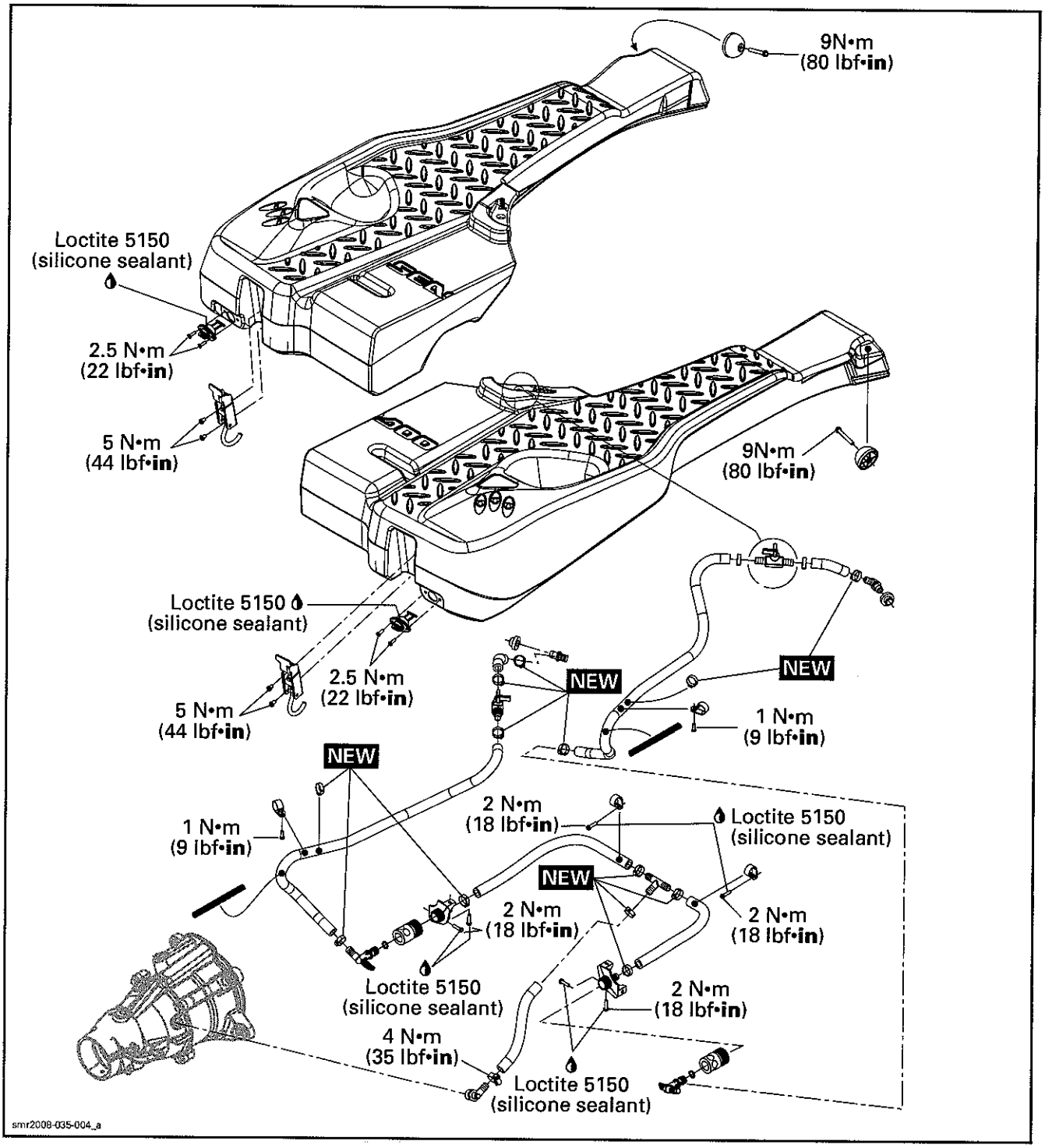
WAKE and RXT Models (Seats)



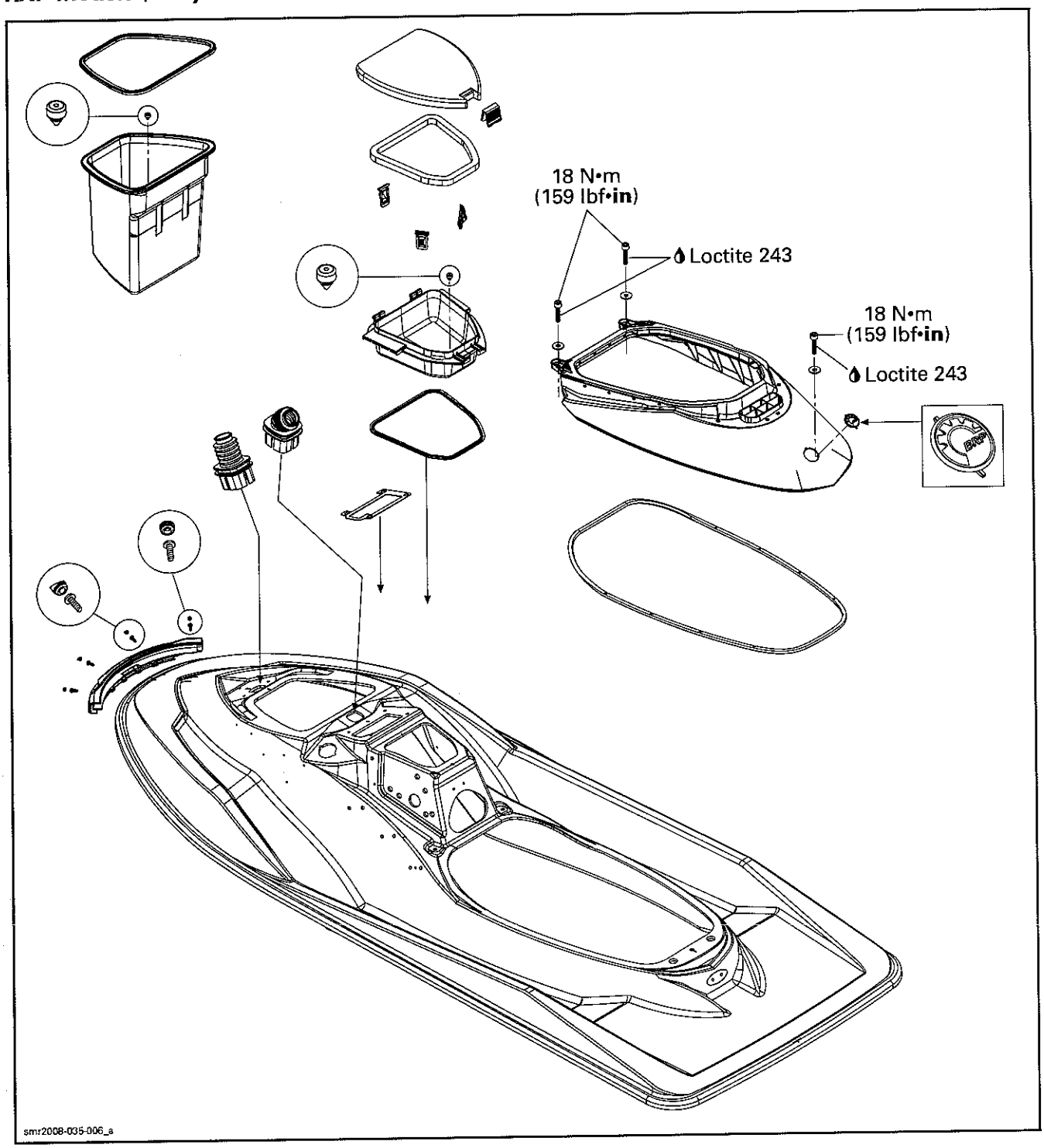
GTX, WAKE and RXT Models (Ventilation)



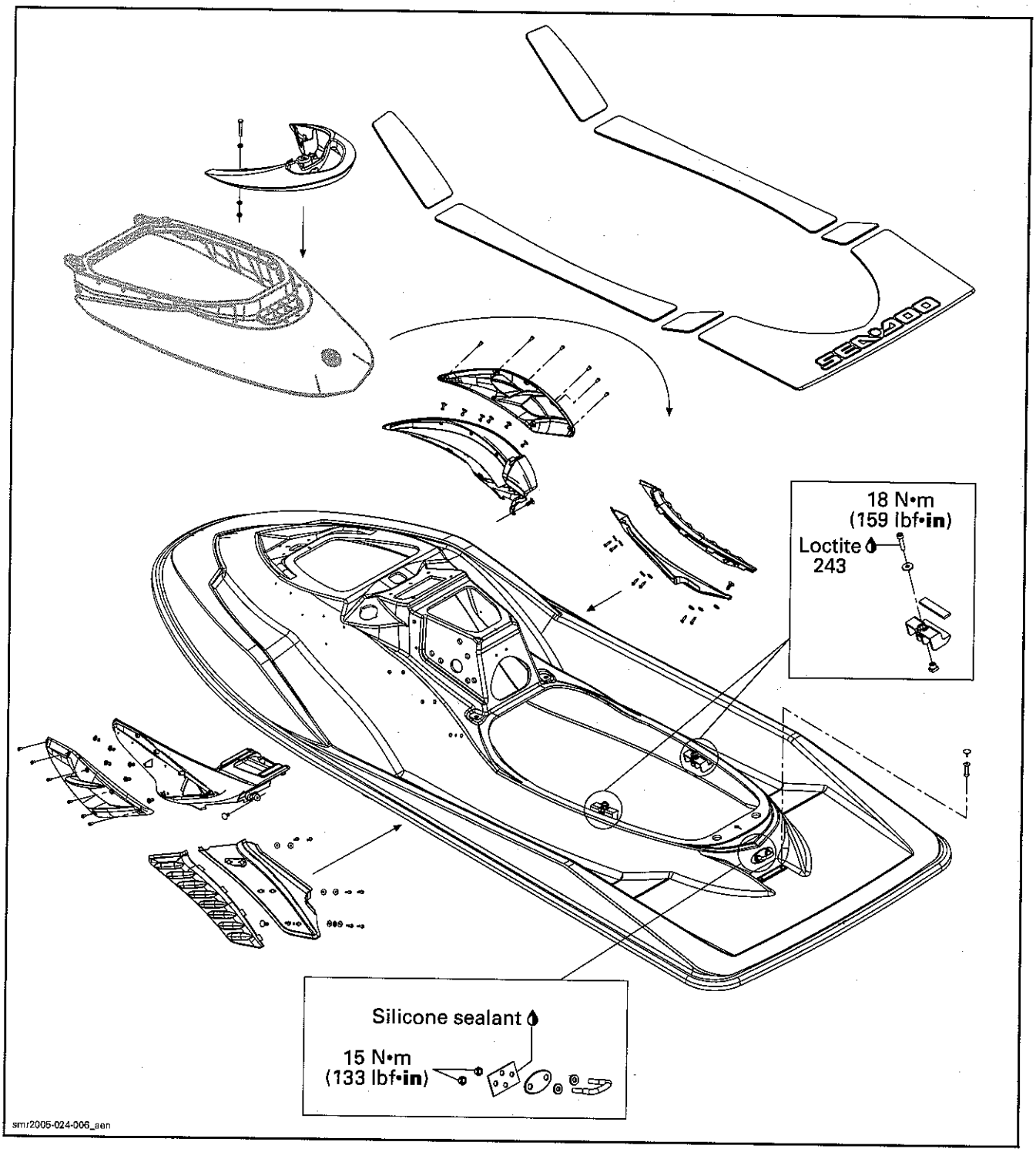
WAKE Models (Ballast)



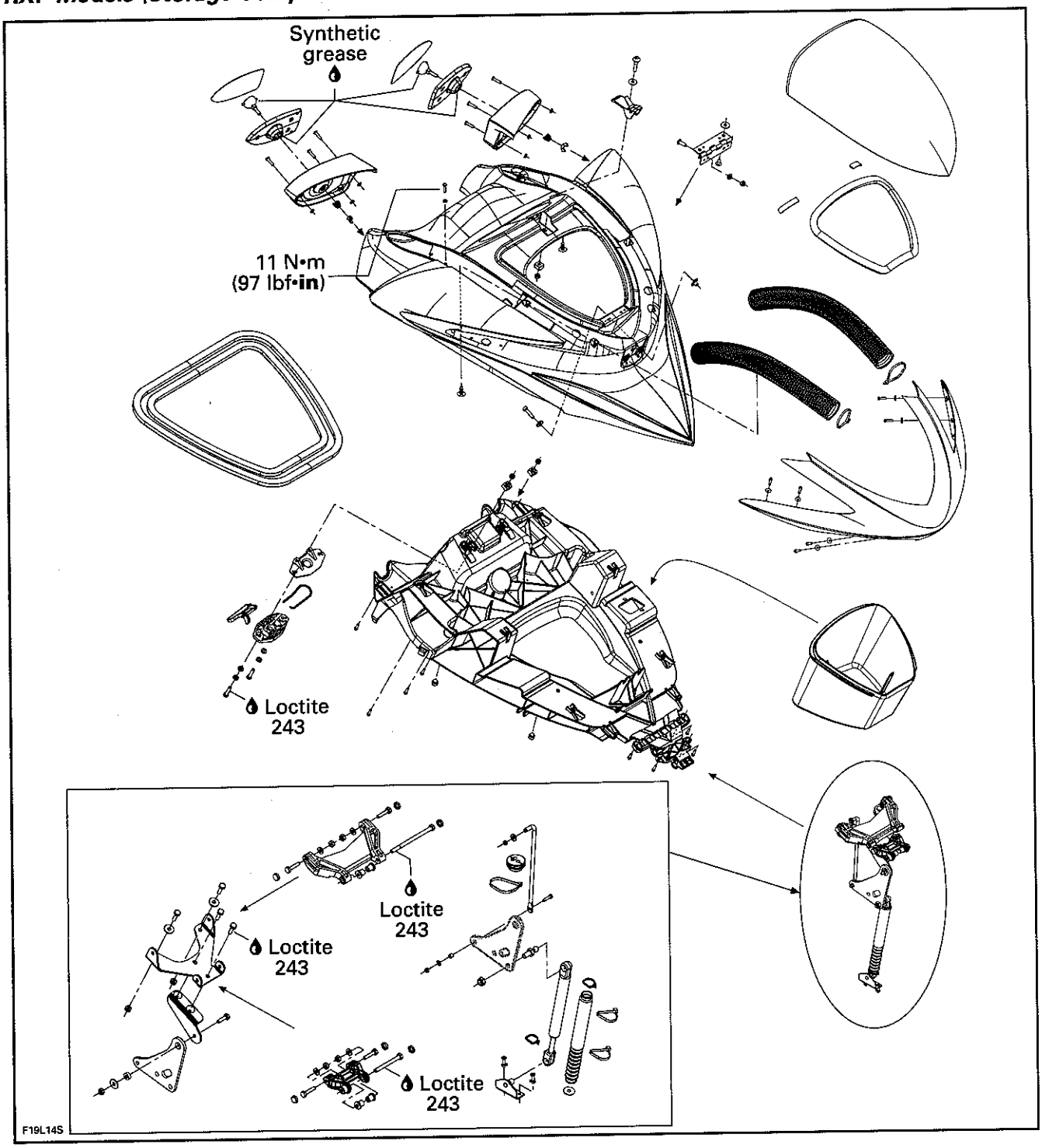
RXP Models (Body Rear View 1)



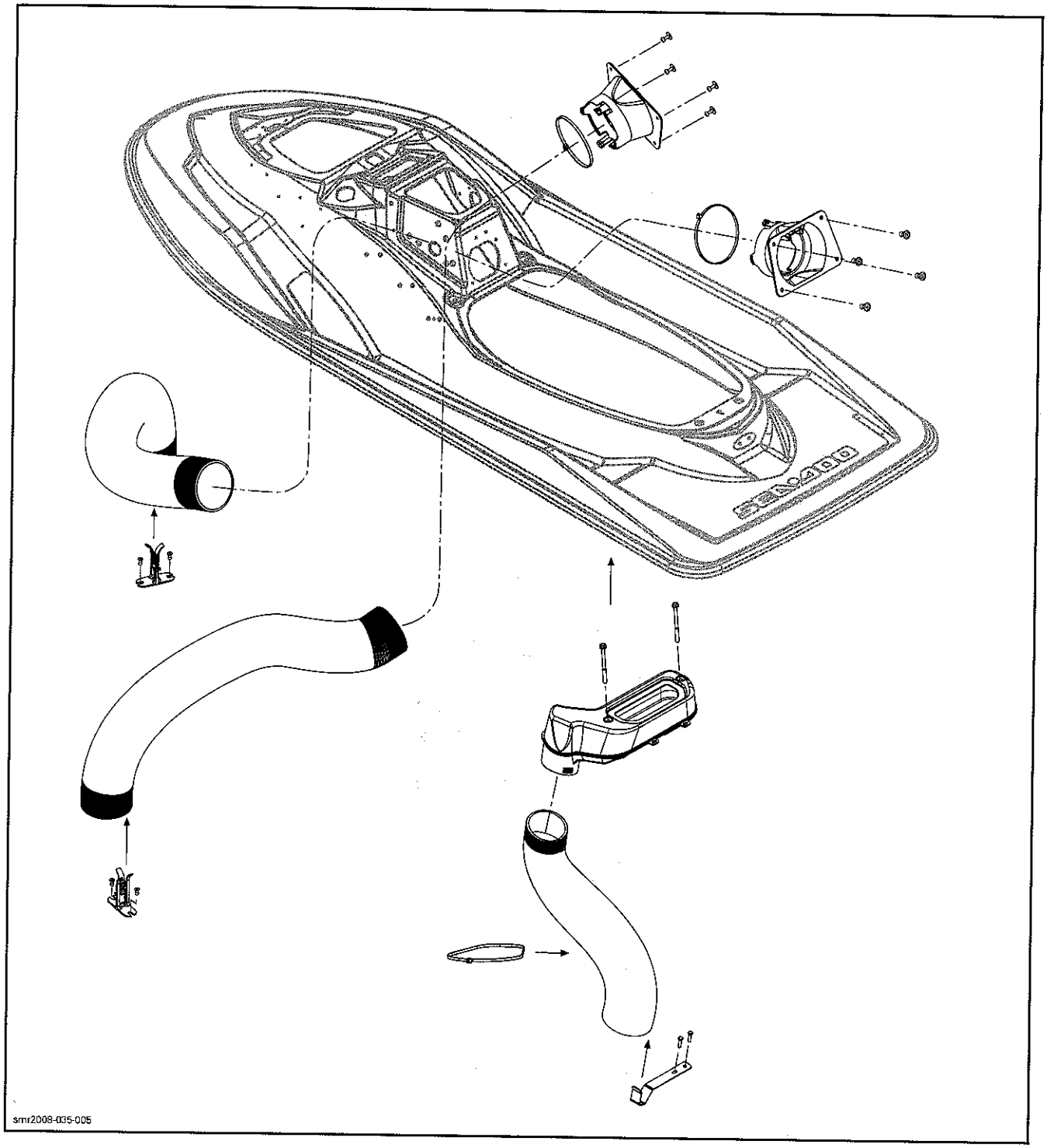
RXP Models (Body Rear View 2)



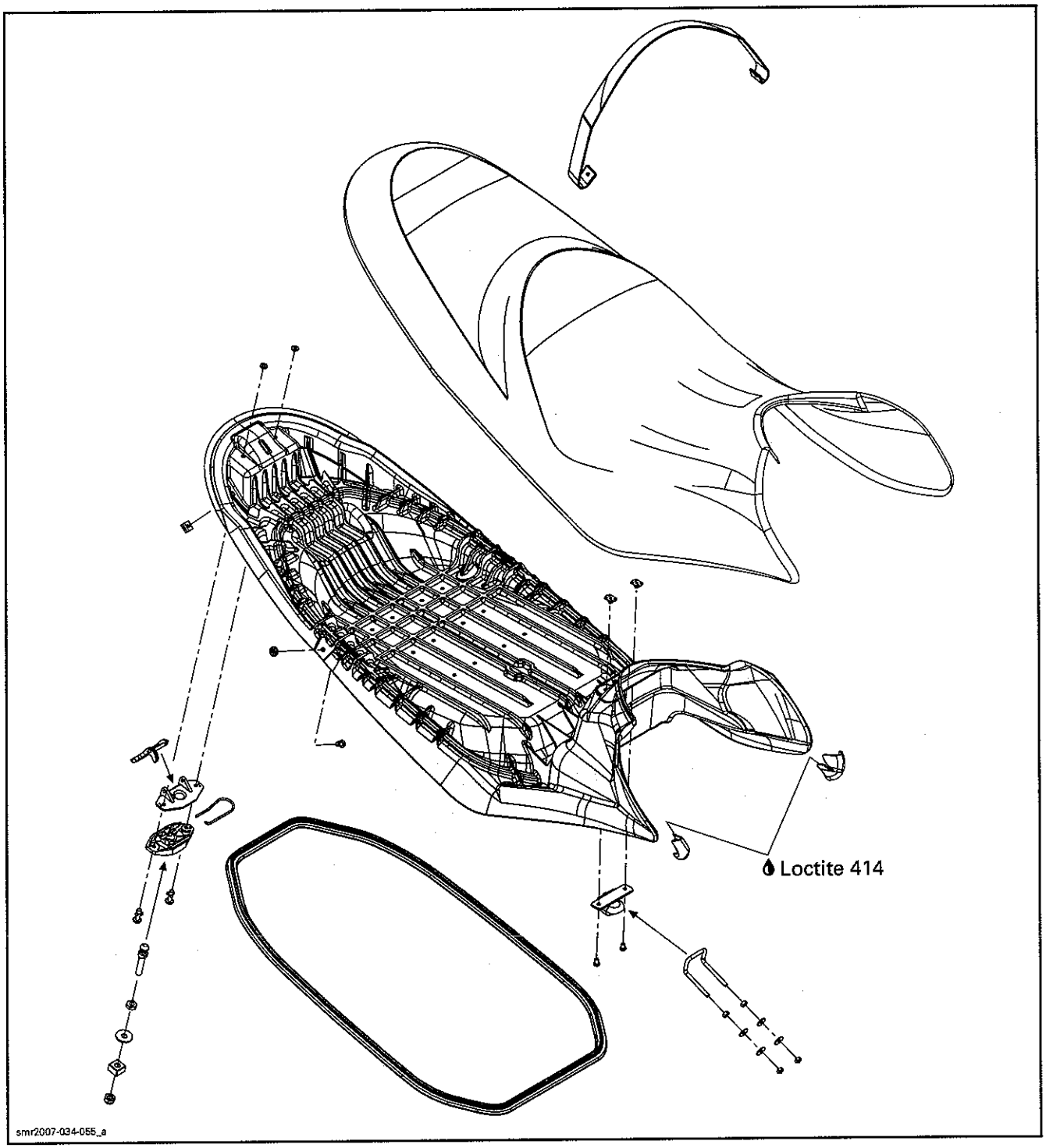
RXP Models (Storage Compartment Cover)



RXP Models (Ventilation)



RXP Models (Seat)



GENERAL

Verify hinges condition and latching mechanisms condition and operation. Replace any damaged components.

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

CAUTION: When applying threadlocker products (anaerobic products), pay attention so that it does not come in contact with ABS plastic parts (painted parts). It could lead to plastic cracks or other damage.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new one.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

Gelcoat Repair

Refer to *HULL REPARATION*. Use same material and procedure to repair the body.

PROCEDURES

DECALS

Removal

Using a heat gun warm up one end of decal for a few seconds until decal can roll off when rubbing with your finger.

NOTE: When heating near light surfaces, duct tape should be applied to protect the surface. Otherwise the light color could become a yellowish color.

Pull decal slowly and when necessary apply more heat to ease removal on the area that has to be peeled off.

If decal tears while pulling off, it has to be heated for a few seconds longer. If decal tends to stretch while pulling off, stop heating and wait a few seconds to let it cool, then peel it off.

Installation of Decals Having a Protective Film on Back Side Only

These decals usually contain written information (e.g.: warning) and are used on gelcoat or metal.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Using a pencil and the decal as a template, mark the area where decal will be located.

Remove half of the decal back protective film and align decal with marks. Start sticking it from center and remove the other half of the film to stick it completely. Carefully squeegee decal beginning at center and working outward using, firm, short, overlapping strokes.

Installation of Decals Having a Protective Film on Both Sides

These decals usually contain graphics and are used on gelcoat or plastic.

Installation on Gelcoat

Using isopropyl alcohol, clean the surface and dry thoroughly.

Using a pencil and the decal as a template mark the area where decal will be located.

For better adhesion a dry application is recommended, however, to ease decal installation a mild solution of soapy water can be sprayed over surface where decal will be installed.

Remove back protective film from decal and align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered to hull.

Installation on Plastic Surface (Storage Cover)

Clean surface with isopropyl alcohol and dry thoroughly.

Using a pencil and the decal as a template, mark the area where decal will be located.

CAUTION: Do not use soapy water to locate decal on plastic parts.

Remove back protective film from decal and carefully align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered.

GLOVE BOX

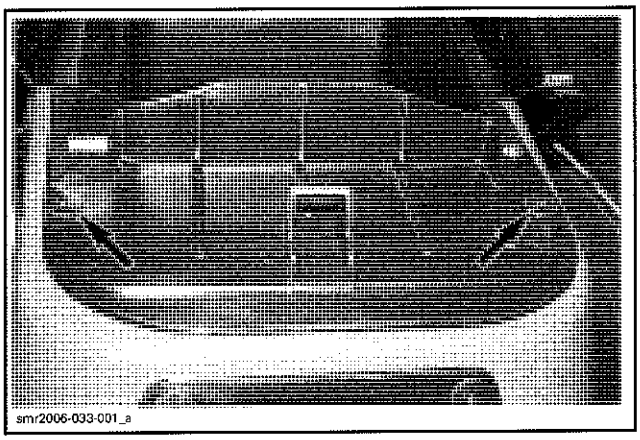
Glove Box Removal

GTI Models

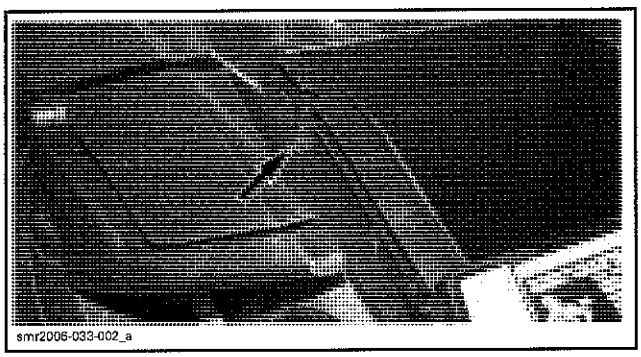
Place shift lever in forward position.

Lift the glove box cover.

Using a Supertanium™ drill bit (P/N 529 031 800), drill both rivets holding glove box to body.



Slide glove box cover to open it, and drill the rivets on each side of glove box.

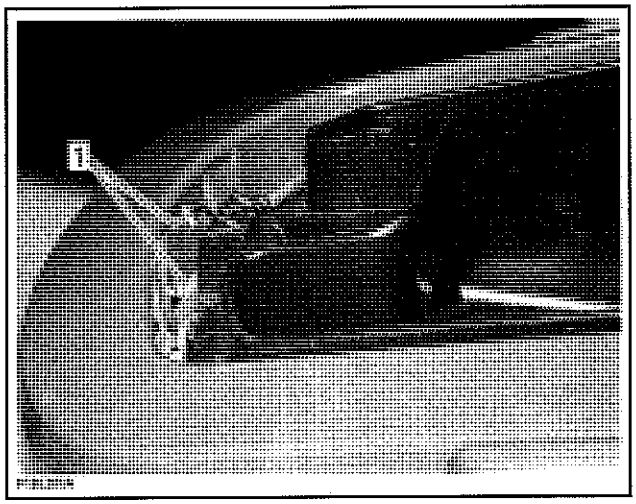


Pull glove box to remove it.

GTX Series and RXT Models

Lift the glove box top cover.

Gently push on both rear tabs while lifting out rear of glove box compartment.



1. Push tabs

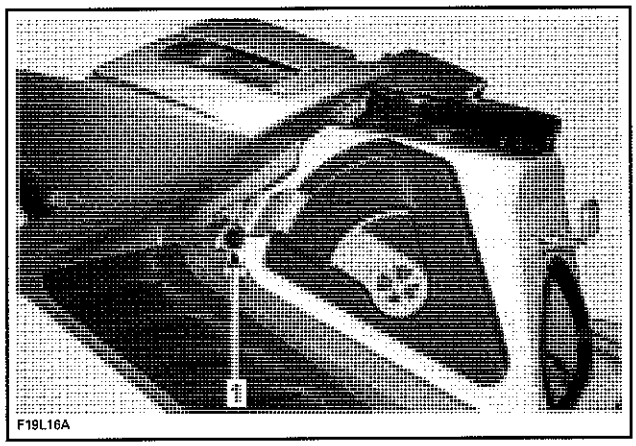
Pull the glove box out of body.

RXP Models

Place shift lever in forward position.

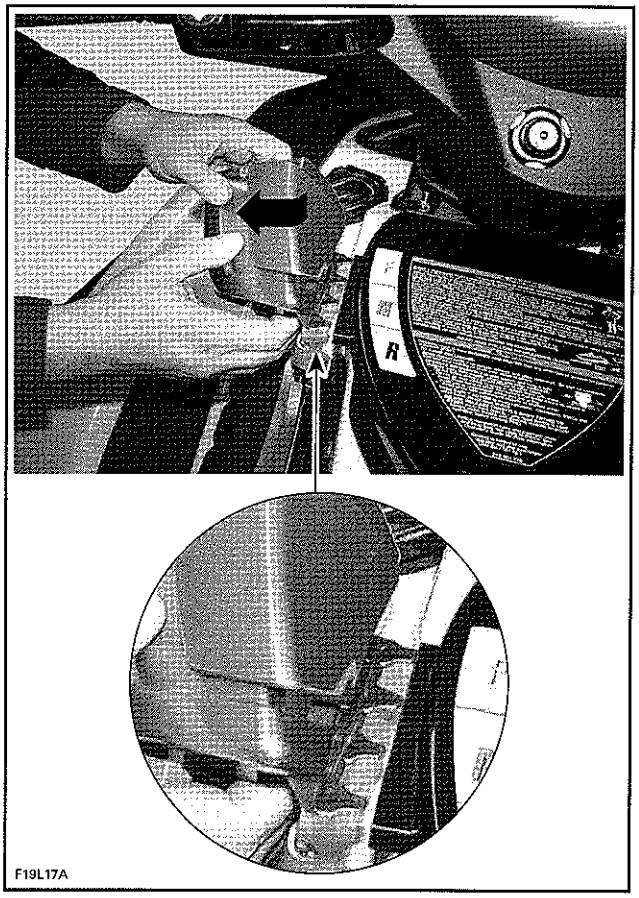
Remove seat.

Pull dart out. See illustration.



1. Pull dart out

Carefully pull the side molded part to release the glove box. Pulling too much might lead to damaging the part.



RELEASE SIDE MOLDED PART FROM GLOVE BOX

Slightly lift glove box to free it.

Proceed with the other side the same way to finally pull glove box out.

Glove Box Installation

Reverse the removal procedure.

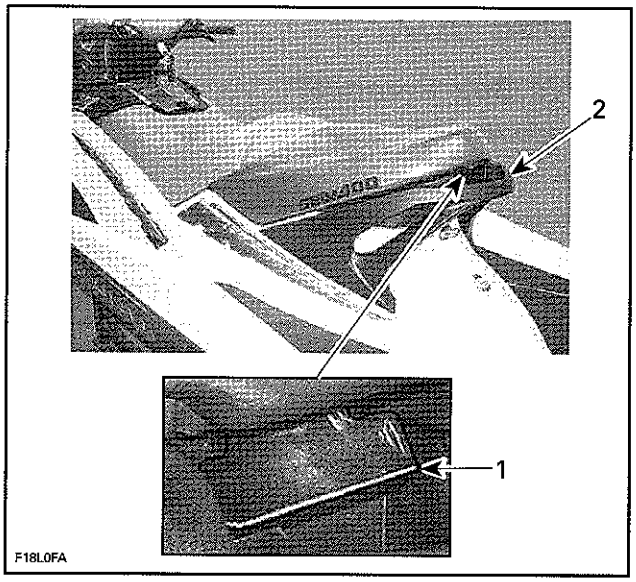
SEAT

Seat Removal

Rear Seat

GTX Series and RXT Models

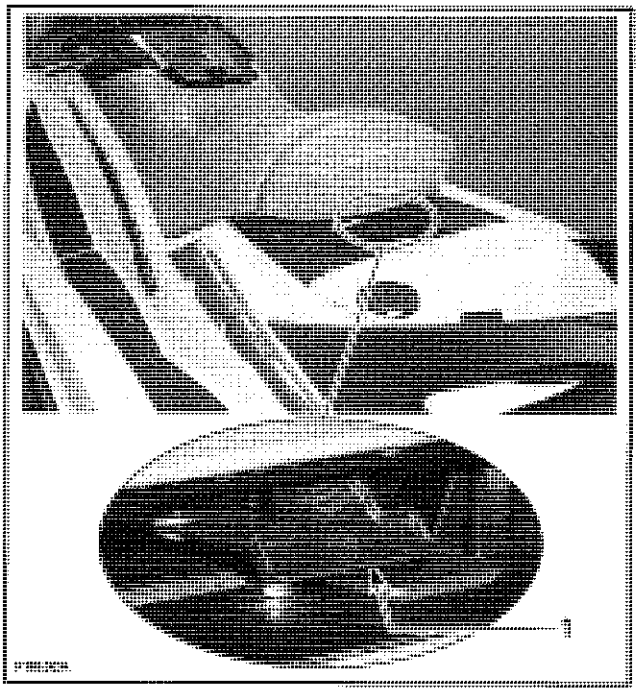
Removing the rear seat allows access to the rear storage basket. It also gives access to the front seat latch.



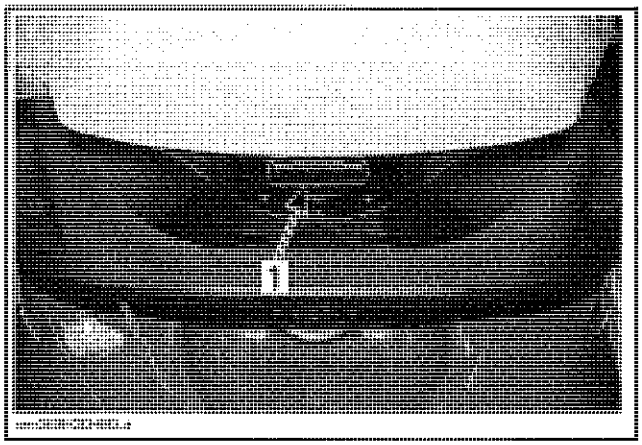
TYPICAL
1. *Rear seat latch*
2. *Rear grab handle*

Front Seat

The front seat latch is located at the rear end and underneath the seat.



TYPICAL — SEAT WITH REAR SEAT
1. *Seat latch*



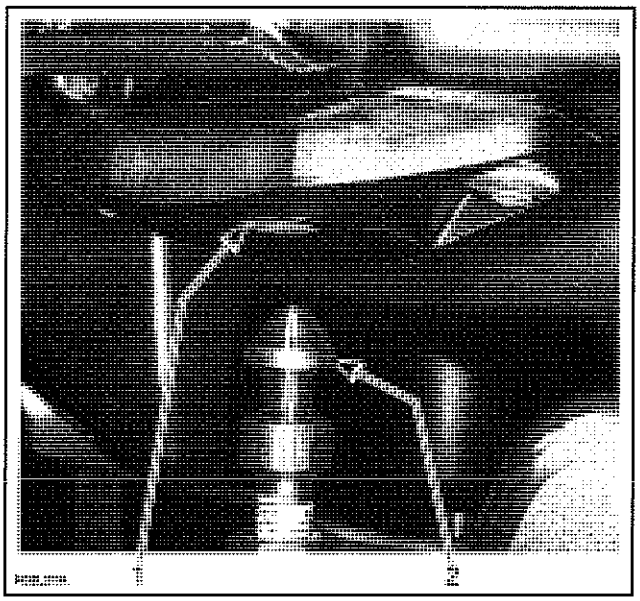
TYPICAL — SEAT WITHOUT REAR SEAT
1. Seat latch

To remove front seat, pull the latch lever upward and hold. Lift and pull the seat rearward.

Seat Installation

Front Seat

To latch front seat, align latch hole with pin then, firmly push down on the rear portion of the seat.



1. Latch hole
2. Pin

Rear Seat

The installation is the reverse of the removal procedure.

Seat Cleaning

For general purpose cleaning, use BRP Plastic & Vinyl Cleaner (P/N 413 711 200), Vinyl Finish Vinyl Cleaner, Fantastik or warm water with a mild dish soap such as Dawn or Ivory. Gently scrub with a small soft bristle brush.

For dirt build-up, use BRP Plastic & Vinyl Cleaner (P/N 413 711 200), Vinyl Finish Vinyl Cleaner or an equivalent. Let soak for approximately 10 minutes, then gently scrub with a soft bristle brush. For specific stain removal, refer to your cleaning and care card.

Do not use any silicone-based protectants. They will extract the plasticizers, leaving the vinyl hard and brittle, and eventually cracking will occur.

RECOMMENDED PRODUCTS
1. BRP Plastic and Vinyl Cleaner (P/N 413 711 200)
2. Dish Soap (Dawn or Ivory)
3. Fantastik
4. 3M Citrus Cleaner
5. 303 Protectant

Vinyl Cleaning Recommendations for Special Stains

TYPE OF STAIN	STEP 1	STEP 2	STEP 3	ACTION
Ballpoint ink*	E	B	A	A. Medium-soft brush, warm soapy water, rinse/dry.
Chewing gum	D	A	—	
Coffee, tea, chocolate	B	—	—	
Pen	D	B	—	B. Vinyl Finish Cleaner, rinse/dry.
Grease	D	B	—	
Household soil	A	B	—	
Ketchup	A	B	—	C. One (1) tablespoon of ammonia, one-fourth (1/4) cup of hydrogen peroxide, three-fourth (3/4) cup of water, rinse/dry.
Latex paint	A	B	—	
Lipstick	A	B	—	
Mildew or wet leaves*	C	B	A	
Motor oil	B	—	—	
Oil-based paint	D	B	—	D. Wipe or scrape off excess (chill gum with ice before hand).
Permanent marker*	E	B	C	
Spray paint	B	B	—	
Suntan lotion	A	B	—	E. Denatured alcohol, rinse/dry.
Tar/asphalt	D	B	—	
Yellow mustard	A	B	C	

* Suntan lotion, tree pollen, wet leaves and some other products can contain dyes that stain permanently.

All cleaning methods must be followed by a thorough rinse with warm water.

Certain household cleaners, powdered abrasives, steel wool and industrial cleaners can cause damage and discoloration and are not recommended. Dry cleaning fluids and lacquer solvents should not be used as they will remove printed pattern and gloss. Waxes should be used with caution as many contain dyes or solvents that can permanently damage the protective coating.

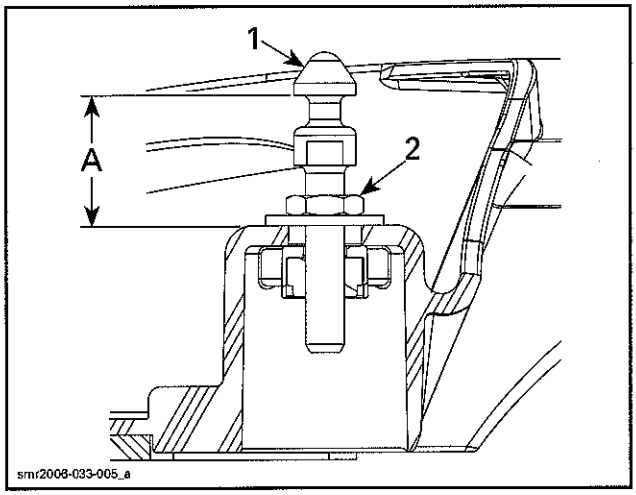
Please contact G&T industries "Marine Specialties Group" hot line at 1 800 318-2887 for any cleaning and care questions.

SEAT LATCH

Seat Latch Adjustment

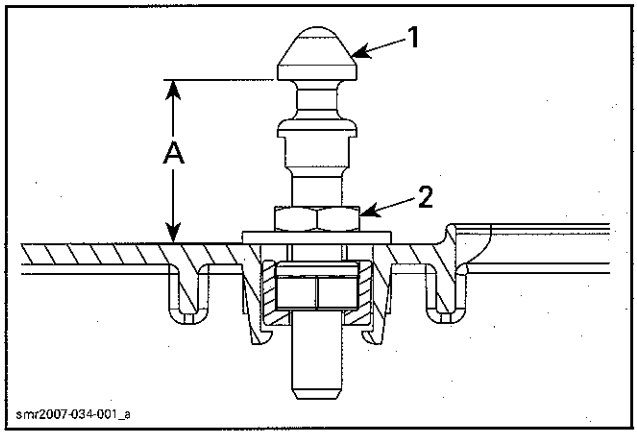
NOTE: Apply Loctite 243 (blue) (P/N 293 800 060) on threads of lock pin when the adjustment is required or when the lock pin is removed then reinstalled. The threads on new lock pin are coated with a self-locking product, do not apply Loctite 243 on threads.

GTI Models

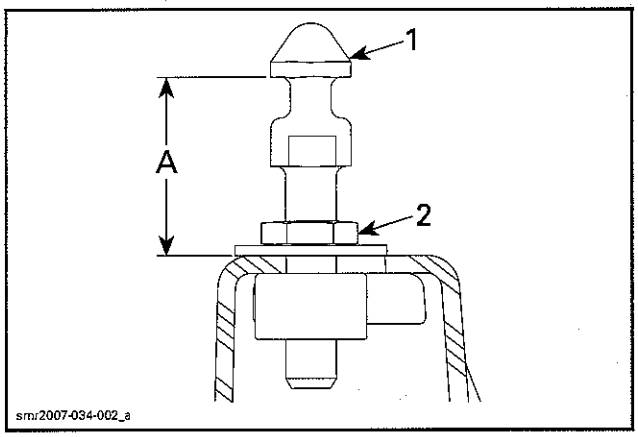


TYPICAL
1. Lock pin
2. Adjustment nut. Torque to 8 N•m (71 lbf•in)
A. 32.5 ± 1 mm (1-9/32 ± 3/64 in)

GTX Series, Wake and RXT Models

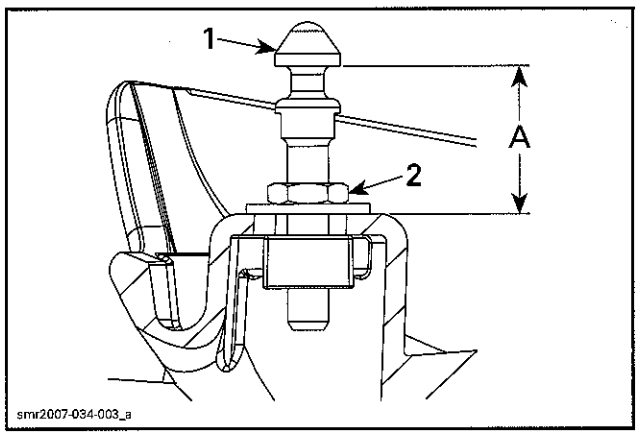


TYPICAL — FRONT SEAT
1. Lock pin
2. Adjustment nut. Torque to 8 N•m (71 lbf•in)
A. 33 ± 1 mm (1-35/64 ± 3/64 in)



TYPICAL — REAR SEAT
1. Lock pin
2. Adjustment nut. Torque to 5 N•m (44 lbf•in)
A. 35 ± 1 mm (1-5/16 ± 3/64 in)

RXP Models



1. Lock pin
2. Adjustment nut. Torque to 8 N•m (71 lbf•in)
A. 36 ± 1 mm (1-35/64 ± 3/64 in)

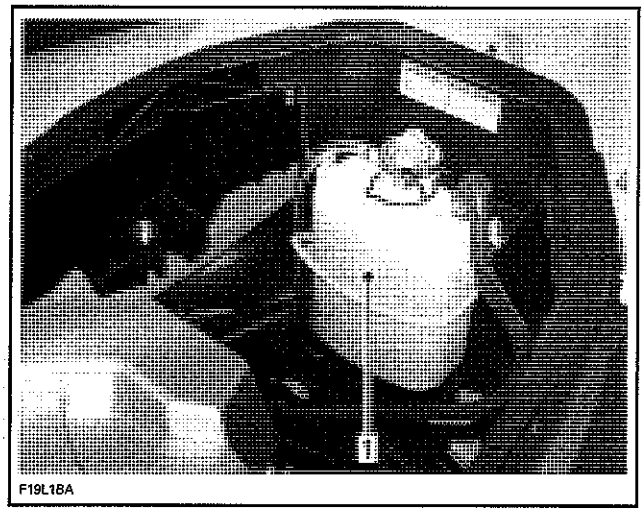
ENGINE COVER

RXP Models

Engine Cover Removal

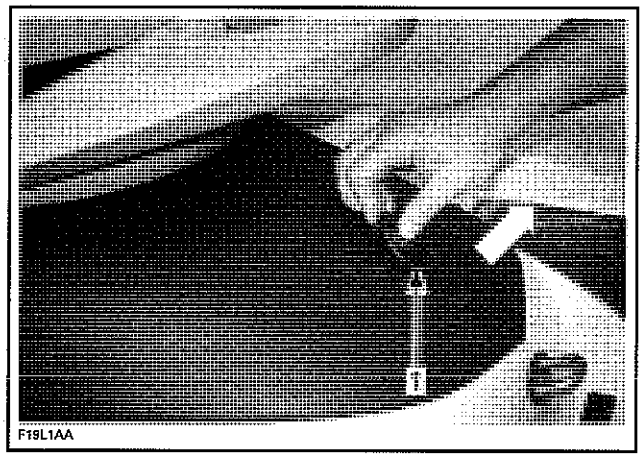
Remove seat.

Detach coolant expansion tank and move away.


F19L18A

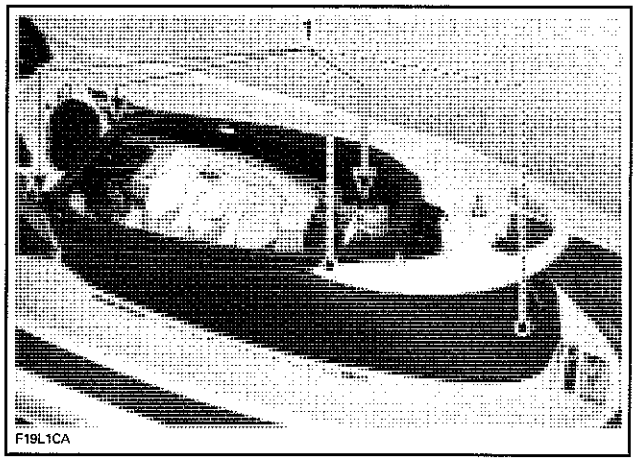
1. Coolant expansion tank

Remove logo at rear.


F19L1AA

1. Logo

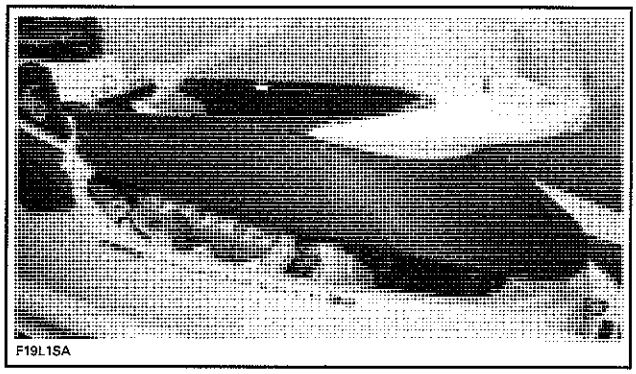
Remove retaining screws.


F19L1CA

1. Retaining screws

NOTE: Pay attention not to drop retaining blocks under cover when removing screws.

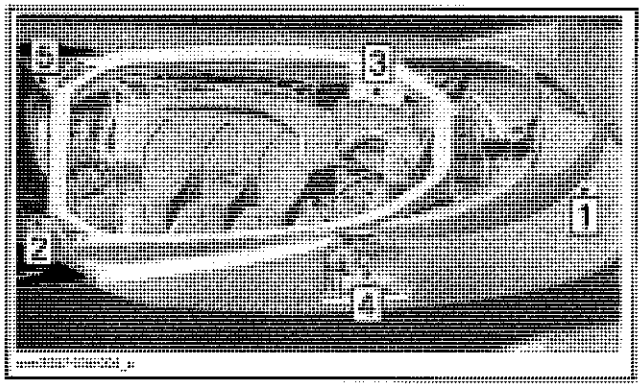
Pull out engine cover.


F19L1SA

Engine Cover Installation

Installation is the opposite procedure of removal, but pay attention to the following.

First, torque engine cover to 15 N•m (133 lbf•**in**) using the following sequence. Then, torque only steps 1, 2 and 5 to 18 N•m (159 lbf•**in**).



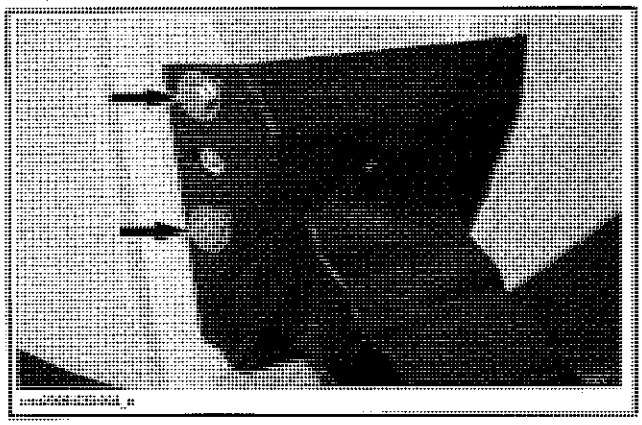
STORAGE COMPARTMENT COVER

Storage Compartment Cover Removal

GTI Models

Open storage compartment cover.

Unscrew bolts retaining the cover to its hinge (two on each side). Discard them.



Remove storage compartment cover.

GTX Series

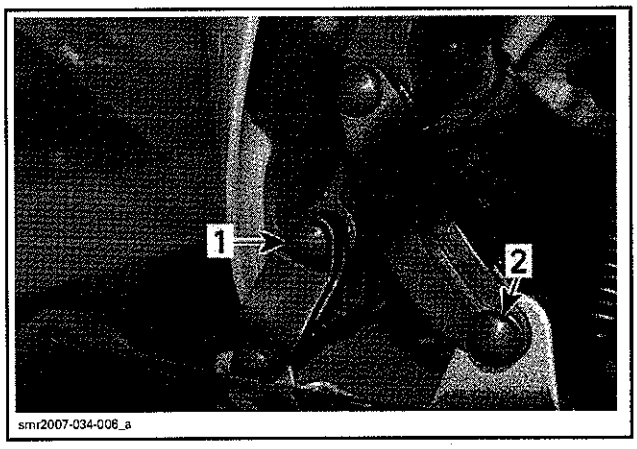
Open storage compartment cover and remove basket and extinguisher.

Disconnect multifunction connector.

Remove the shock absorber. Refer to *STORAGE COMPARTMENT COVER SHOCK* further in this section.

Remove the long retaining screw (front).

Remove two short retaining screws located in the back lower side and hold cover firmly.



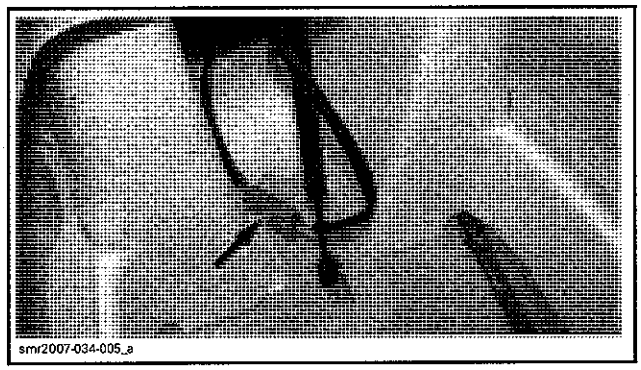
TYPICAL
1. *Long retaining screw (front)*
2. *Short retaining screw (one on each side to the back)*

Remove storage compartment cover.

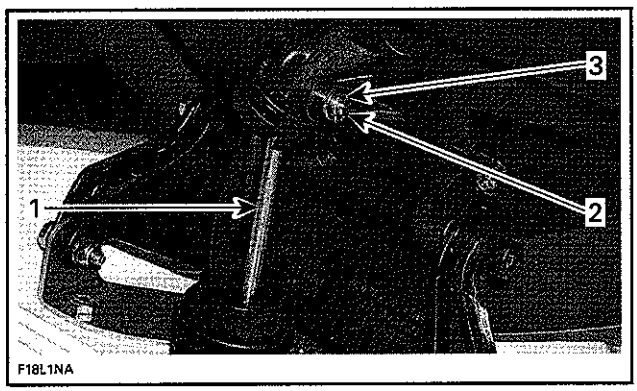
RXP and RXT Models

Open storage compartment cover and remove basket.

Disconnect multifunction connector.



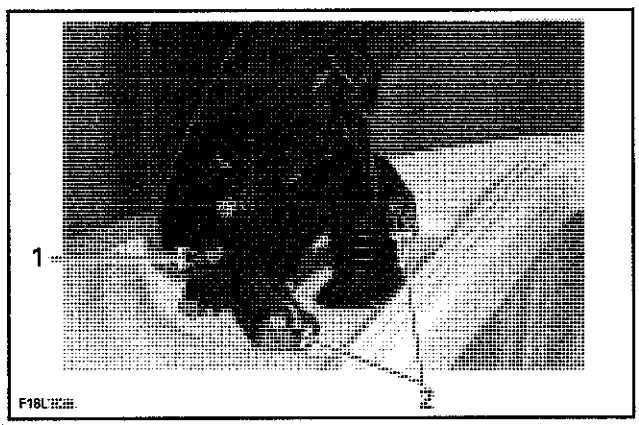
Unlock shock rod from circlip and remove washer.



TYPICAL
1. *Shock rod*
2. *Circlip*
3. *Washer*

Remove one long retaining screw (front).

Remove two short retaining screws located in the back lower side and hold cover firmly.



TYPICAL
1. *One long retaining screw (front)*
2. *Short retaining screw (one on each side to the back)*

Remove storage compartment cover.

Storage Compartment Cover Installation

The installation is the reverse of the removal procedure.

GTI Models

When installing screws retaining storage compartment cover, use **NEW screw with Scotch Grip**. NEVER use liquid threadlocker with this cover.

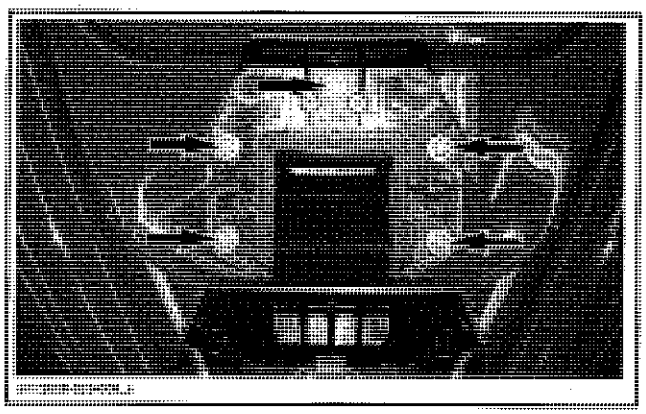
STORAGE COMPARTMENT COVER HINGE

Hinge Removal

GTI Models

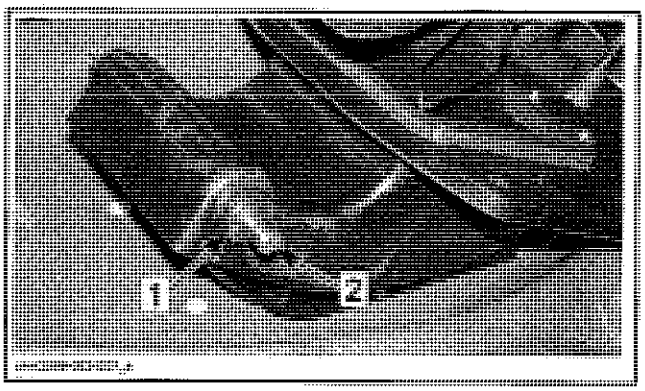
Remove storage compartment cover, see above.

Unscrew the 5 bolts securing the hinge to the body.



Pull hinge to remove it from body.

Cut a push nut retaining hinge shaft.



1. *Push nut*
2. *Hinge shaft*

Remove hinge shaft and separate both parts of hinge.

Hinge Installation

For installation, reverse the removal procedure.

STORAGE COMPARTMENT COVER SHOCK

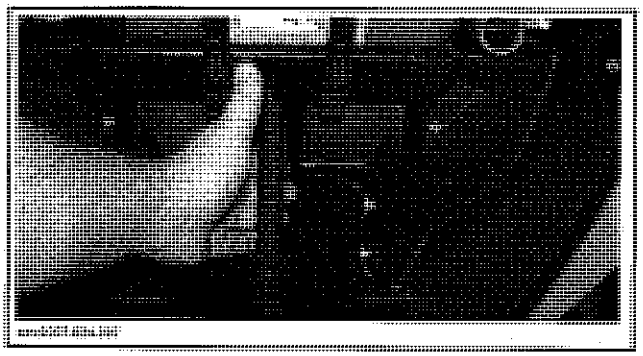
Shock Removal

GTX Series

Open storage compartment cover.

Retain the cover with one hand while pulling the shock body. Pull on shock strongly.

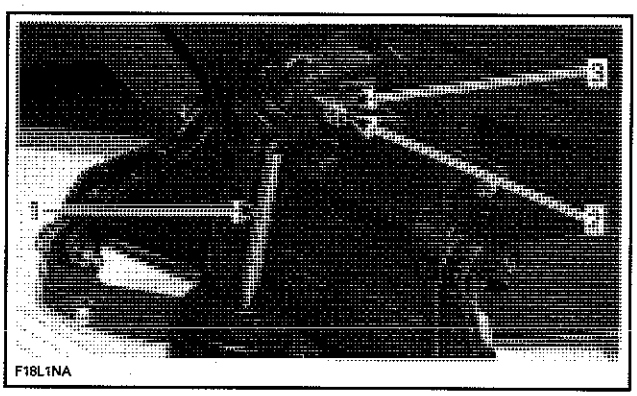
NOTE: The shock retaining ball is snapped to inner shell socket and has a very tight fit.



Pull the shock rod out of its support to remove the shock.

RXP and RXT Models

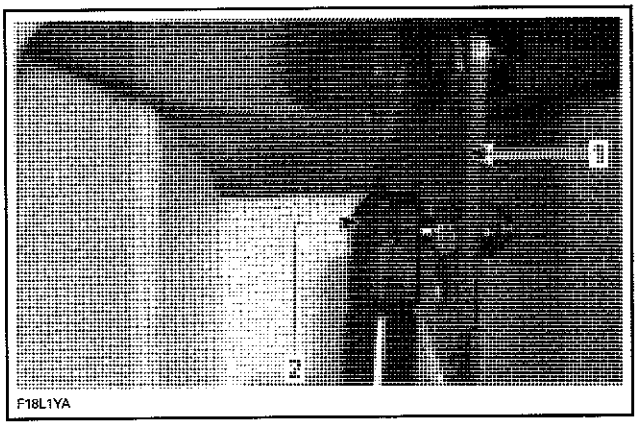
Unlock shock rod from circlip and remove washer.



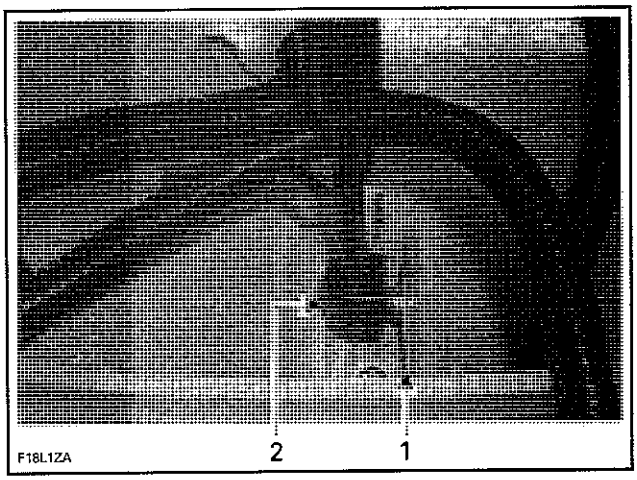
1. *Shock rod*
2. *Circlip*
3. *Washer*

Install a 2 x 4 piece of wood between storage cover and body. This piece of wood will support the storage cover while changing the cover shock.

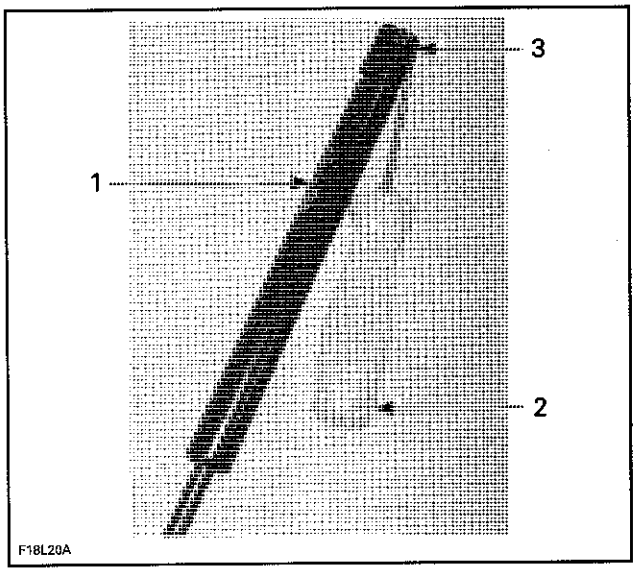
Release the shock from top linkage bracket and bottom support bracket by inserting a flat screwdriver in the shock top and bottom locking devices.



1. *Top linkage bracket*
2. *Shock top locking device*



1. *Bottom support bracket*
2. *Shock bottom locking device*



1. *Shock absorber*
2. *Flat screwdriver*
3. *Shock top locking device*

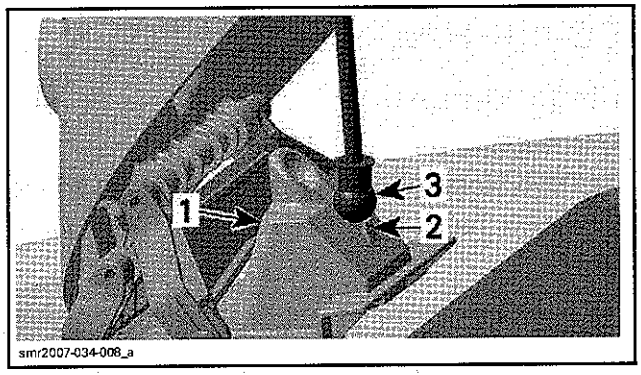
Shock Installation

The installation is the reverse of the removal procedure.

GTX Series

Snap the shock body in inner shell socket.

Place the shock rod against the bump on the shock support and close storage compartment cover. The bottom of the shock will be inserted in its place automatically.



1. *Shock support*
2. *Bump*
3. *Shock rod*

STORAGE COMPARTMENT COVER INNER SHELL

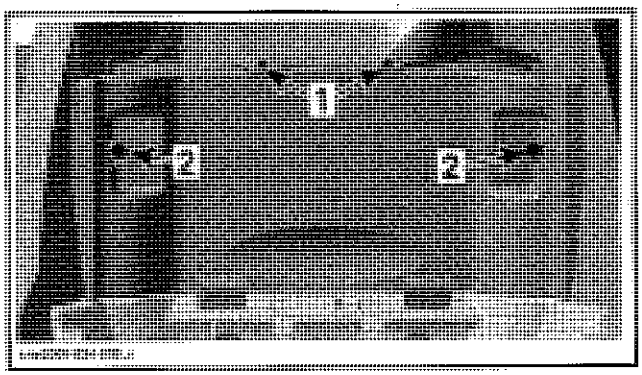
Inner Shell Removal

GTX Series

Upper Inner Shell

Open storage compartment cover.

Loosen both upper screws and remove both plastic rivets.



1. *Upper screws*
2. *Plastic rivets*

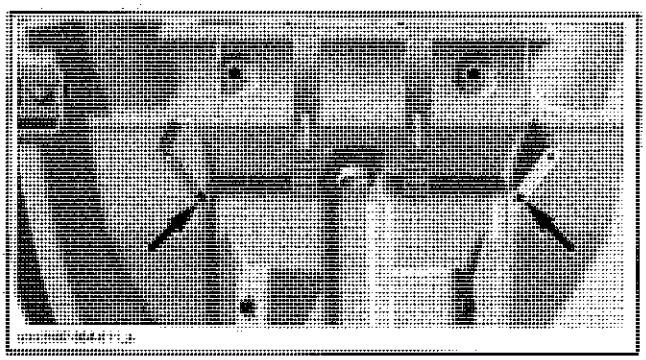
Pull the top of inner shell then lift it.

Lower Inner Shell

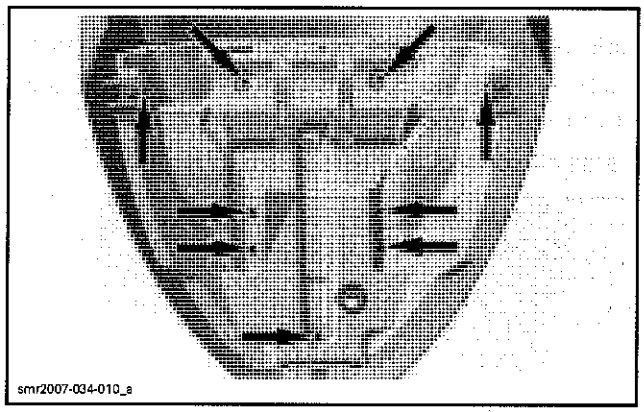
Remove the storage compartment cover from vehicle. Refer to *STORAGE COMPARTMENT COVER* above.

Remove the upper inner shell.

Remove screws holding front grills.



Remove all screws (9) securing lower inner shell to storage compartment cover.



Cut locking ties retaining wiring harness to shell.

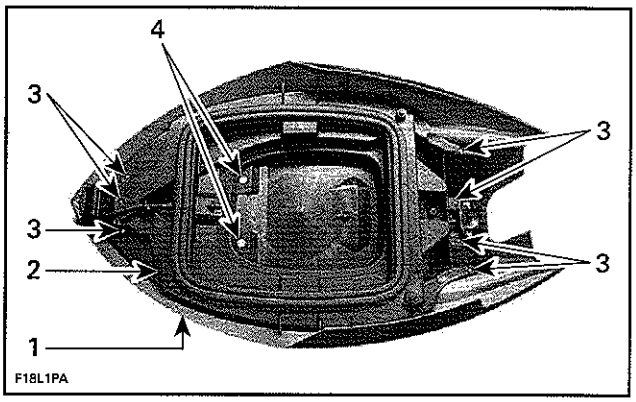
RXT Models

Remove the *STORAGE COMPARTMENT COVER*, see procedure above in this section.

CAUTION: Failure to follow this order may lead to damaging inner plastic studs.

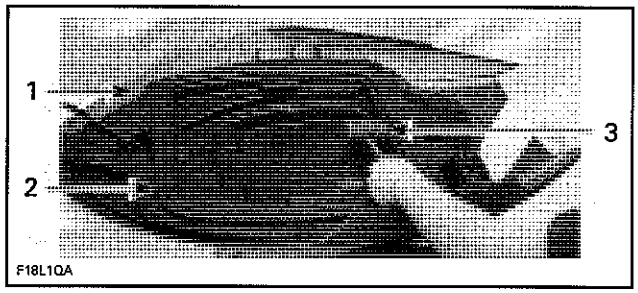
Remove seven inner shell short screws (flanged screws).

Remove two long inner shell screws (hexagonal screws).



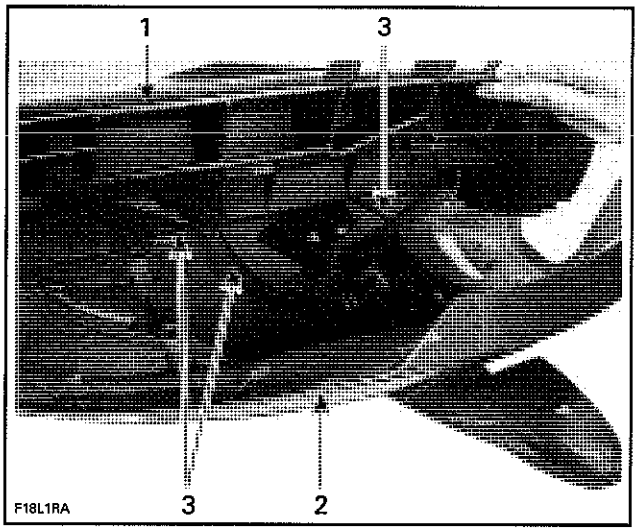
1. *Storage cover*
2. *Inner shell*
3. *Inner shell short screws (x 7)*
4. *Inner shell long screws (x 2)*

Use a rubber hammer to remove the inner shell from the cover. If the inner shell is too stiff, install a piece of 2 x 4 against the inner shell and hit it with the rubber hammer.



1. *Storage cover*
2. *Inner shell*
3. *Rubber hammer*

Remove connector harness from the inner shell by cutting tie raps.

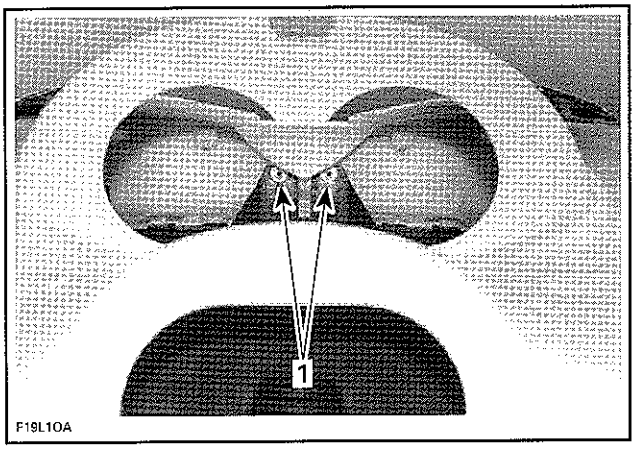


1. *Inner shell*
2. *Storage cover*
3. *Connector harness*

Remove inner shell.

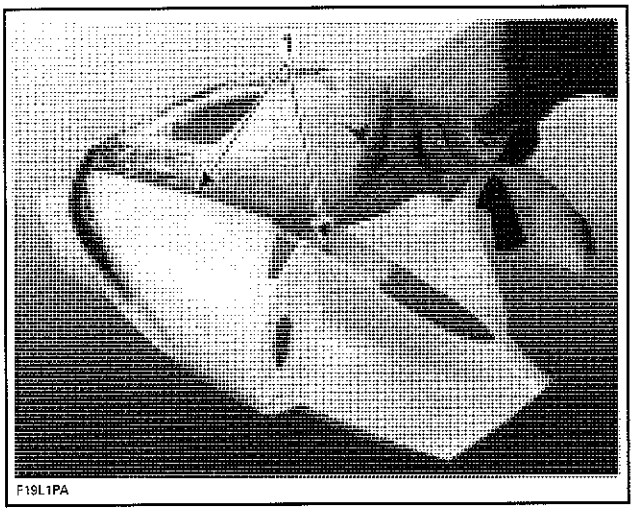
RXP Models

Remove retaining screws from inner shell including the front screws.



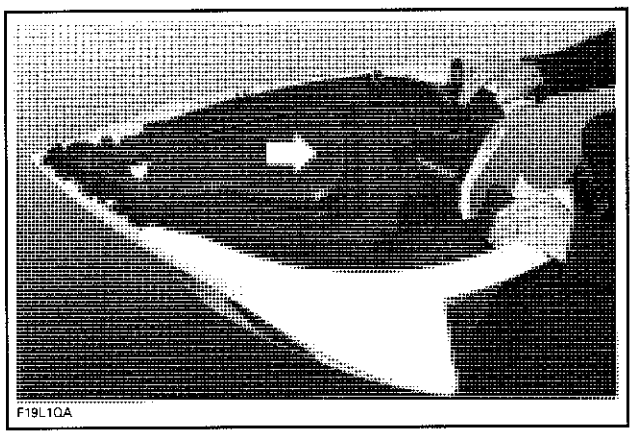
1. Front screws

Lift the end of top tubes and remove retaining screws.



1. Retaining screws

Slide inner shell out as shown.



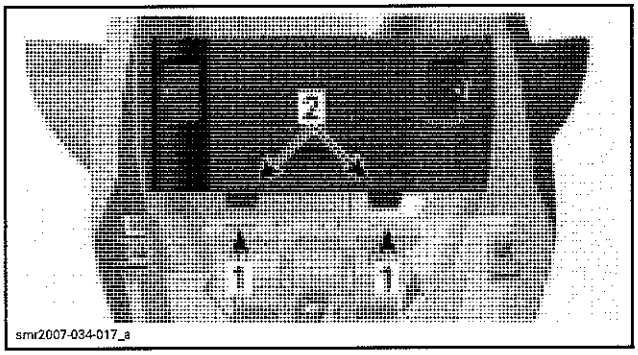
SLIDE OUT

Inner Shell Installation

GTX Series

Upper Inner Shell

Insert tabs in slots of lower inner shell.



1. Slots
2. Tabs

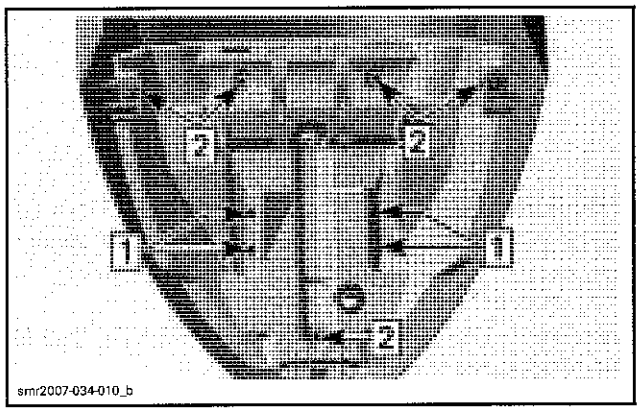
Install plastic rivets and tighten screws.

Lower Inner Shell

Slide wiring harness through the inner shell hole.

Position the hinge side first then lay down lower inner shell in storage compartment cover.

Install all screws and torque them as follow.



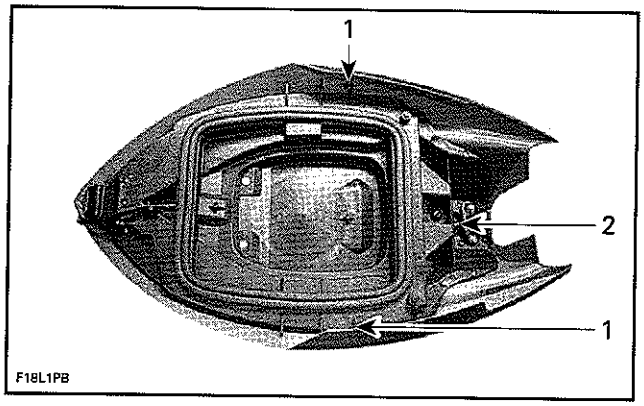
*1. Torque to 6 N•m (53 lbf•**in**)*
*2. Torque to 4 N•m (35 lbf•**in**)*

RXT Models

Install new inner shell in the reverse process.

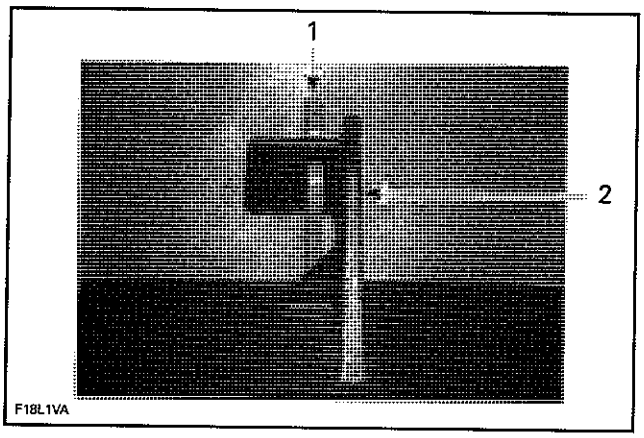
For installation, proceed as follows:

- Install the compass and secure it with the two darts.
- Install the temperature sensor in grommet.
- Install the tie raps around wire harnesses.
- Align inner shell with storage cover and make sure that the lateral locking hooks in the inner shell get engaged in the storage cover locking bracket.

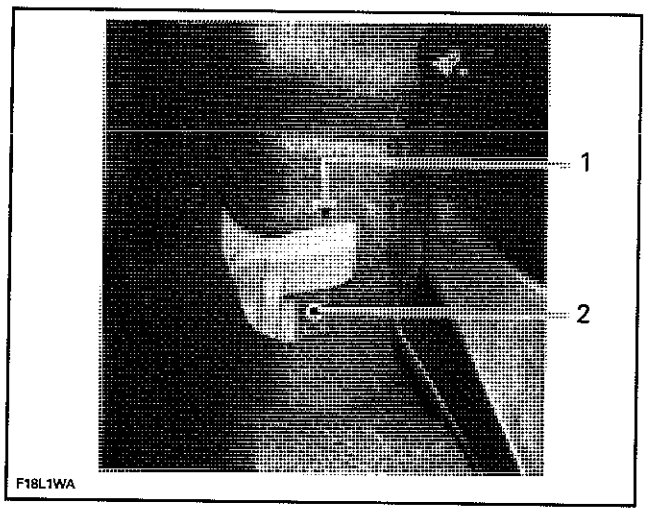


1. *Inner shell lateral locking hook*
2. *Inner shell back locking bracket*

If the two lateral locking hooks get properly aligned and engaged the storage cover back locking hook will be engaged properly in the inner shell back locking bracket.



1. *Storage cover lateral locking bracket*
2. *Inner shell lateral locking hook*



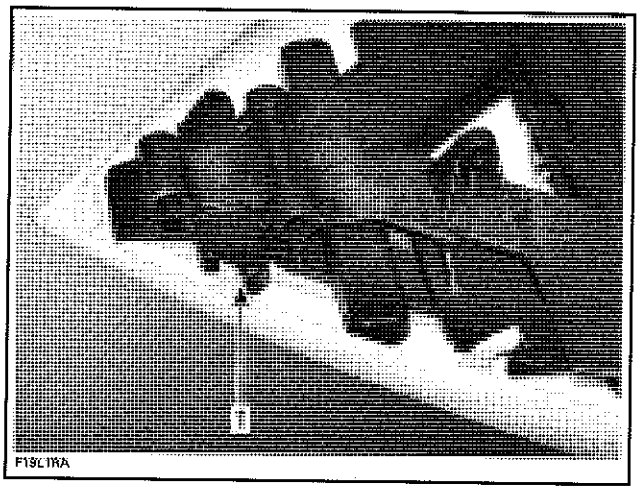
1. *Storage cover back locking hook*
2. *Inner shell back locking bracket*

- Secure the inner shell in the storage cover by using the rubber hammer.
- Fasten the seven inner shell short screws and the two inner shell long screws.

RXP Models

Installation is the reverse of removal procedure. However, pay attention to the following.

Lay down inner shell in storage cover. Align inner shell slot with cover tab. Do not force inner shell forward.



1. *Align cover tab with inner shell slot*

Install front screws. This will properly move inner shell forward and lock it into cover tabs.

Install top retaining screws (those located under the top tubes). Torque screws to 11 N•m (97 lbf•**in**).

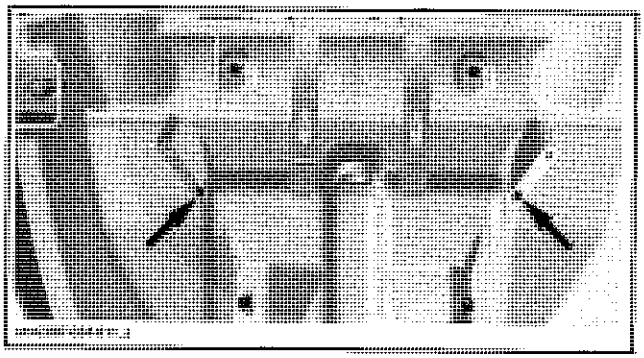
Install remaining retaining screws of inner shell.

FRONT GRILLE (STORAGE COMPARTMENT COVER)

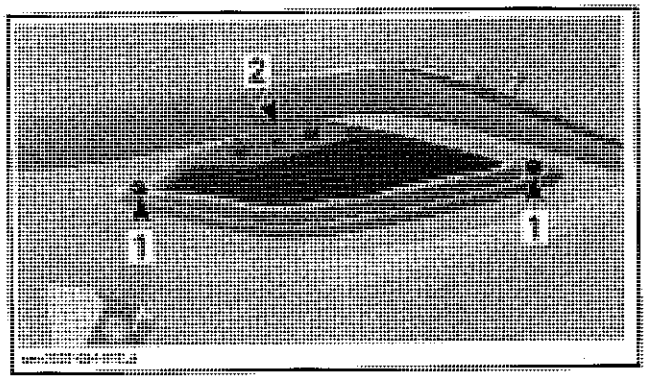
Front Grille Removal

GTX Series

Open storage compartment cover and remove screws securing front grille.



On GTX Limited model, to remove the chrome trim, remove lower inner shell then the locking washers.



1. Locking washers
2. Front grille

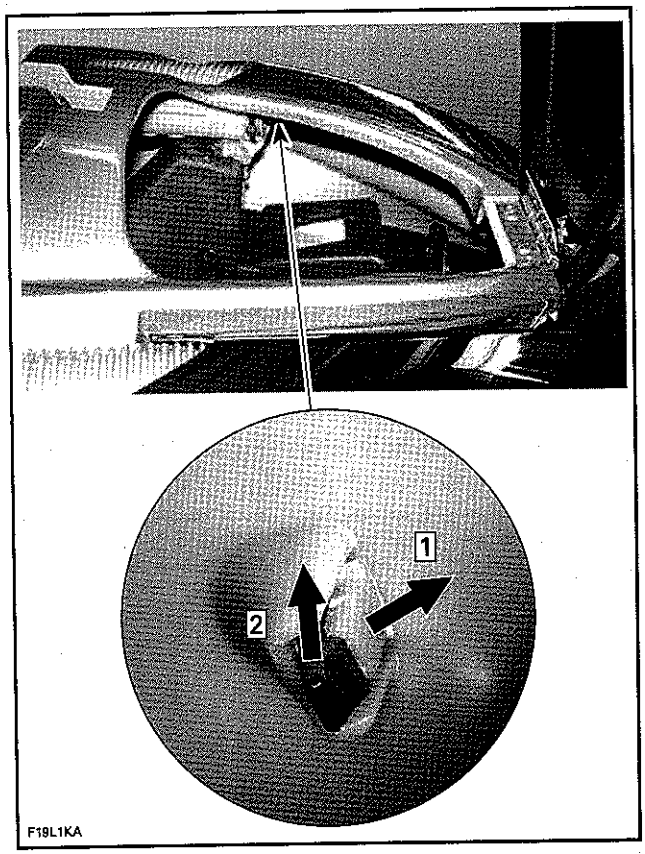
RXP Models

Remove inner shell.

Remove retaining screws of grille.

Carefully release the locking tabs.

CAUTION: Proceed with caution. Damaging the locking part of the storage cover will prevent proper retaining of the front grille after reinstallation.



Step 1: Release the locking tab and HOLD
Step 2: Push tab upward

Release front part of grille and remove it.

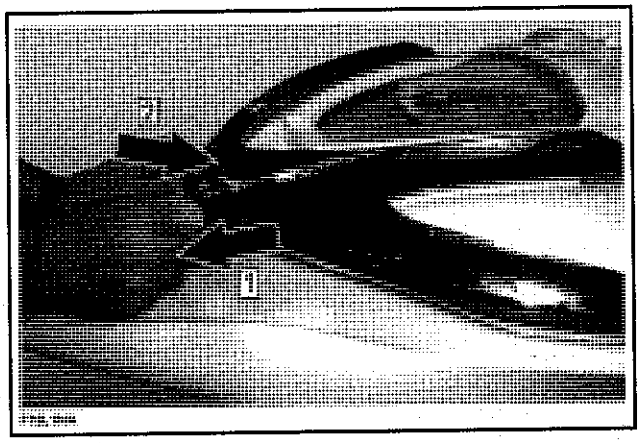
Front Grille Installation

GTX Series

The installation is the reverse of the removal procedure.

RXP Models

At installation, first install the front part of front grille. Do not snap rear tabs yet.



Step 1: Pull out the bottom edges by slightly twisting to hook up
Step 2: Push the top corner to snap in

Ensure to properly position and secure top tubes.

Snap the other tabs of front grille.

Install screws to retain front grille.

Reinstall inner shell.

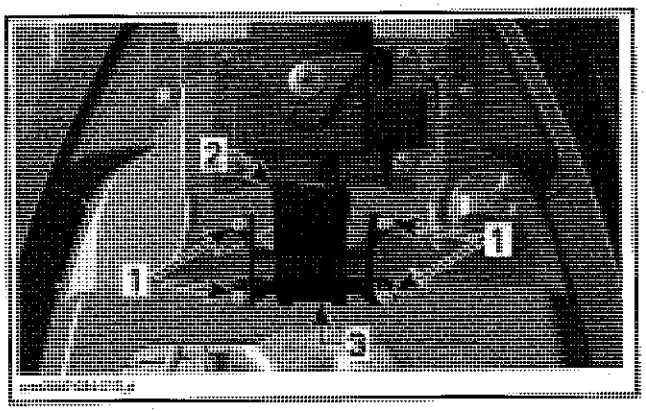
BASKET LATCH

GTI Models and GTX Series

Basket Latch Removal

Open storage compartment cover and remove basket.

Drill rivets and remove latch base from body.



1. Rivets
2. Latch base
3. Latch

smr2008-035

To replace the latch. Remove latch base and open its tabs to release the latch.

Basket Latch Installation

The installation is the reverse of the removal procedure.

WIND DEFLECTOR

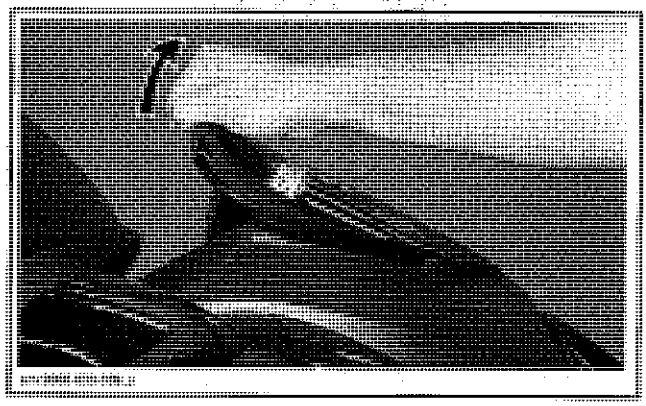
NOTE: There is no storage area underneath wind deflector. Do not remove needlessly.

Wind Deflector Removal

GTI Models

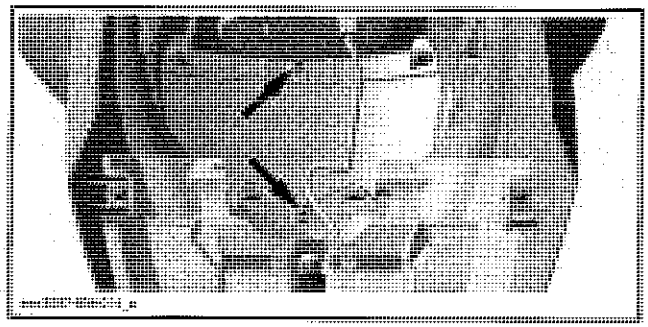
The wind deflector is located on the top of console.

Pull wind deflector to remove it.



GTX Series

The wind deflector must be removed by removing the upper inner shell and both retaining screws. Pull the deflector to remove it.



Wind Deflector Installation

The installation is the reverse of the removal procedure.

ACCESS COVER

Access Cover Removal

RXP Models

On these models, the access cover is located on the top of the storage compartment cover.

Press latch and lift up cover to open it.

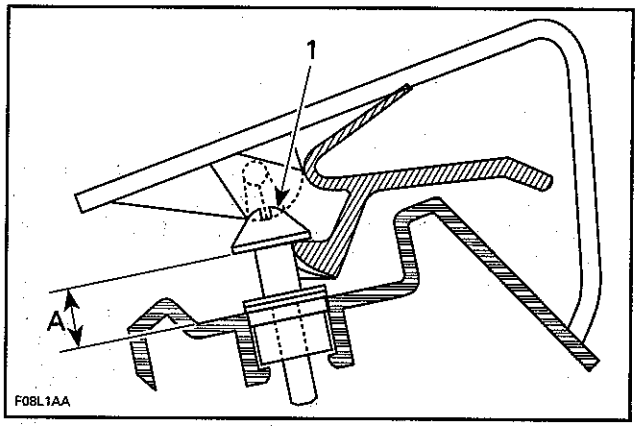
Access Cover Installation

GTI Models

The installation is the reverse of the removal procedure.

RXP Models

When installing the access cover, adjust its locking pin. Refer to the following illustration.



1. Access cover locking pin
A. 12 mm ± 0.9 mm (.472 in ± .035 in)

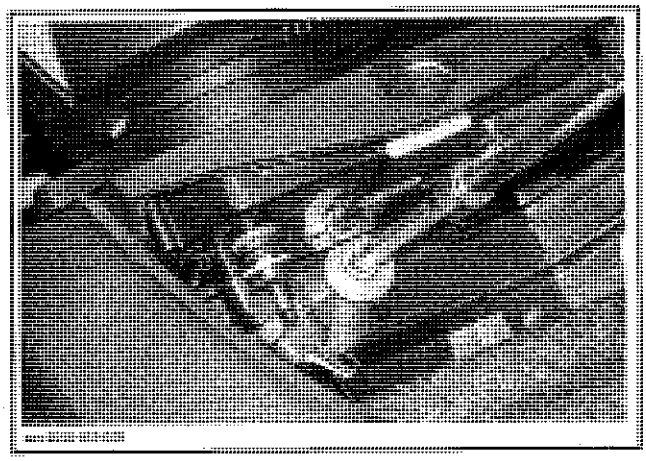
CONSOLE

GTI Models

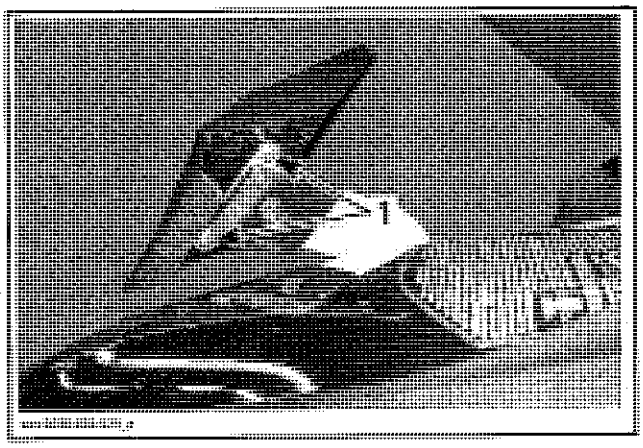
Console Removal

Remove access cover and unplug the information center.

On **GTI SE model**, using a 8 mm Allen screw, remove the socket screw holding mirror support to steering support.



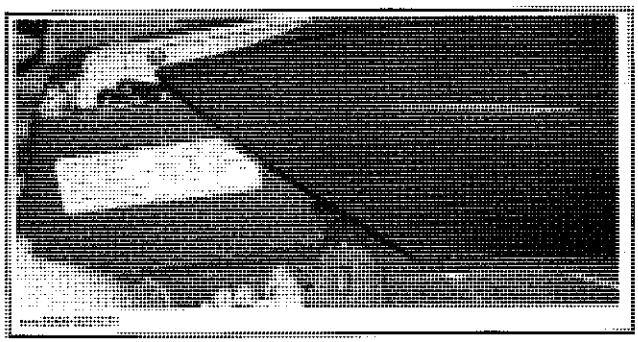
Remove shift lever handle.



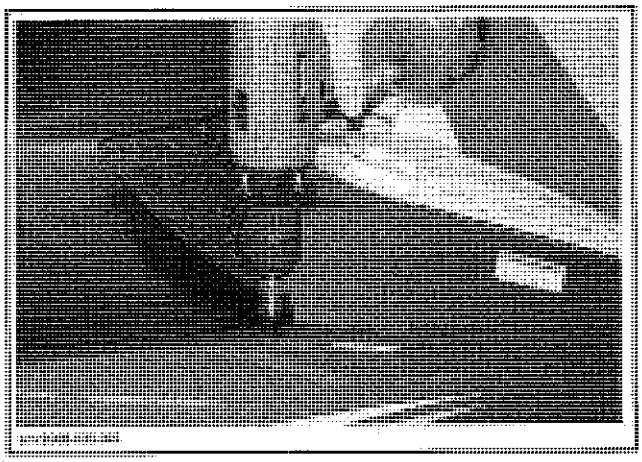
1. *Shift lever handle screws*

Remove *GLOVE BOX*, see procedure above in this section.

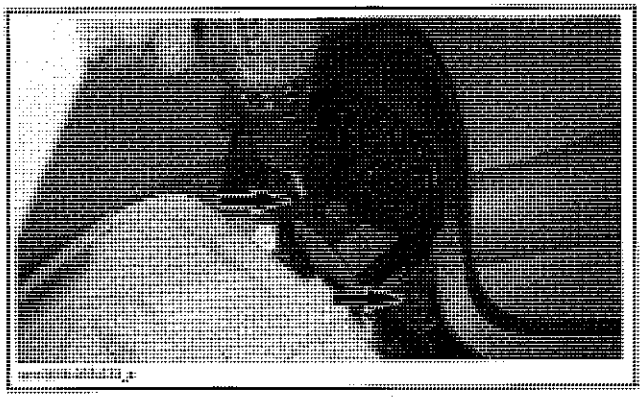
Using a Supertanium™ drill bit (P/N 529 031 800), drill rivets holding console to body.



RH SIDE OF VEHICLE — NEAR GLOVE BOX



RH SIDE OF VEHICLE — FRONT OF CONSOLE



UNDER STORAGE COMPARTMENT COVER

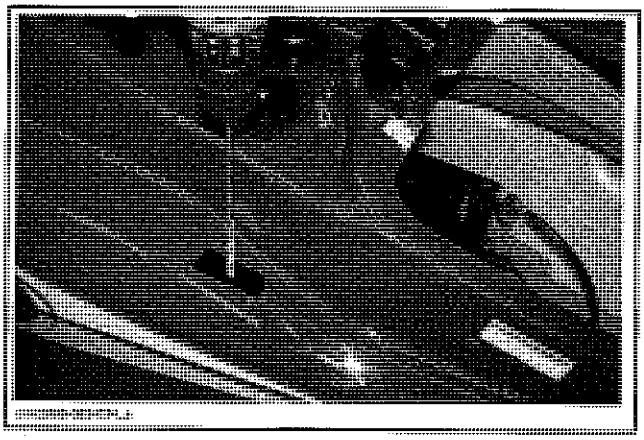
Console Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Install console with its foam. Do not apply products such as glue or silicone, to retain foam on body or foam to console. The foam must moved freely to allow a good air flow toward engine.

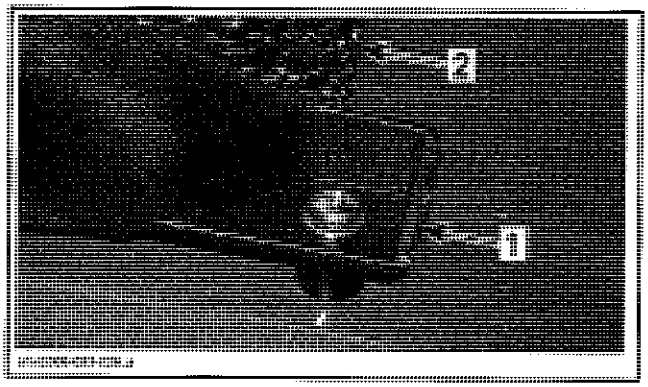
During installation of front rivets if a rivet does not keep console against body, use the following procedure.

- On each side, using a 6 mm (15/64 in) drill bit, drill front rivet holes. Install a tip of adhesive tape over holes to avoid gelcoat damages.



– Install the following fasteners to attach console to body.

QUANTITY	FASTENERS DESCRIPTION
2	Pan head Phillips screw M5 x 35 (P/N 208 653 560)
4	Flat washer (P/N 234 061 600)
2	Elastic stop nut M5 (P/N 232 561 600)



1. *Console*
2. *Foam*

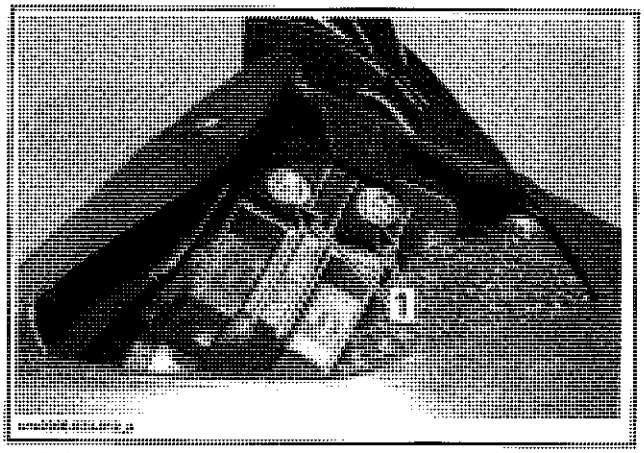
MIRROR

Mirror Removal

GTI SE Model

Remove the information center. See *GAUGE/ FUSES* section.

Unscrew mirror housing bolts.

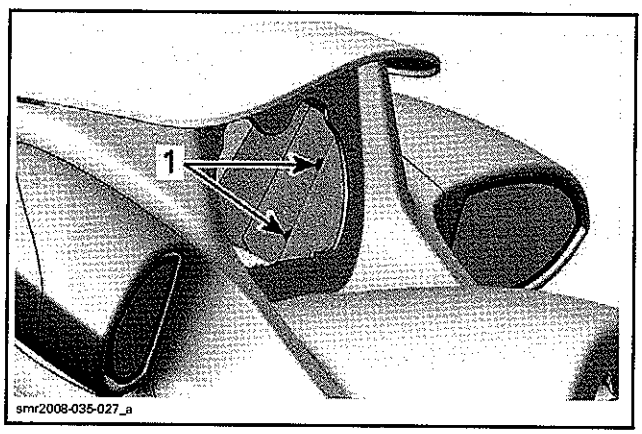


1. *Left mirror bolts*

GTX Series

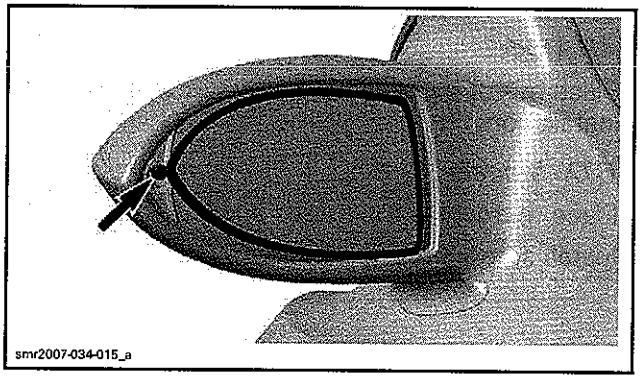
Remove the information center. See *GAUGE/ FUSES* section.

Remove screws holding the mirror housing.



1. *Mirror housing screws*

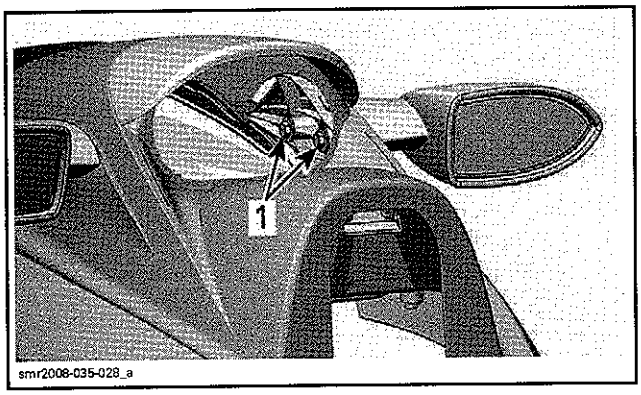
Remove the last screw located behind the mirror.



RXP and RXT Models

Remove the information center. See *GAUGE/ FUSES* section.

Unscrew mirror housing screws and remove their flat washers.



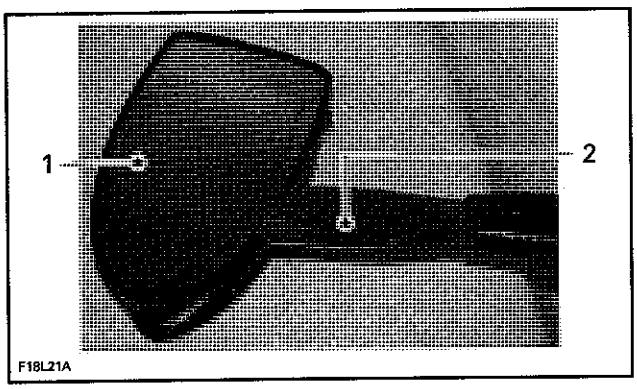
1. Mirror housing screws

Remove mirror assemblies from front storage cover.

Pry out mirrors from mirror shells.

All Models

Remove defective mirror from mirror moulding with a spatula.



1. Mirror
2. Spatula

Mirror Installation

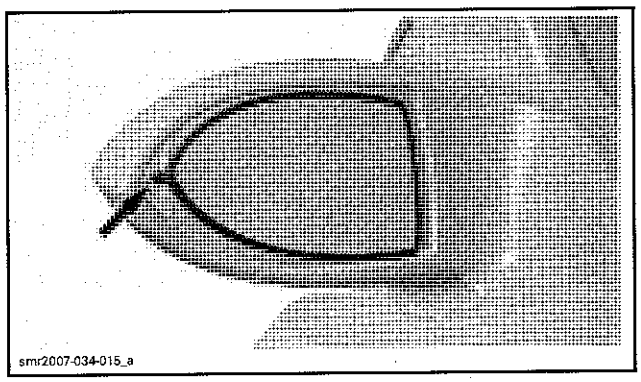
All Models

Place mirror moulding in hot water to allow mirror installation.

GTX Models

Place mirror into the mirror shell.

Install screw behind mirror.



Torque it to 1 N•m (9 lbf•**in**).

Tighten mirror shell screws fingertight to ensure a correct installation.

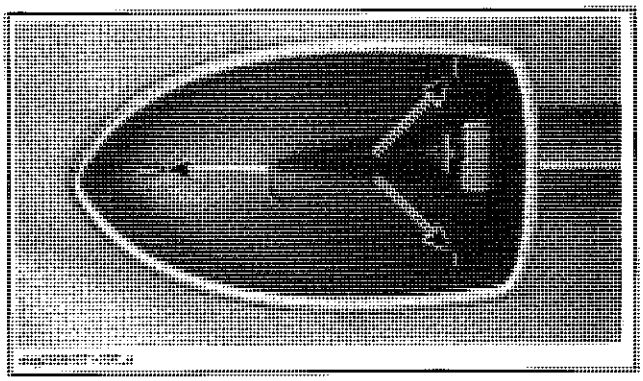
Torque them to 1 N•m (9 lbf•**in**).

Install the information center.

RXP and RXT Models

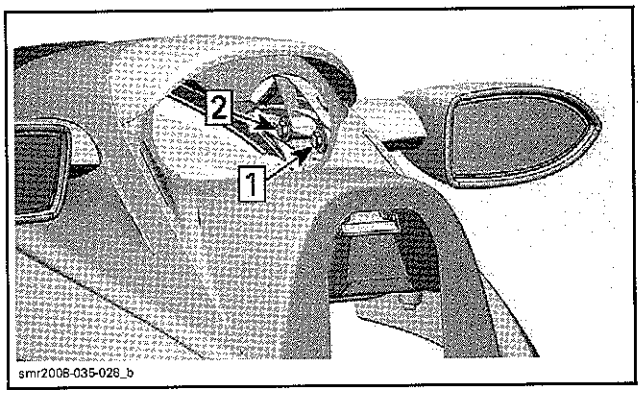
Place mirror into the mirror shell.

NOTE: Mirror should be pressed against plastic tabs into mirror shell.



Install and tighten screws fingertight to ensure a correct installation.

Using the following sequence, torque screws to 5 N•m (44 lbf•**in**).



Install the information center.

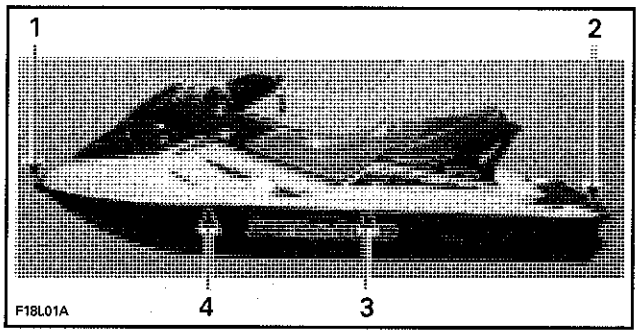
BUMPER

Bumper Replacement

Remove trim from side bumper rail.

Remove screws to remove side bumper rail.

Mark hole positions on body straight and bow sections.



TYPICAL
1. *Front bumper*
2. *Corner bumper*
3. *Straight section*
4. *Bow section*

Slide bumper rail under front bumper.

Using a 4.80 mm (3/16 in) drill bit, drill first hole through bumper rail at front of bow section.

CAUTION: When drilling, be careful not to damage bumper rail and/or hull.

Position bumper rail properly onto body and cut excess length if necessary.

Slide bumper rail in corner bumper.

Install trim using soapy water.

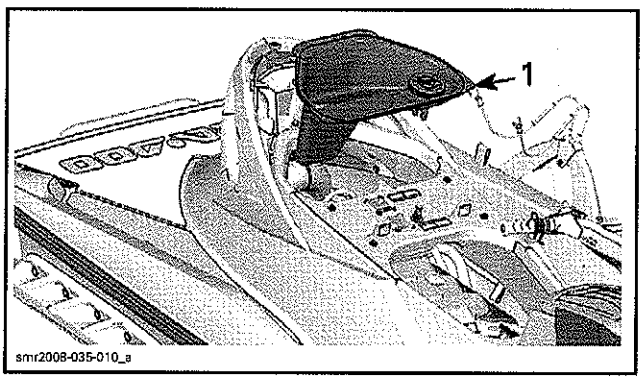
Repeat procedure for the other side.

WAKE PYLON (MOULDED)

GTX Wake Model

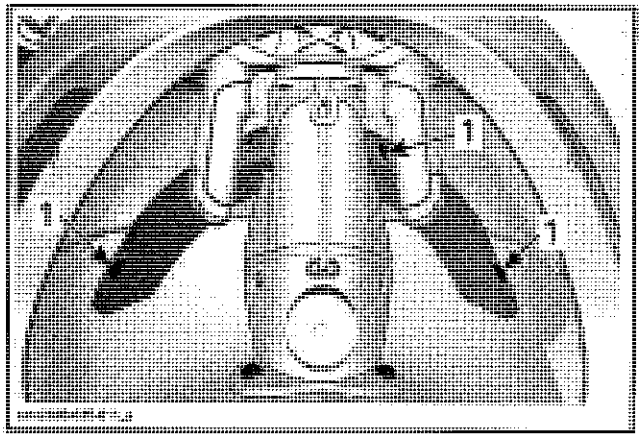
Wake Pylon Removal

Remove rear seats and storage basket.



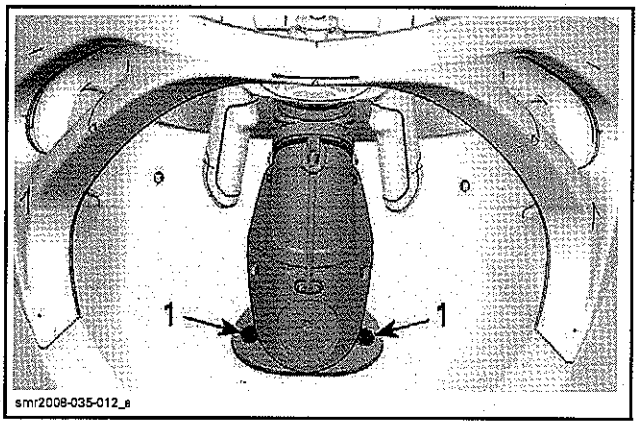
1. *Storage basket*

Remove both lateral arms.



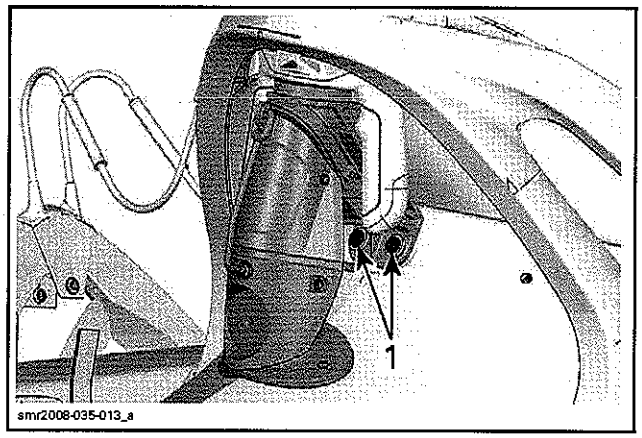
1. *Lateral arms screws*

Remove bolts at the bottom of wake pylon.



1. *Wake pylon bottom bolts*

Remove bolts securing the wake pylon support to body.



1. *Wake pylon support bolts*

Lift the wake pylon to disengage its bottom from the body.

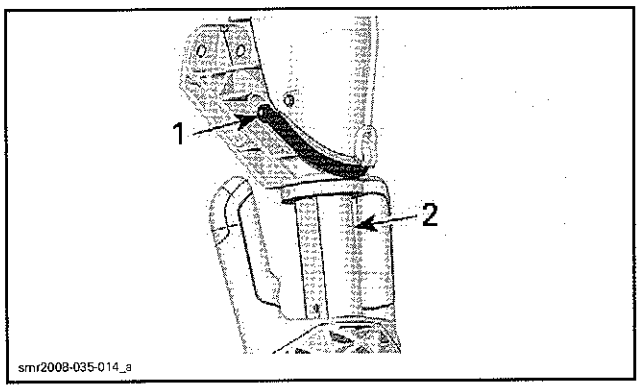
Remove the wake pylon from vehicle.

Wake Pylon Disassembly

Extend the handle completely.

Turn the wake pylon up side down.

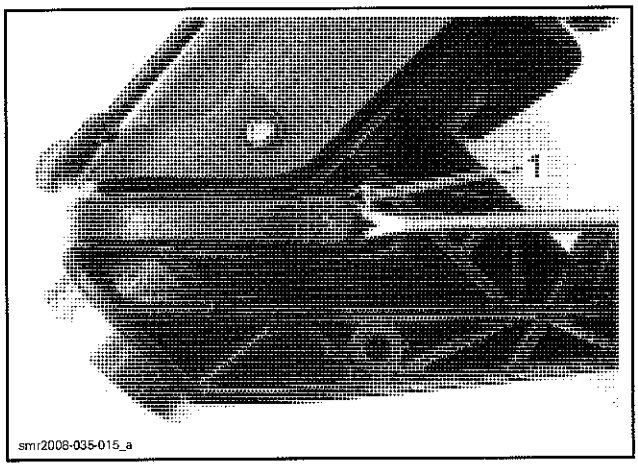
Move both ends of locking strap to disengage the inner lock and free the handle.



1. Locking strap end
2. Handle stem

Locking Strap

Using a screwdriver or any other suitable tool, detach a side of the locking strap from retaining pin.

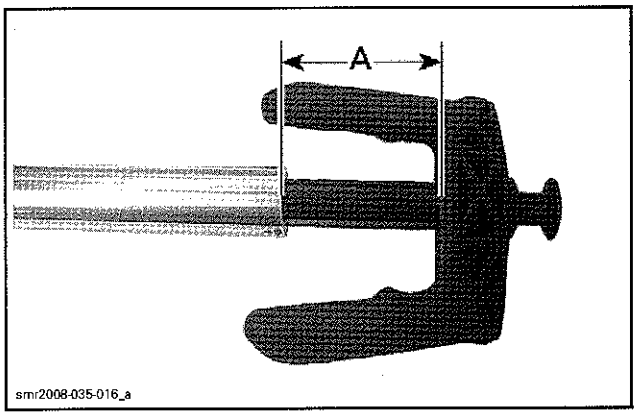


1. Locking strap

Remove locking strap and the inner lock.

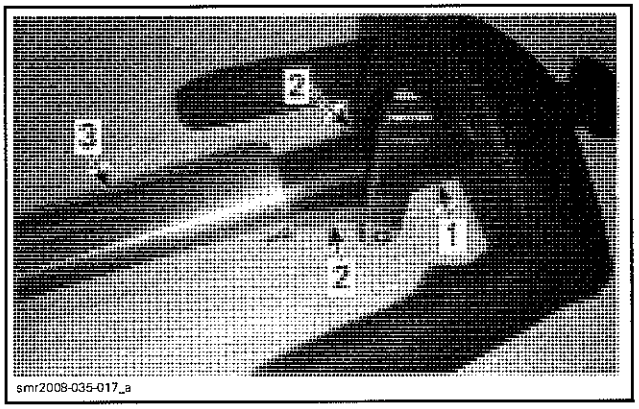
Handle

Extend handle approximately 75 to 90 mm (3 to 3–1/2 in).



A. 75 to 90 mm (3 to 3–1/2 in)

Insert two thin feeler gauges between handle stem and extension tube.



1. Handle stem
2. Feeler gauges
3. Extension tube

Place a rag around the joint to catch balls and spring.

Hold feeler gauges and pull the handle.

Wake Pylon Assembly

Handle

Install a loose locking tie on handle stem.

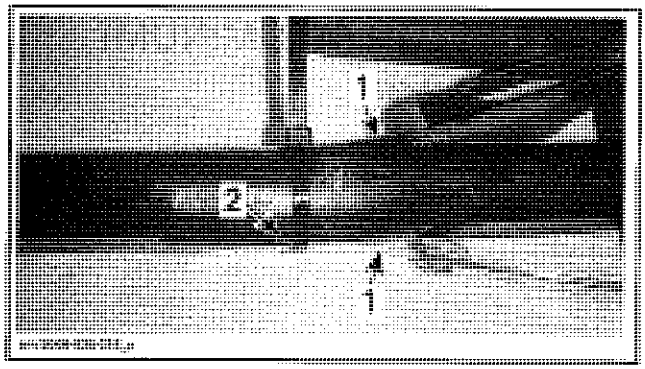
Apply XP-S synthetic grease (P/N 293 550 010) on each ends of spring.

Insert the spring in the handle stem hole.

Position a ball on each ends of spring.

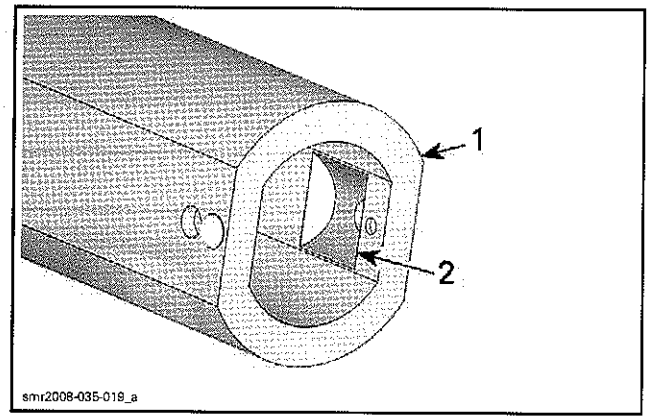
Install a feeler gauge over each balls.

Tighten the locking tie in order to retain feeler gauges and balls.



1. *Feeler gauges*
2. *Ball*

Apply XP-S synthetic grease (P/N 293 550 010) in both recesses of the extension tube.



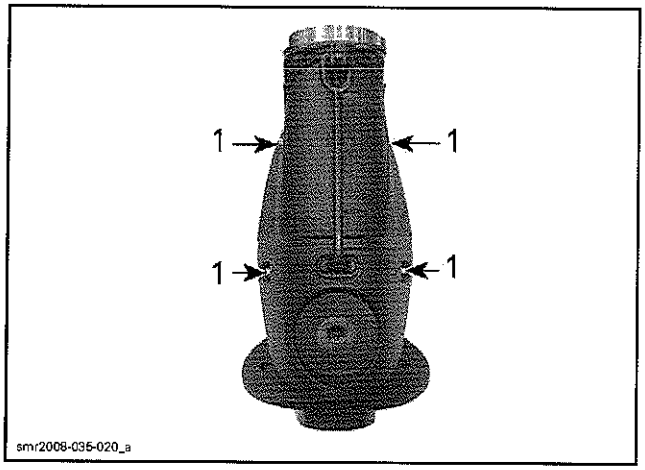
1. *Extension tube*
2. *Recesses*

Slide the handle stem into the extension tube.

Remove feeler gauges and locking tie.

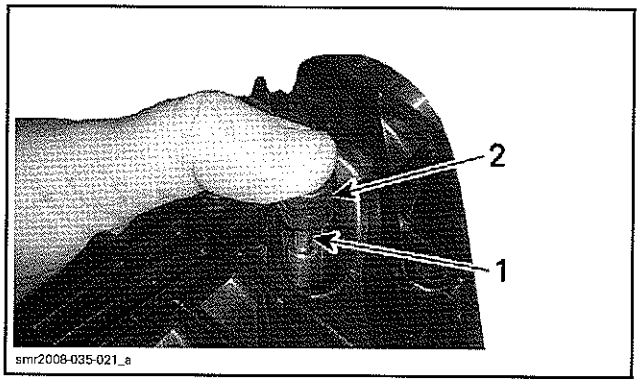
Locking Strap

Remove the wake pylon trim.



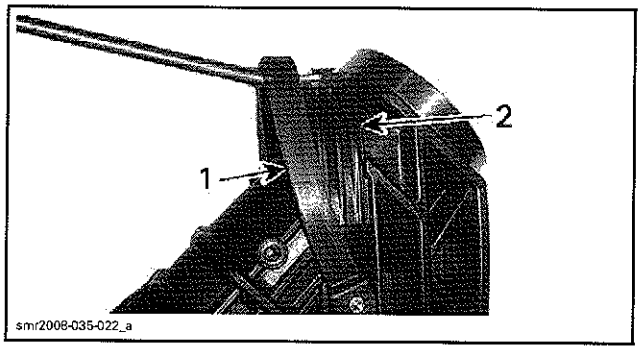
1. *Wake pylon trim screws*

Install lock and insert the end of the locking strap over the retaining pin.



1. *Retaining pin*
2. *Locking strap*

Using a suitable tool, position the locking strap in its groove.



1. *Locking strap*
2. *Locking strap groove*

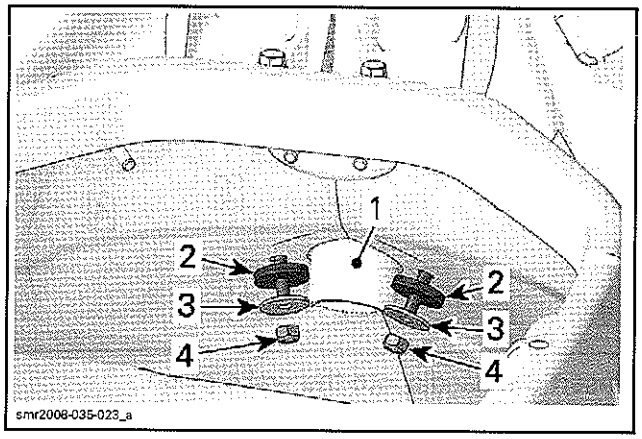
Reinstall the wake pylon trim.

Do not install the handle into wake pylon yet.

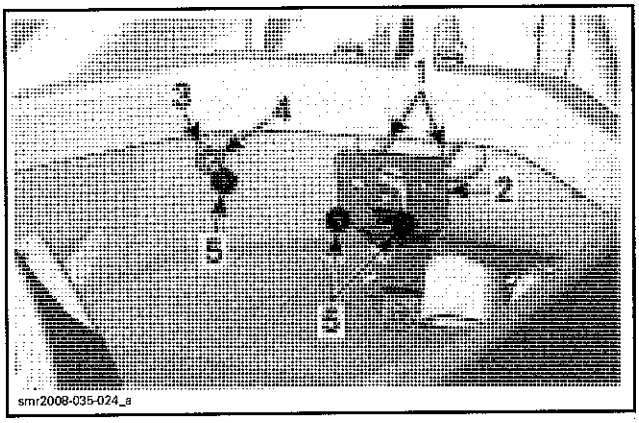
Wake Pylon Installation

Position the wake pylon on vehicle.

Install all bolts securing wake pylon and lateral arms.



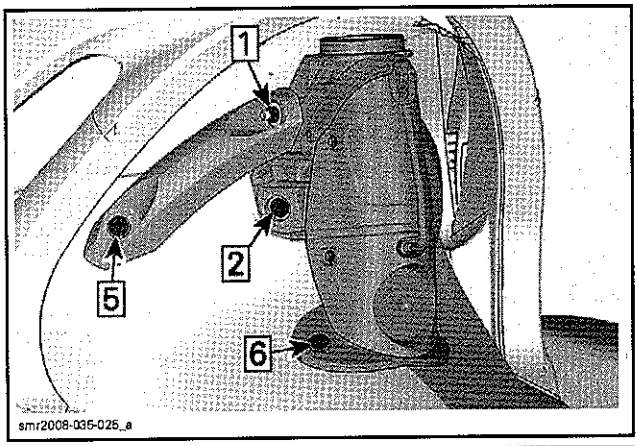
1. *Bottom of wake pylon*
2. *Rubber washers*
3. *Flat washers*
4. *Nuts*

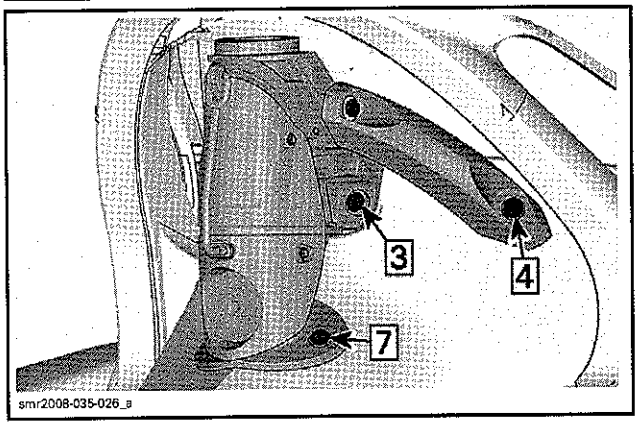


1. *Wake pylon support bolts*
2. *Support plate*
3. *RH lateral arm bolt*
4. *Flat washer*
5. *Nuts*

Tighten all bolts fingertight.

Ensure base of wake pylon is well leaned against body and tighten all bolts using this following sequence.





Insert the handle into the wake pylon.

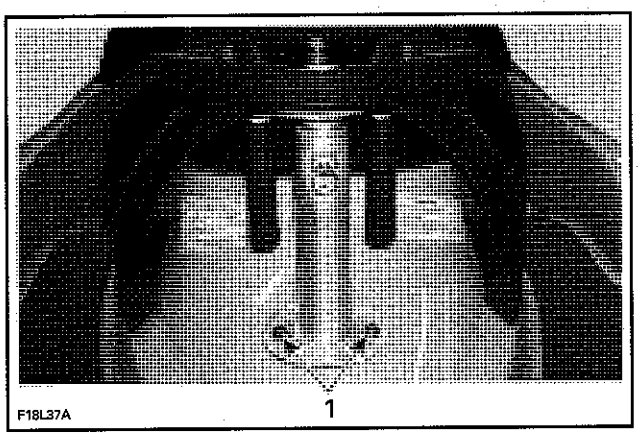
Move both ends of the locking strap forward to insert the handle completely.

WAKE PYLON (ALUMINUM)

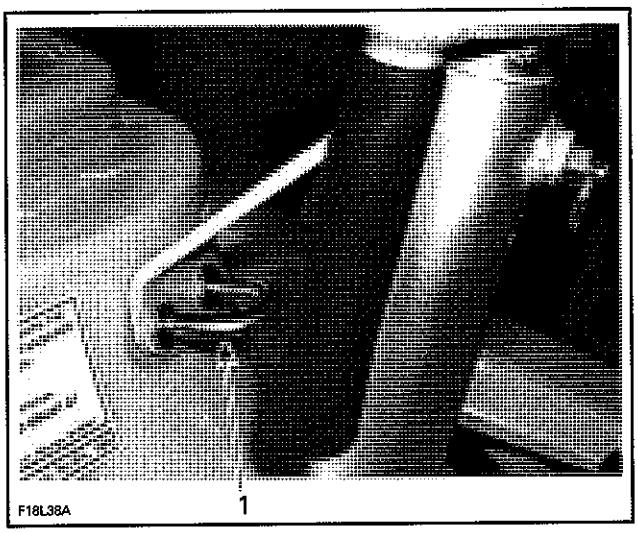
GTX Wake Model

Wake Pylon Removal

Remove the rear seat and storage basket under it.
Remove nuts.



1. *Screws to be removed*

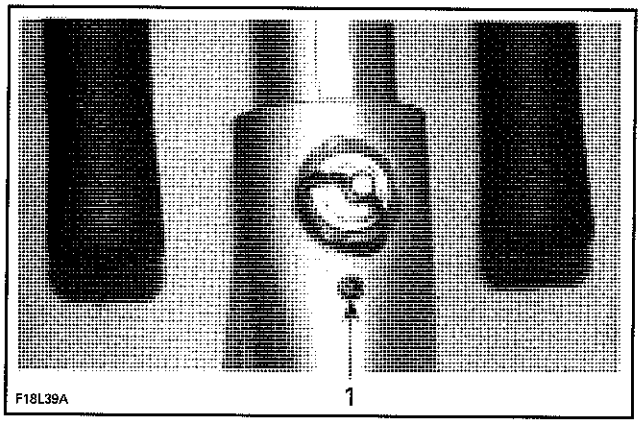


1. *U-clamp*

Remove finition U-clamp, and screws then pull out wake post.

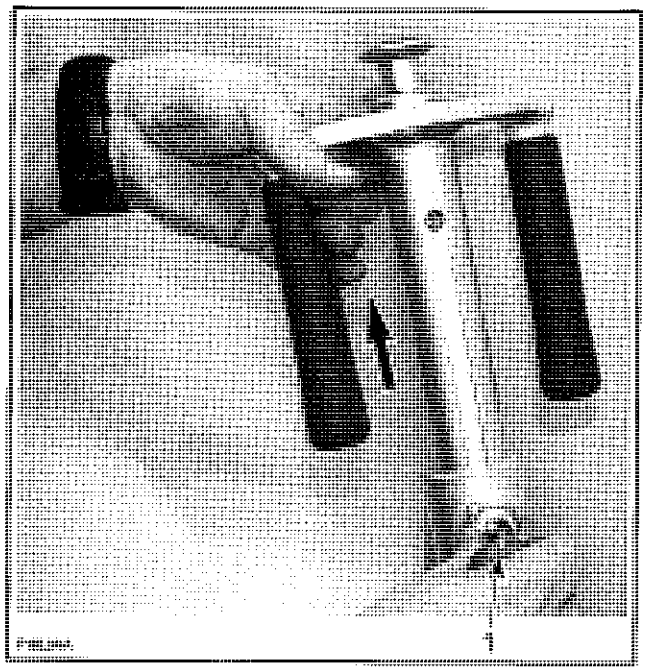
Wake Pylon Disassembly

Loosen the stopper screw.



1. Stopper screw

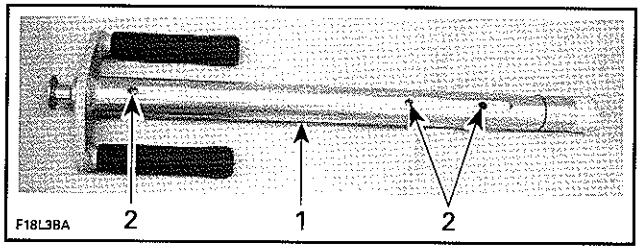
Pull the safety lock pin to unlock and pull out the cylinder.



1. Safety lock pin

Wake Pylon Assembly

Before assembly verify the physical condition of cylinder groove and adjustment holes.



1. Groove
2. Adjustment holes

Align groove with stopper screw, while inserting the cylinder into housing.

Tighten the stopper screw.

Wake Pylon Installation

Before installation, make sure:

- Inside cylinder slides up and down freely without obstruction from grab handle
- Safety lock pin operates properly
- Stopper screw stops cylinder at its most upwards position.

To install the wake post, reverse removal procedure.

CARPET

Carpet Removal

Unstick a carpet corner.

Pull carpet vigorously to remove the carpet and its glue from body.

To remove the remaining glue from body, use a plastic or rubber spatula. Scrape remaining glue with spatula.

NOTE: Do not use any products (alcohol, acetone, thinner, etc.) or heat the remaining carpet glue. Chemical reactions make glue very hard to remove.

Carpet Installation

Clean body surface with isopropyl alcohol and dry thoroughly.

Install new carpet.

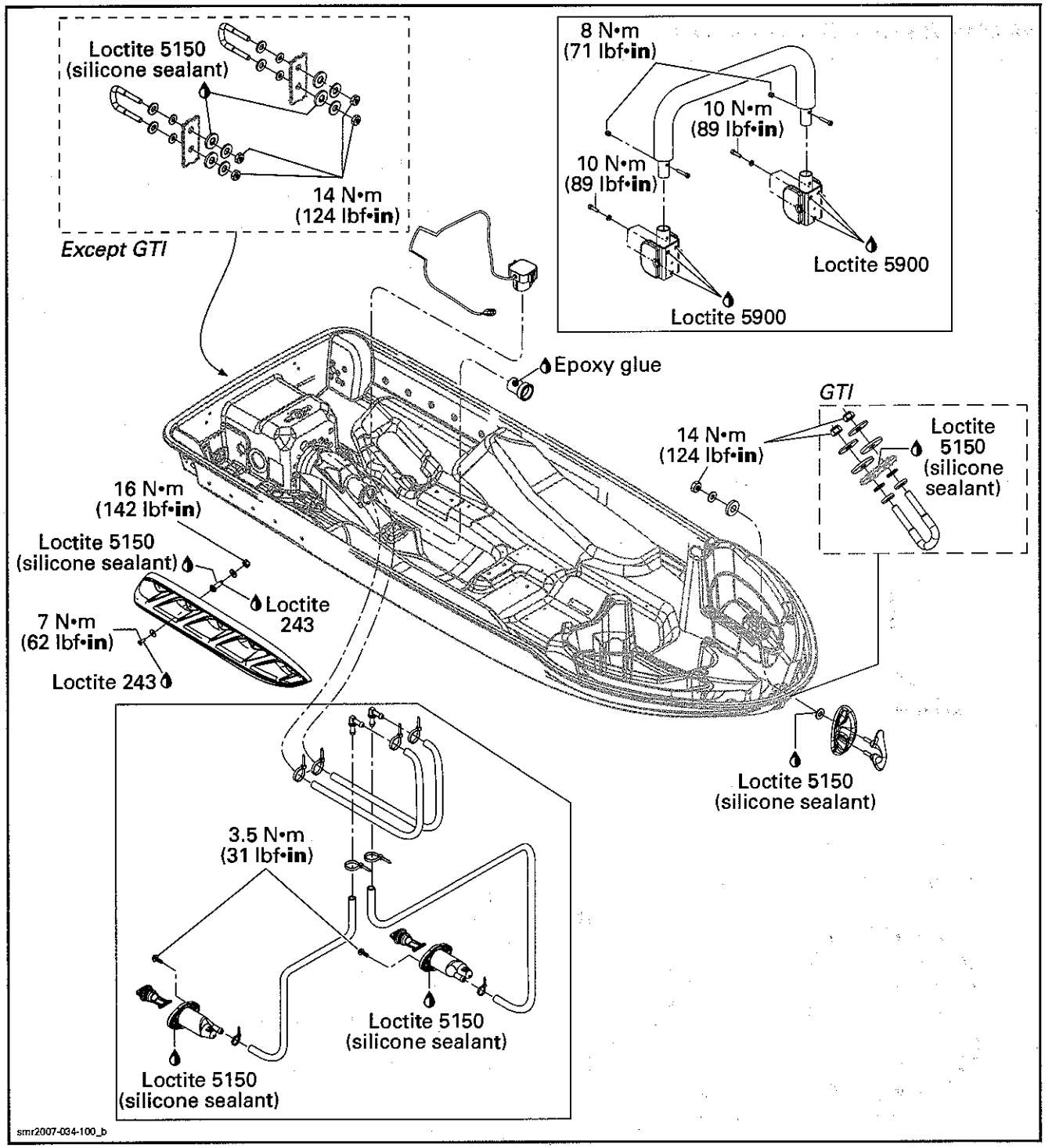
Carpet Cleaning

To clean the carpets, use 3M™ Citrus Base Cleaner or the equivalent. See the manufacturer's instructions.

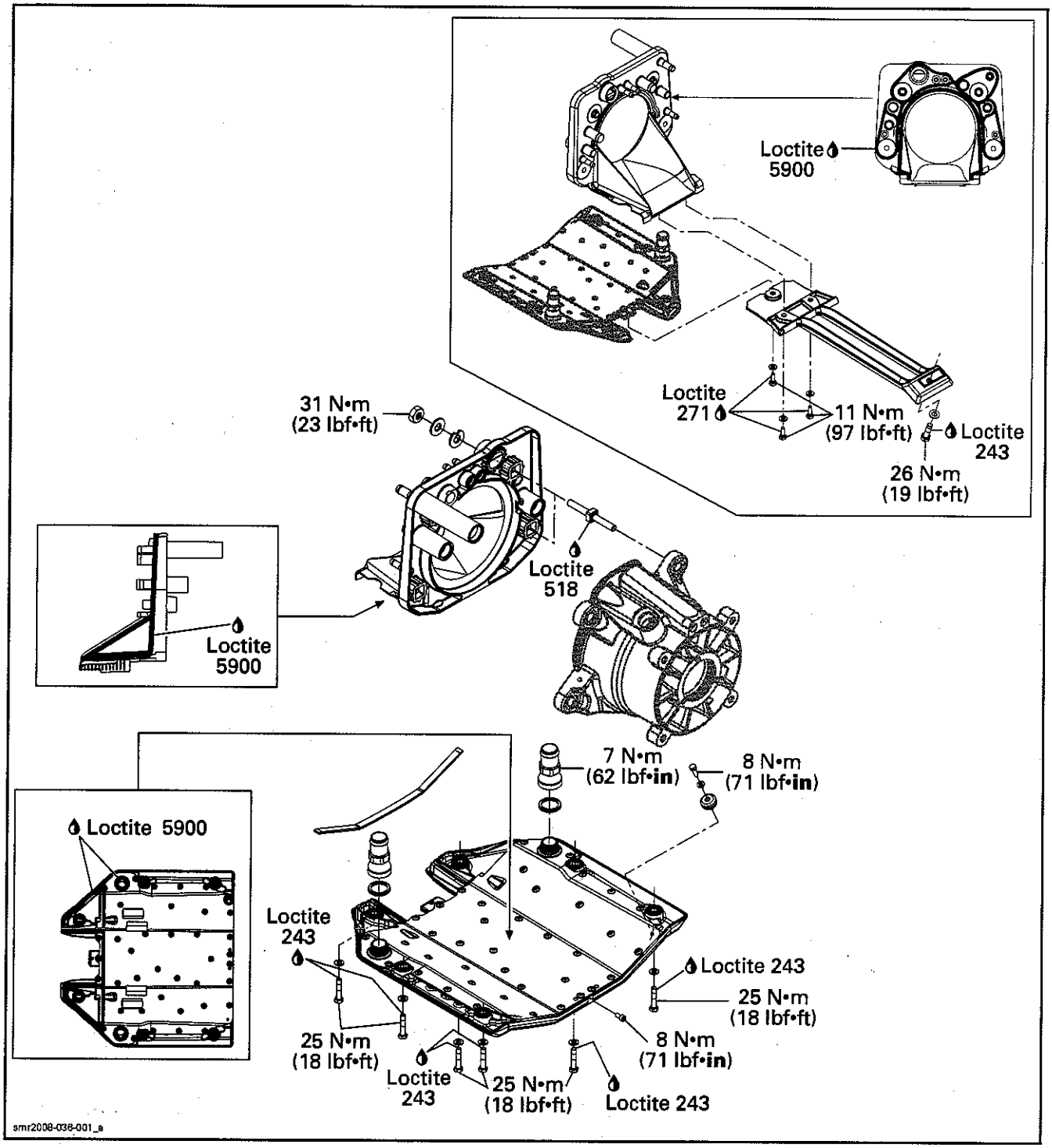
HULL

SERVICE PRODUCTS

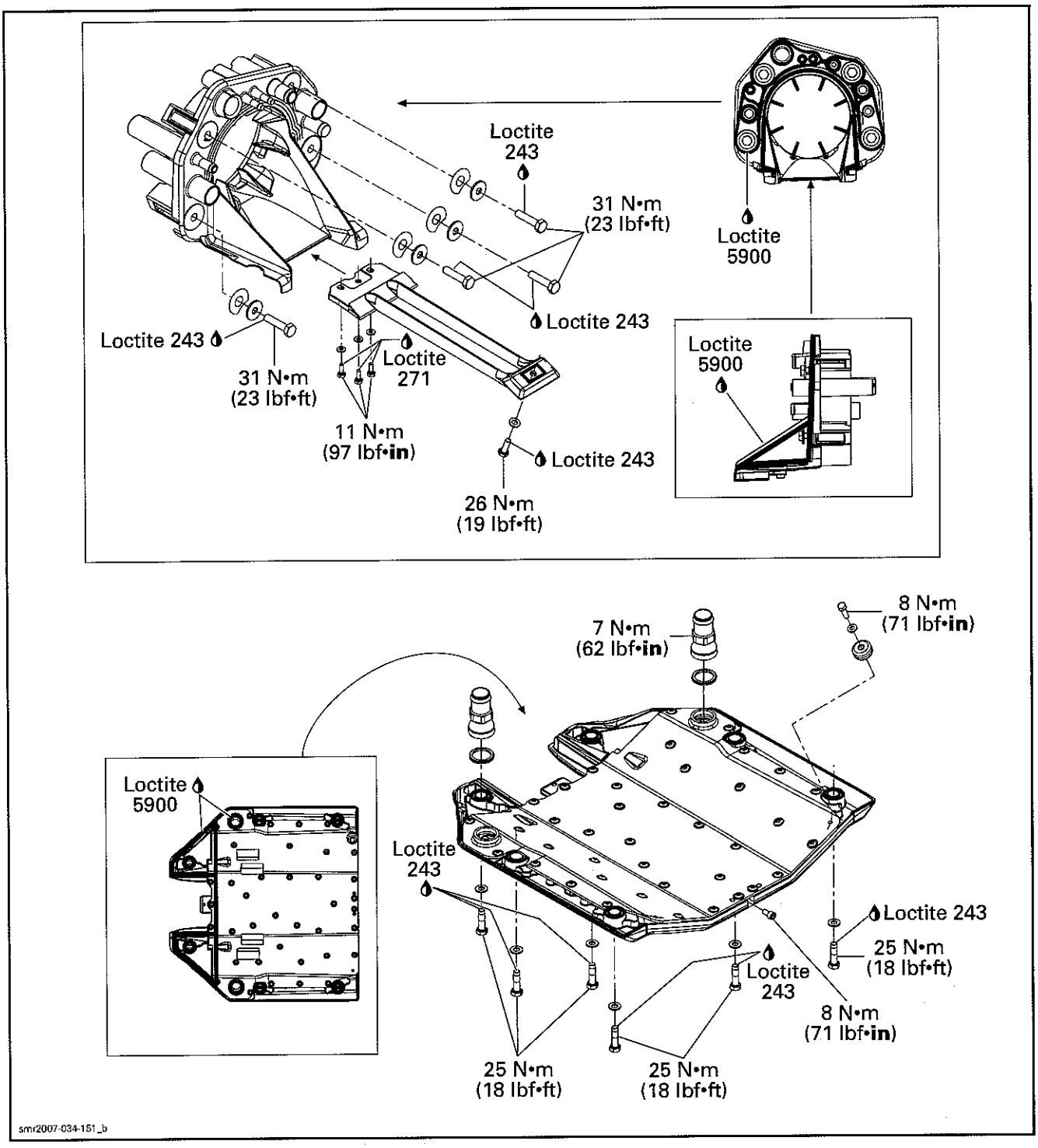
Description	Part Number	Page
BRP heavy duty cleaner	293 110 001	479–480
Loctite 271 (red)	293 800 005	477
Loctite 518	293 800 038	480
Loctite 243 (blue)	293 800 060	477, 479–480, 482
Loctite 5900	293 800 066	479–480
Loctite 5150 (silicone sealant)	293 800 086	477, 482–485



All Models except RXP Series and RXT 255



RXP Series and RXT 255



GENERAL

Verify hinges condition and latching mechanisms condition and operation. Replace any damaged components.

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

CAUTION: When applying threadlocker products (anaerobic products), pay attention so that it does not come in contact with ABS plastic parts (painted parts). It could lead to plastic cracks or other damage.

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new one.

Hoses or cables removed or disconnected must be installed and routed at the same place.

CAUTION: Locking ties removed during a procedure must be replaced and installed at the same location.

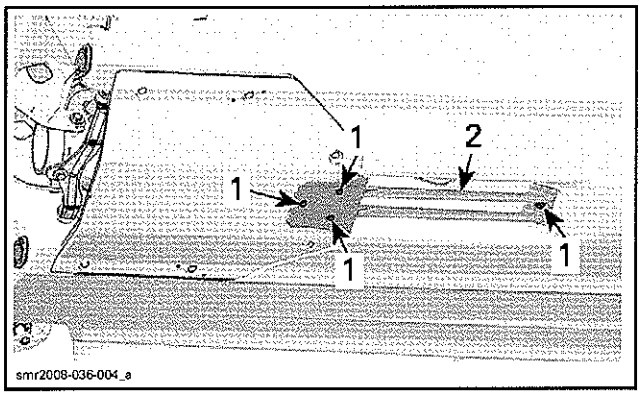
PROCEDURES

INLET GRATE

Inlet Grate Removal

Using a heat gun, heat screws to break threadlocker.

Loosen screws and remove inlet grate.



1. *Inlet grate screws*
2. *Inlet grate*

NOTE: An impact screwdriver should be used to loosen screws.

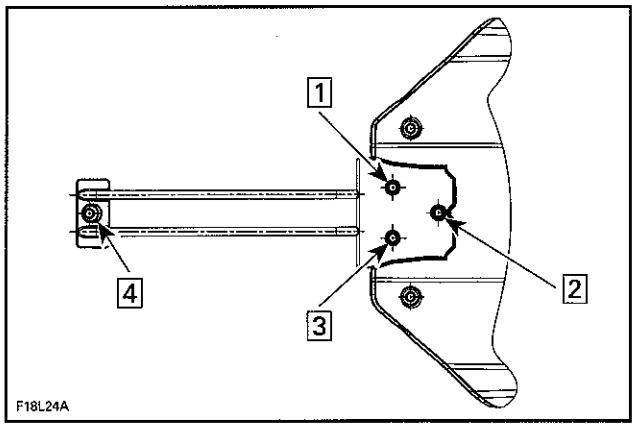
Inlet Grate Installation

When installing inlet grate, apply Loctite 271 (red) (P/N 293 800 005) on threads of M6 screws.

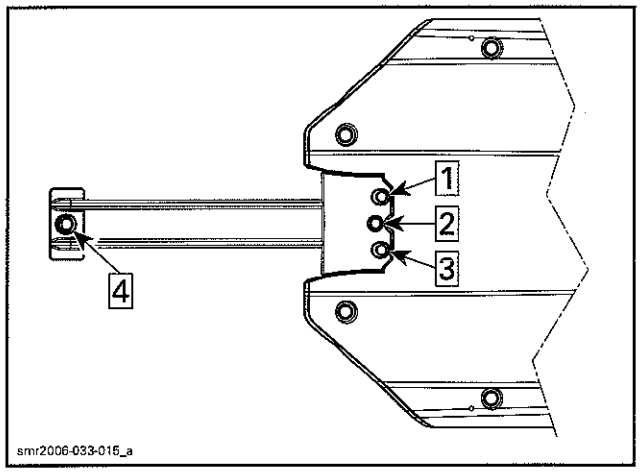
Apply Loctite 243 (blue) (P/N 293 800 060) on threads of M8 screw or use a new M8 screw with self-locking threadlocker.

Follow this sequence referring to the illustration:

- Hand tighten screws from 1 to 4.
- Torque screw from 1 to 3 to 11 N•m (97 lbf•**in**).
- Torque screw 4 to 26 N•m (19 lbf•ft).



ALL MODELS EXCEPT RXP SERIES AND RXT 255



RXP SERIES AND RXT 255

From inside of hull, apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on the end of the M8 screws and install a protector disc.

RIDING PLATE

Riding Plate Removal

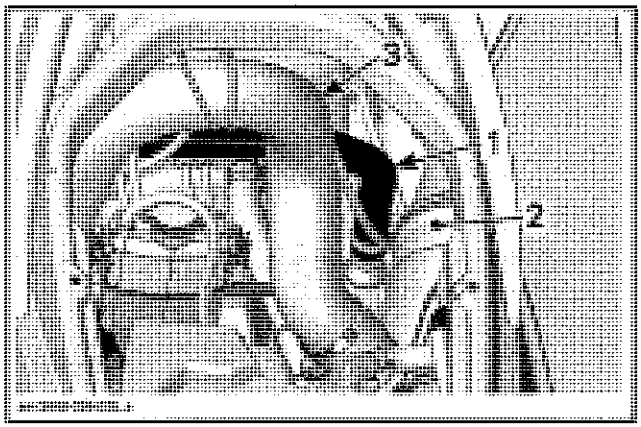
Remove *INLET GRATE*, see procedure in this section.

Remove jet pump. Refer to *JET PUMP* section.

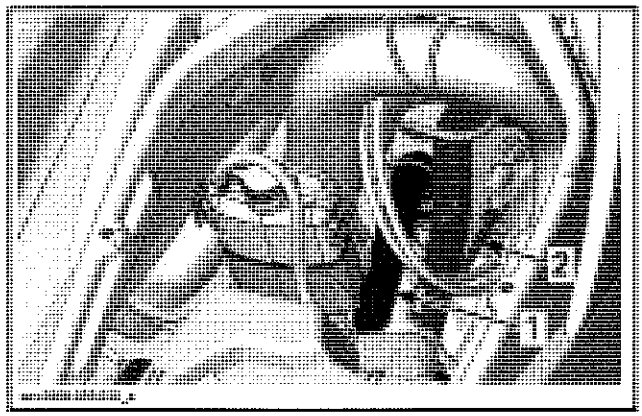
Drain cooling system. Refer to *COOLING SYSTEM* section.

On **255 engines**, remove the inlet and outlet air hoses from intercooler.

Disconnect hoses from ride plate.

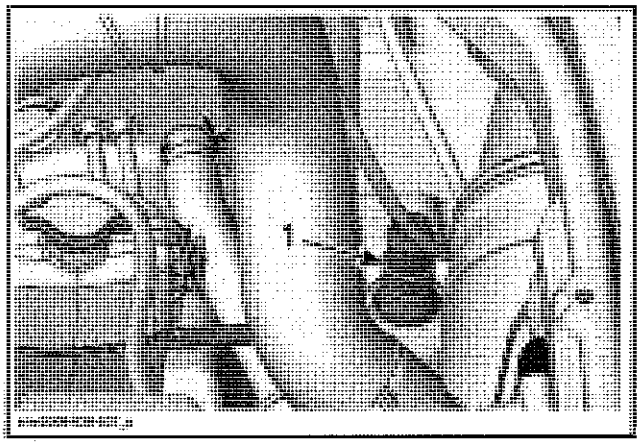


1. *LH hose*
2. *Muffler*
3. *Muffler hose*



1. *RH hose*
2. *Steering cable*

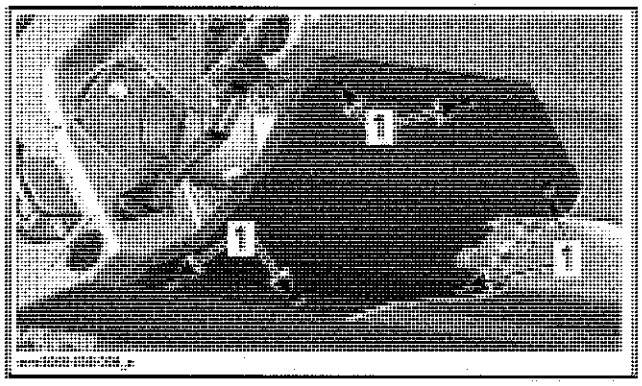
Unscrew hose fittings from ride plate.



1. *LH hose fitting*

CAUTION: Removing hose fittings prior to pulling out ride plate prevents the possibility to damage fittings.

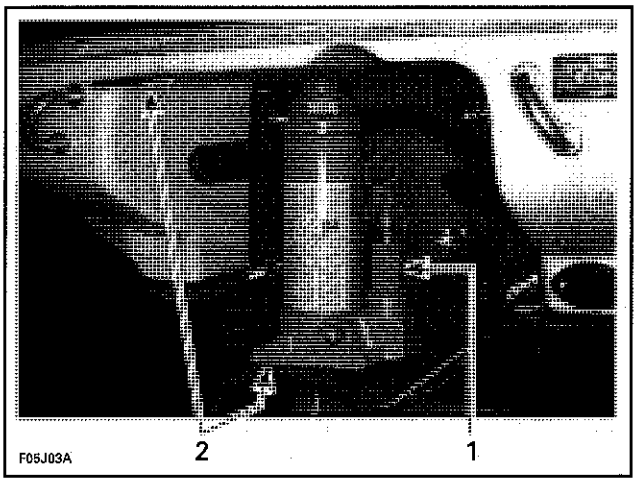
Using a heat gun, heat riding plate screws to break threadlocker then remove them.



1. *Riding plate screws*

NOTE: An impact screwdriver should be used to loosen screws.

Using a low height hydraulic bottle jack and 2 steel plates, pry out riding plate. Heat the riding plate with a heat gun before prying.



TYPICAL
1. *Hydraulic bottle jack*
2. *Steel plates*

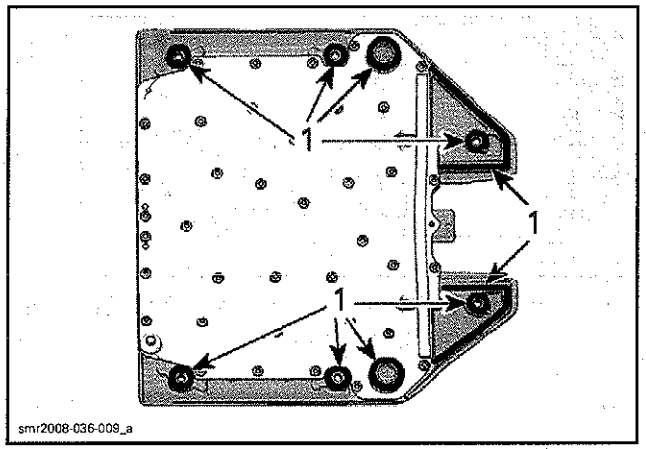
Riding Plate Cleaning

Scrape off all excess of sealant from riding plate and hull.

Clean hull surface with BRP heavy duty cleaner (P/N 293 110 001) to eliminate grease, dust and any residue of sealant. Clean fitting threads.

Riding Plate Installation

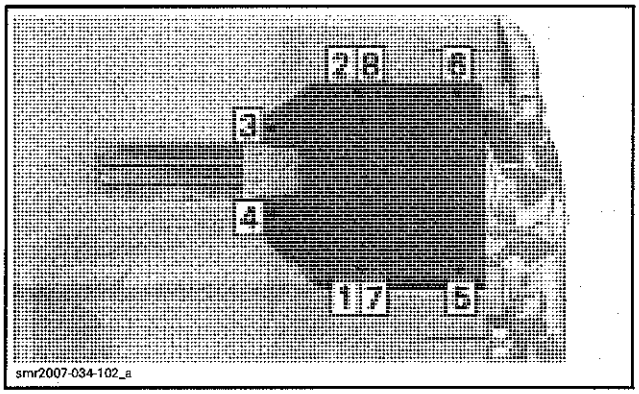
Apply Loctite 5900 (P/N 293 800 066) as indicated by the shaded areas in the next illustration.



1. *Apply Loctite 5900 here*

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of M8 screws or use new M8 screws with Scotch grip.

Torque screws to 25 N•m (18 lbf•ft) as per following sequence.



Properly reinstall hose fittings to ride plate.

Reinstall hoses to ride plate and refill cooling system. Refer to *COOLING SYSTEM* section.

Install jet pump and inlet grate.

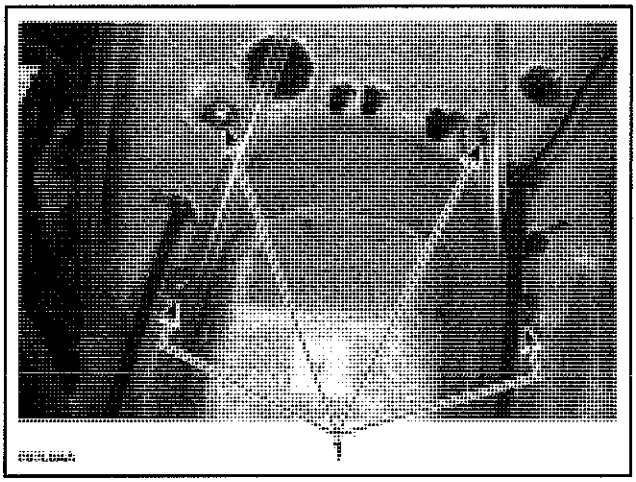
JET PUMP SUPPORT

Jet Pump Support Removal

Inside Hull

Disconnect water supply hose, water return hose and bailer hoses from jet pump support.

Remove elastic stop nuts or screws as well as flat washers securing jet pump support.



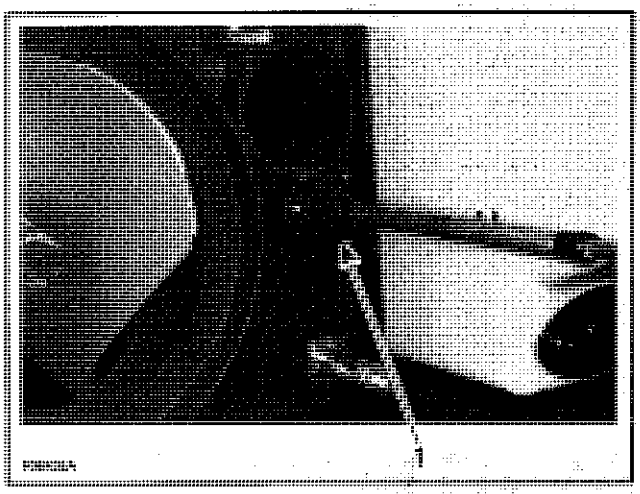
TYPICAL
1. *Elastic stop nuts*

Outside Hull

Remove jet pump.

Remove inlet grate and riding plate.

Remove ball joint, boot, nut, half rings and O-rings from steering cable.



TYPICAL
1. Unscrew nut

Remove ball joint, boot, nut, half rings and O-rings from reverse cable.

Remove boot and nut from VTS sliding shaft (**RXP supercharged intercooled models**).

Using a heat gun, heat jet pump support until it is possible to pull it.

NOTE: Shims may have been installed between support and body. Do not remove these shims, otherwise jet pump alignment will be altered.

Jet Pump Support Cleaning

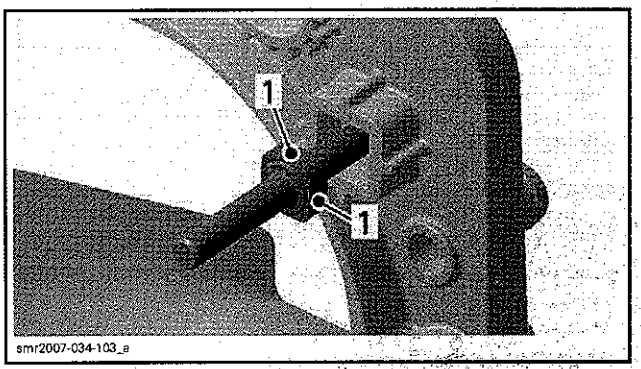
Scrape off all excess of sealant from jet pump support and hull.

Clean hull surface with BRP heavy duty cleaner (P/N 293 110 001) to eliminate grease, dust and any residue of sealant.

Jet Pump Support Installation

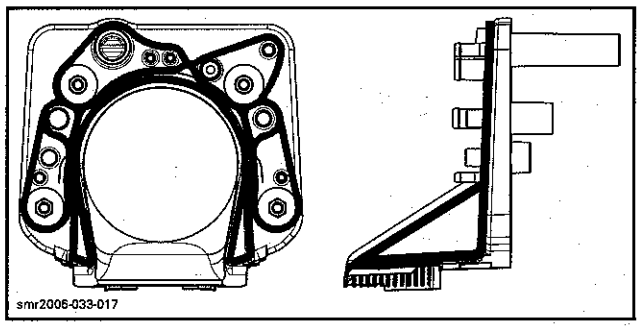
All Models except RXP Series and RXT 255

Apply Loctite 518 (P/N 293 800 038) against contact surface of studs with jet pump support.

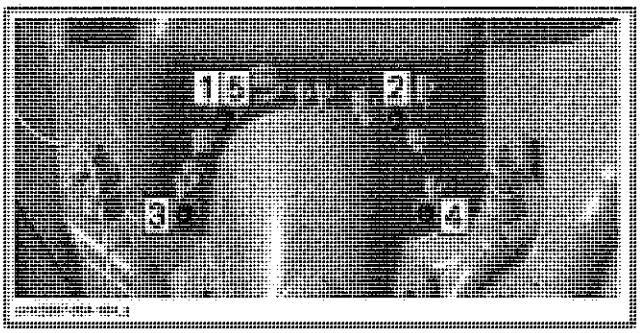


1. Apply Loctite 518 here

Apply Loctite 5900 (P/N 293 800 066) as indicated by the shaded areas in the next illustration.



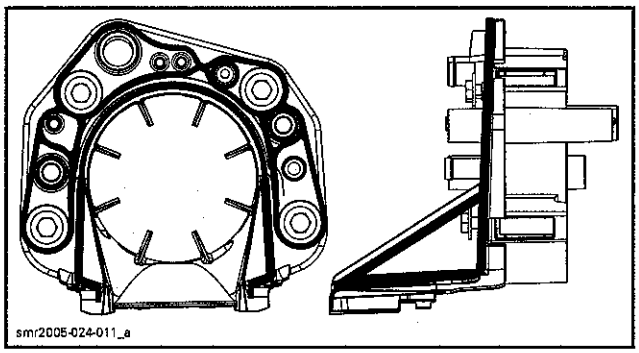
Torque jet pump support nuts to 31 N•m (23 lbf•ft) using the following sequence.



Reinstall all removed parts.

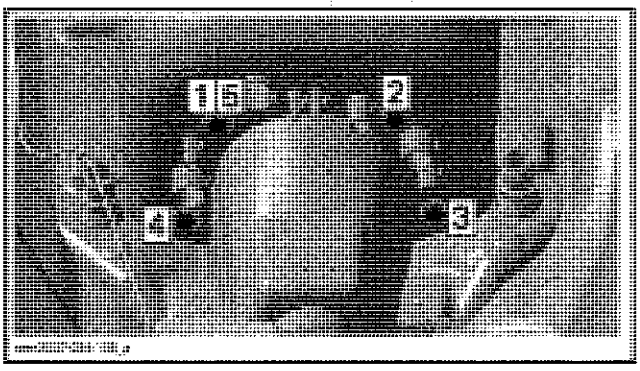
RXP Series and RXT 255

Apply Loctite 5900 (P/N 293 800 066) as indicated by the shaded areas in the next illustration.



Apply Loctite 243 (blue) (P/N 293 800 060) on threads of jet pump support screws or use new screws with Scotch grip.

Torque jet pump support screws to 31 N•m (23 lbf•ft) using the following sequence.



Reinstall all removed parts.

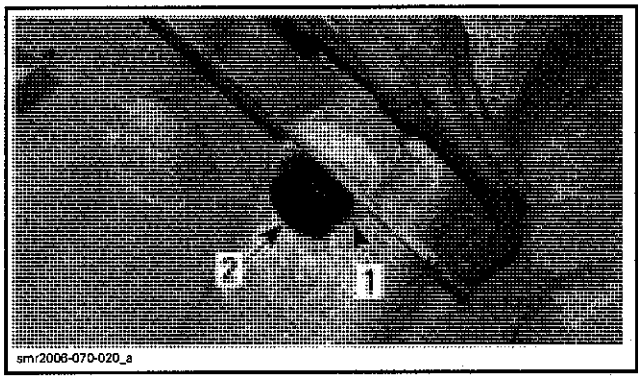
THRU-HULL FITTING

Thru-Hull Fitting Replacement

NOTE: An aluminum hull insert must be used. Refer to the appropriate *PARTS CATALOG*.

Remove drive shaft. Refer to *DRIVE SYSTEM* section.

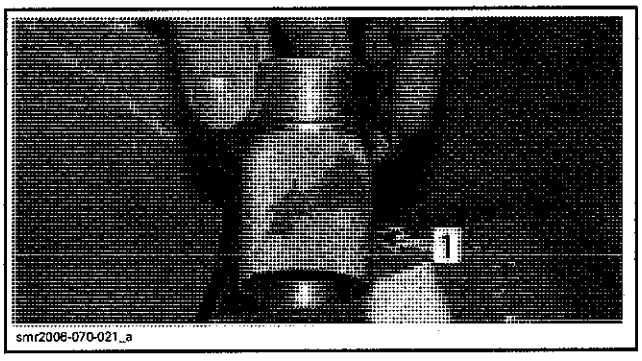
Cut thru-hull fitting flush with hull using a saw.



1. *Hull*
2. *Thru-hull fitting*

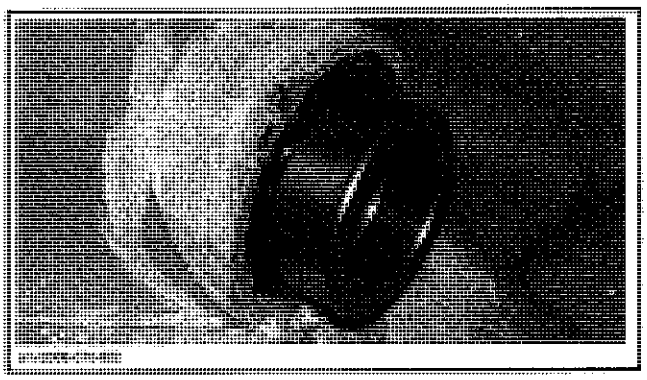
Mix epoxy glue, follow manufacturer's instructions.

Apply epoxy glue on aluminum insert knurled surface and inside thru-hull fitting.



1. *Knurled surface*

Install aluminum insert into thru-hull fitting.



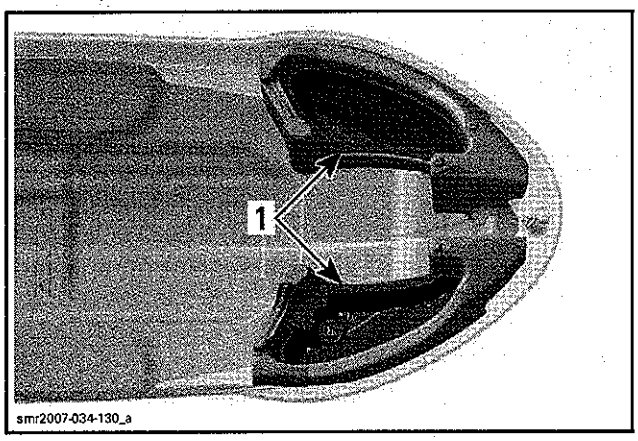
CAUTION: If you notice any clearance between thru-hull fitting and aluminum insert, fill gap with epoxy glue to obtain good adhesion of aluminum insert.

FRONT INNER CONTAINER

All Models except GTI

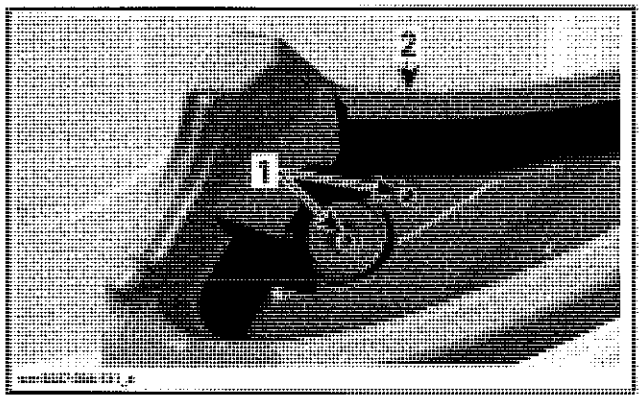
Front Inner Container Removal

If the front inner container is damaged, always replace container and foam.



1. *Front inner containers*

Carefully drill both rivet heads retaining container to hull.



1. *Pop rivets*
2. *Container*

Cut foam in pieces and remove container.

Front Inner Container Installation

Install the container into foam.

On RXP and RXT models, remove the shock of storage compartment cover.

Install foam with container in watercraft.

Install pop rivets with washers to maintain container in place.

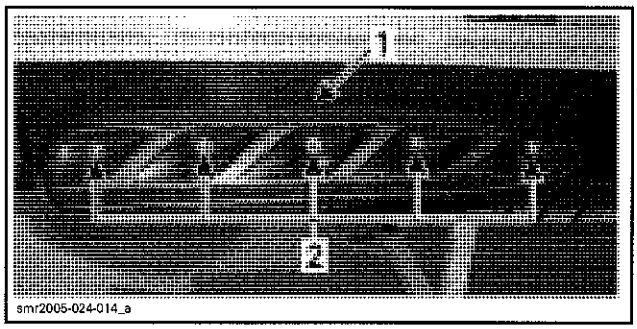
Reinstall all removed parts.

SPONSON

NOTE: Removal and installation procedure for RH and LH sponson is the same.

Sponson Removal

Unscrew sponson bolts then remove sponson.



1. Sponson
2. Bolts

Clean any residues of silicone sealant on hull and sponson.

Sponson Installation

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) around sponson adapters.

Apply Loctite 243 (blue) (P/N 293 800 060) on sponson bolt threads.

Install sponson and torque sponson bolts to 7 N•m (62 lbf•**in**).

SPONSON ADAPTER

NOTE: Removal and installation procedure for RH and LH sponson adapter is the same.

Sponson Adapter Removal

Remove appropriate sponson.

Remove muffler and/or resonator. Refer to *EXHAUST SYSTEM* section.

Hold sponson adapters and unscrew sponson adapter nuts.

Clean any residues of silicone sealant on hull and sponson.

Sponson Adapter Installation

Apply Loctite 243 (blue) (P/N 293 800 060) on sponson adapter threads.

Torque sponson adapter nuts to 16 N•m (142 lbf•**in**).

Install all other removed parts.

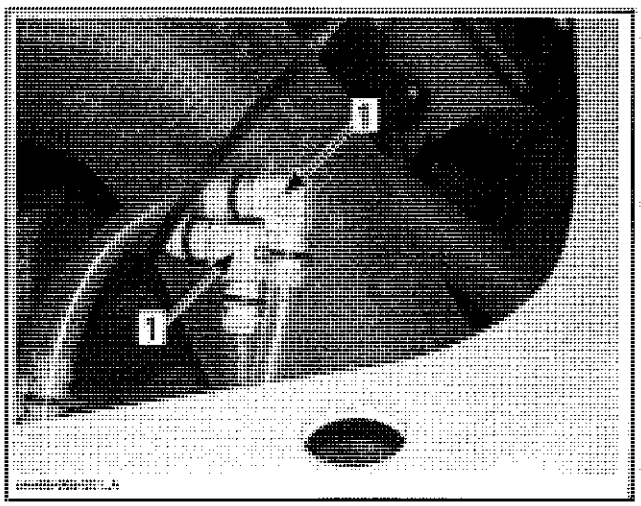
DRAIN PLUG

NOTE: The drain plugs have two functions. It is used to manually drain the bilge, and also as a bailer pick up when watercraft is in operation.

Drain Plug Inspection

Inside hull, check if holes at the end of drain plug are obstructed. Clean if necessary.

Check if the hole on the bailer hose elbow fitting is obstructed. Clean both elbow fittings if necessary.

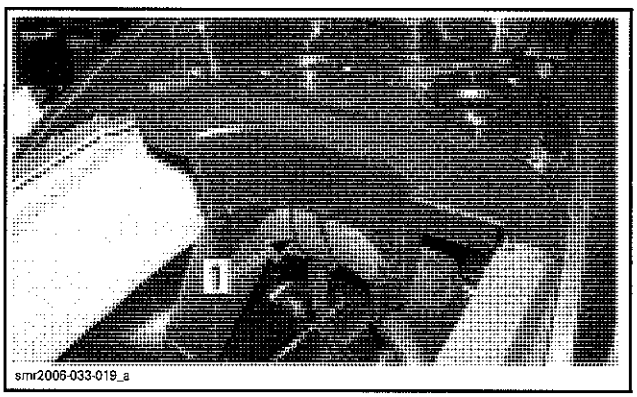


1. Elbow fitting holes

Drain Plug Removal

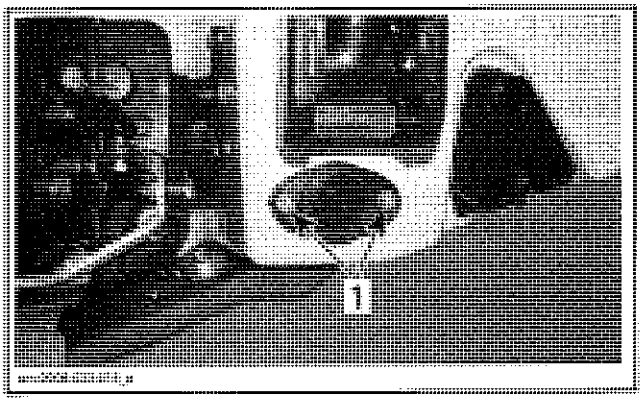
Remove seat and the rear storage basket on some models.

Cut locking tie securing bailer hoses to exhaust hose.



TYPICAL
1. Cut this locking tie

Remove screws securing drain plug to hull.



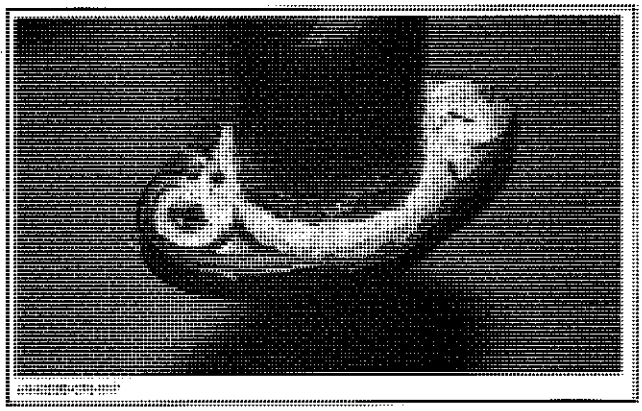
1. Drain plug screws

Pull the drain plug and unplug bailer hose.

Remove all silicone residues on hull (inside and outside) and in screws holes.

Drain Plug Installation

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on back side of drain plug.

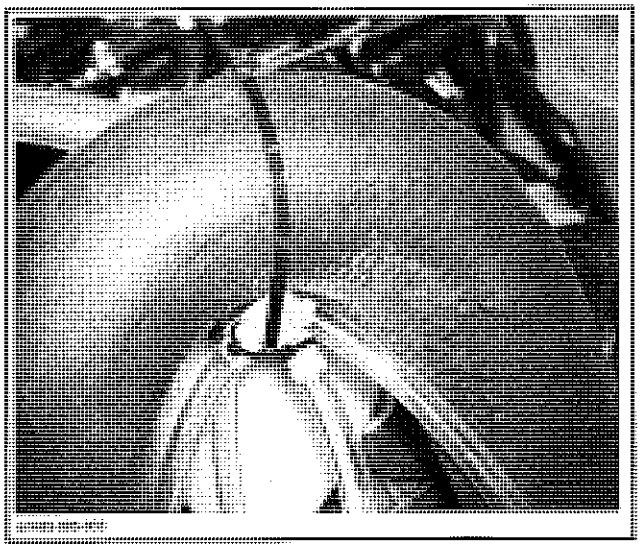


Plug hose on drain plug and carefully insert drain plug in its hole.

Inside hull, apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on the end of screws.

CAUTION: Make sure the end of drain plug (with small holes) does not touch the silicone. Silicone could block drain holes at the end of drain plug.

Attach elbow fittings at the highest position that you can on the exhaust hose.

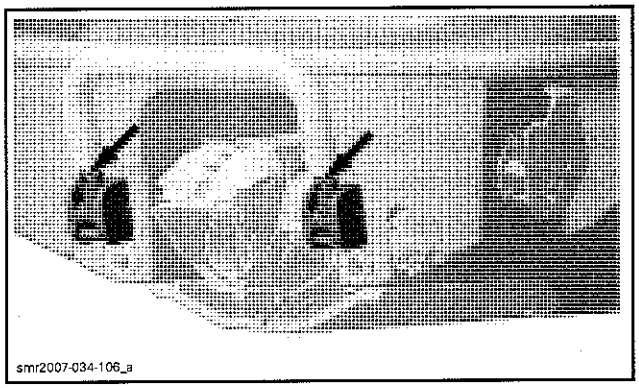


TYPICAL

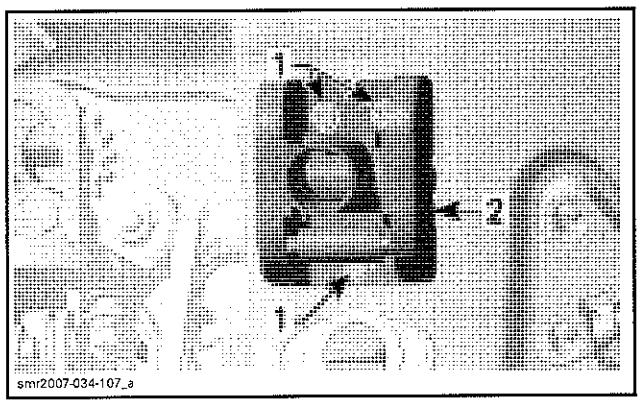
BOARDING STEP

Boarding Step Removal

Remove both bolts securing the boarding step tube to boarding step supports.



Remove socket screws that attach the support to hull.



1. Socket screws
2. Boarding step support

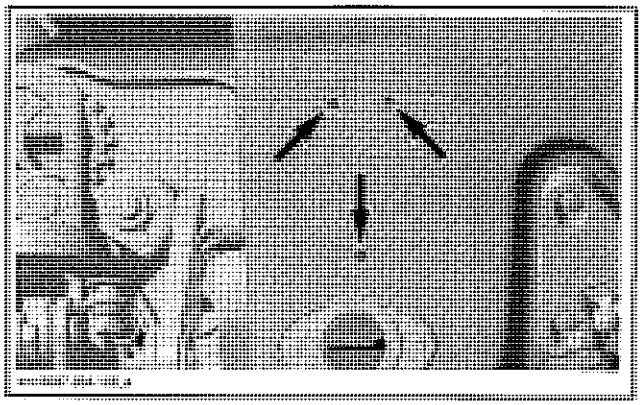
Pull support to remove it.

Clean any residues of silicone sealant on hull and in threaded holes.

Boarding Step Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Put Loctite 5900 (P/N 293 800 086) in threaded holes of hull.



Install support and torque socket screws to 10 N•m (89 lbf•**in**).

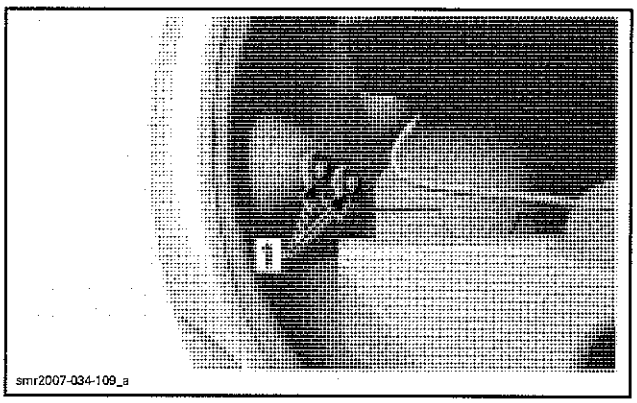
Install the boarding step tube into supports and torque cap nuts to 8 N•m (71 lbf•**in**).

BOW EYELET

Bow Eyelet Removal

Open storage cover and remove basket.

Unscrew and discard both elastic stop nuts holding the bow eyelet in place.



TYPICAL
1. Elastic stop nuts

Pull bow eyelet and shell to remove it from watercraft.

NOTE: The GTI models do not have a shell.

Clean any residues of silicone sealant on hull.

Bow Eyelet Installation

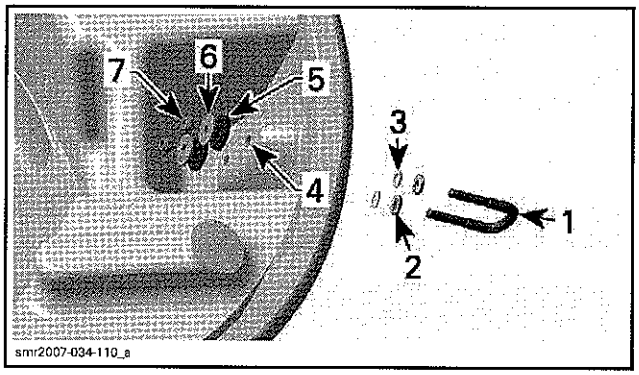
The installation is the reverse of the removal procedure. However, pay attention to the following.

GTI Models

Inside hull, apply Loctite 5150 (silicone sealant) (P/N 293 800 086) all around holes.

Install small washers and nylon washers on bow eyelet and insert it into hull holes. Inside hull, install rubber washers, large washers and new elastic stop nuts.

Torque nuts to 14 N•m (124 lbf•**in**).



1. Bow eyelet
2. Small washer
3. Nylon washer
4. Loctite 5150 (silicone sealant) here
5. Rubber washer
6. Large washer
7. Elastic stop nut

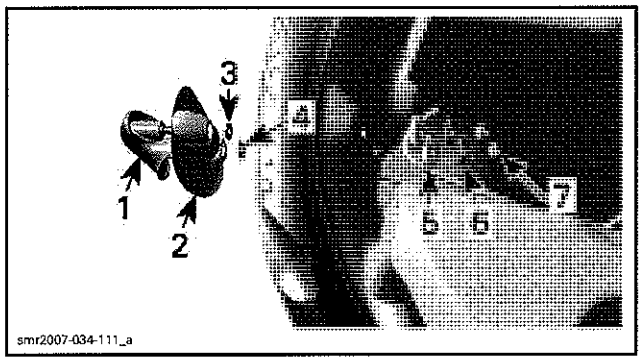
All Models except GTI

Install the shell on the bow eyelet and washers.

Apply Loctite 5150 (silicone sealant) (P/N 293 800 086) on washers then install bow eyelet on watercraft.

Inside hull, install rubber washers, large washers and new elastic stop nuts.

Torque nuts to 14 N•m (124 lbf•**in**).



1. *Bow eyelet*
2. *Shell*
3. *Washer*
4. *Loctite 5150 (silicone sealant) here*
5. *Rubber washer*
6. *Large washer*
7. *Elastic stop nut*

STERN EYELETS

Stern Eyelets Removal

Remove seat and rear storage tray.

Inside hull, unscrew and discard elastic stop nuts securing the stern eyelet to hull.

Pull stern eyelet to remove it from watercraft.

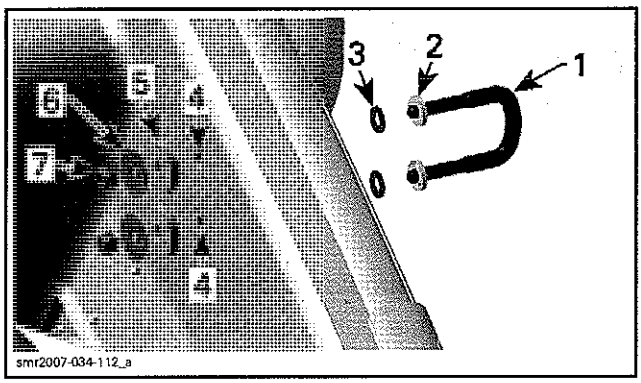
Clean any residues of silicone sealant on hull.

Stern Eyelets Installation

Install small washers and nylon washers to stern eyelet and insert it through the hull.

Inside hull, apply Loctite 5150 (silicone sealant) (P/N 293 800 086) all around holes.

Install rubber washers, large washers and new elastic stop nuts.



1. *Stern eyelet*
2. *Small washer*
3. *Nylon washer*
4. *Loctite 5150 (silicone sealant) here*
5. *Rubber washers*
6. *Large washers*
7. *Elastic stop nuts*

Torque nuts to 14 N•m (124 lbf•**in**).

GELCOAT

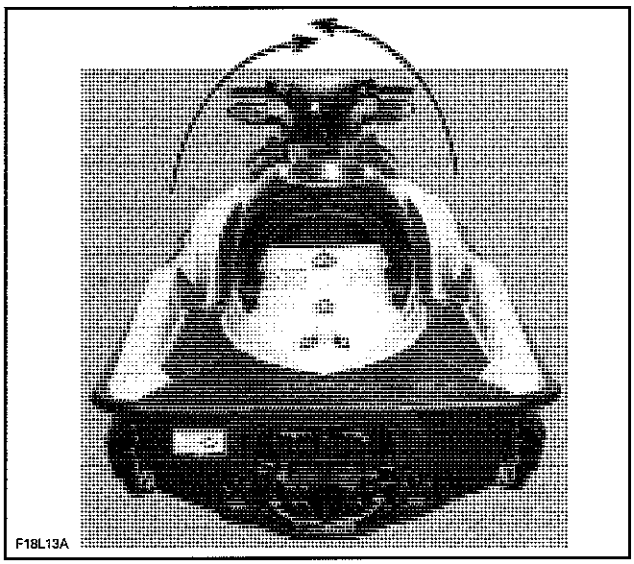
General

Gelcoat is the smooth and durable cosmetic finish which coats the fiberglass hull and body of a SEA-DOO watercraft. It also provides a protective barrier against water and sun. It consists of a mixture of resin, pigment (coloring), fillers, monomers and catalyst which is sprayed into the mold.

The body and hull of the SEA-DOO are constructed of chopped fiberglass, saturated with resin. It is sprayed on the layer of gelcoat along with pieces of fiberglass mat, cloth and woven roving which are added at required areas. This type of construction is very accommodating for high quality repairs. With patience, the proper techniques and materials, a damaged area can be restored to an original finish.

Gelcoat Repair Information

When repairing the hull, drain engine oil and fuel tank to avoid flowing. Rotate watercraft either way (seen from the rear) maximum to 90°.



NOTE: Fiberglass repair kit is available through automotive or marine suppliers. Gelcoat repair kits are available directly from Gelcote International Ltd.

⚠ WARNING

Protect skin, wear gloves when in contact with resin, hardeners and gelcoat. A barrier skin cream may also be used. Do not expose area to open flame or lit cigarette. Some of the materials are flammable. Protect eyes, wear safety glasses when grinding, sanding or spraying. Use a dust mask when sanding or grinding. When spraying wear a respirator or paint mask. Always read warning labels on products.

TOOLS	
Air mask	Power sander
Buffing pad	Putty knife
Cover sheets	Safety glasses
Heavy-duty polisher	Sanding block
Paint brush	Scissors
Plastic container (mixing)	Spray gun
Plastic film	Stirring stick
Plastic squeegee	White cloths

MATERIALS	
Acetone	Epoxy filler
Cabosil	Masking tape
Cardboard	Liquid gelcoat
Fine compound (white)	Medium compound (white)
Fiberglass cloth	Polyester resin
Fiberglass mat	24-grit sanding disks
gelcoat putty	Wax
Sandpaper (100-grit, 220-grit, 320-grit, 400-grit, 600-grit, 1000-grit)	

Air Bubbles Repair

Possible cause:

- Air pocket trapped between layers of laminate and gelcoat.

Preparation of Surface

Remove all of the damaged gelcoat surrounding the air bubble with a putty knife or preferably a carbide grinding tip. Make sure all loose and weak areas are completely removed. Sand a small area of the gelcoat surface with 220-grit sandpaper. If needed, sand the cavity itself. These areas must have a rough surface to allow the gelcoat putty to bond properly.

Filling the Cavity

The prepared surface must be cleaned with acetone on a cloth. Use a gelcoat repair kit. Follow the mixing instructions in the kit when preparing the gelcoat putty.

Carefully mix the required amount while making sure there are no air bubbles in the mixture. With a putty knife, fill the repair area and cover with plastic film. Curing time may depend on temperature, amount of putty and percentage of catalyst. After 2 hours, press lightly on the surface with fingers to test the hardness. When the area becomes hard, remove the plastic film.

Sanding

Begin block sanding the patch with 320-grit sandpaper until you come close to the original surface. Remove dust with a water soaked cloth and continue sanding with a 400-grit wet paper. Finish wet sanding with a 600-grit to remove deeper scratches. If needed you can wet sand with finer grit paper such as 1000-grit.

Buffing and Waxing

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Blisters Repair

Possible causes:

- Insert catalyst
- Improper catalyst/gelcoat ratio.

A blister is a visible bump on the watercraft surface that may not necessarily come right through the gelcoat layer. In the case of only a few blisters, follow the same repair procedure as for air bubbles. If they are numerous and in close concentration, spray liquid gelcoat to achieve proper repair. This procedure is covered in *MINOR GELCOAT FRACTURES*.

Minor Gelcoat Fractures Repair

Possible causes:

- Flexing of fiberglass laminate
- Gelcoat thickness
- Direct result of impact.

In case of fractures which have not penetrated past the gelcoat layer, the repair concerns the gelcoat only. If flex cracking or impact are evident, then additional reinforcement may be necessary. This subject will be covered in *COMPOUND FRACTURES*.

Preparing the Surface

Small Fractures: Open the cracks up with a sharp triangular can opener or preferably a carbide tipped die grinder. The V groove will provide a good bonding area for the gelcoat. With 220-grit sandpaper, sand the sides of the notched out areas.

Numerous Fractures: Using a grinder with a 24-grit disk, remove the gelcoat. Sand the area edge with 220-grit sandpaper.

Filling the Repair Area

Small Fractures: Refer to the same procedure as in the *AIR BUBBLES*.

Numerous Fractures Over Large Surface: Prepare the area for spray application of liquid gelcoat. Wipe down the surface with acetone. Mask the area off to protect the watercraft from overspray.

Mix the needed quantity of gelcoat and catalyst according to suppliers recommendations. The gelcoat can be thinned with acetone up to 10%. If it needs more consistency you can add cabosil.

Make sure that the air supply is free of oil, dirt and water.

Test spray the gelcoat mixture on paper to verify its consistency and pattern. You may have to apply 5 or 6 coats to cover the area properly. Overlap each coat further than the last, leaving at least 30 seconds between passes. Avoid trying to coat the surface with only a few heavy coats, this will not allow the gelcoat to dry properly.

Apply a coat of polyvinyl alcohol (PVA) to seal off the air and protect the gelcoat surface from dust. PVA speeds up the curing process because gelcoat will not cure properly when exposed to air.

Sanding

Wash the polyvinyl alcohol off with water. Depending on the size of the area repaired, you can either block sand as per previous procedure or you may use an air sander. Sand the surface down with progressively finer grits of sandpaper until the desired finish is achieved.

Buffing and Waxing

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Compound Fractures Repair

Possible causes:

- Thickness of fiberglass laminate
- Direct result of impact.

Compound fractures are those that have gone past the gelcoated surface and in through the layers of fiberglass laminate. Two types of repairs have to be performed. The first is to restore the structural integrity of the damaged area. Fracture types can vary from a simple crack to a large hole. Usually, fiberglass reinforcement becomes necessary, especially if the fracture can be attributed to weakness. The final part of the repair is the gelcoating, which cannot be done until the interior and exterior laminate surfaces have been repaired.

Outside: Remove the damaged gelcoat and fiberglass with a 24-grit disk using a power sander. Grind outward at least 2 inches from the fracture to allow the patch to bond to strong material. Cut enough pieces of fiberglass mat necessary to build up the area. The pieces should be cut so they overlap each other by at least a half inch. For a smoother finish, the last layer should be fiberglass cloth. If the fracture is small enough all you may have to do is fill the area with an epoxy filler.

Inside: For the interior repair, you can grind more. This will allow for more fiberglass material which will strengthen the area. If the fracture opening is too large after surface preparation, you may need a backing support to cover the opening. Cut alternating pieces of fiberglass mat and cloth in overlapping sizes.

Patching the Repair Area

Outside: The outside should be done first. Wipe clean the area with acetone on a cloth, then mask off area. For a small crack use an epoxy filler in the same way you would use gelcoat repair putty. When laying up a larger area you will use mat, cloth and fiberglass resin and catalyst. Use a clean container to mix the resin, mix only what you will need. Follow the recommended catalyst ratio.

Using a clean paintbrush, brush the mixed resin on the surface. Place the smallest piece of mat over the fracture and then wet out the mat. Follow with the remaining pieces of mat and final layer of cloth. While wetting the pieces make sure you work the air bubbles out and saturate all the pieces evenly. Try to work quickly, you may only have 15 or 20 minutes. You may clean the brush with acetone.

Wait until the repair has hardened before moving on to the interior repair. If the size of the opening is too large for the pieces to maintain the proper shape, you will have to use a backing support. It is a shaped piece of cardboard that fits flush to the interior surface and has a plastic layer on the repair side. It is held in place by tape or a support.

Inside: Wipe down the area with acetone on a cloth. Apply the same procedure as for outside repair when laminating the alternating pieces of fiberglass material. If a backing support was used, remove it before starting the repair. After the area has hardened, remove sharp edges of material from surface. If required paint the surface.

Sanding

Outside: This surface will have to be prepared for application of gelcoat. The size of the area will determine the gelcoating procedure to be used. Refer to the *MINOR GELCOAT FRACTURES REPAIR.*

Buffing and Waxing

Refer to the *BUFFING AND WAXING* in *MINOR GELCOAT FRACTURES REPAIR.*

1503 ENGINE (130 HP)

MODEL				GTI	GTI SE	GTI RENTAL
ENGINE						
Engine type				ROTAX 1503 4-TEC, 4-stroke, Single Over Head Camshaft (SOHC)		
Induction				Naturally aspirated		
Number of cylinders				3		
Number of valves				12 valves with hydraulic lifters (no adjustment)		
Bore		Standard	mm (in)	100 (3.9)		
		1st Oversize	mm (in)	100.25 (3.95)		
Stroke			mm (in)	63.4 (2.49)		
Displacement			cm^3 (in^3)	1493.8 (91)		
Compression ratio				10.6:1		
Maximum HP			RPM	7300 ± 50		
Lubrication		Type		Dry sump (2 oil pumps). Replaceable oil filter. Water-cooled oil cooler		
		Oil type		10W40 4-stroke oil API service classification SM, SL or SJ		
		Capacity	L (U.S. qt)	3 (2.7) oil change w/filter 4.5 (4.1) total		
Intake valve opening				10° BTDC		
Intake valve closing				50° ABDC		
Exhaust valve opening				50° BBDC		
Exhaust valve closing				10° ATDC		
Valve stem diameter	Intake	New	mm (in)	5.961 to 5.975 (.2347 to .2352)		
		Wear limit	mm (in)	5.930 (.2330)		
	Exhaust	New	mm (in)	5.946 to 5.960 (.2341 to .2346)		
		Wear limit	mm (in)	5.930 (.2330)		
Valve guide diameter		New	mm (in)	5.990 to 6.010 (.2358 to .2366)		
		Wear limit	mm (in)	6.060 (.2386)		
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)		
		Wear limit	mm (in)	38.80 (1.499)		
	Outer	New	mm (in)	45.45 (1.789)		
		Wear limit	mm (in)	43.00 (1.693)		
Valve seat contact width	Intake	New	mm (in)	1.10 to 1.30 (.043 to .051)		
		Wear limit	mm (in)	1.60 (.063)		
	Exhaust	New	mm (in)	1.25 to 1.55 (.049 to .061)		
		Wear limit	mm (in)	1.80 (.071)		
Rocker arm inner diameter		New	mm (in)	20.000 to 20.020 (.7874 to .7882)		
		Wear limit	mm (in)	20.030 (.7886)		
Rocker arm shaft diameter		New	mm (in)	19.980 to 19.990 (.7866 to .7870)		
		Wear limit	mm (in)	19.960 (.7858)		
Cylinder head maximum warpage		Service limit	mm (in)	0.15 (.006)		

MODEL				GTI	GTI SE	GTI RENTAL
ENGINE (cont'd)						
Piston ring type		1st		Upper compression ring, rectangular		
		2nd		Lower compression ring, tapered face		
		3rd		Oil scraper ring		
Ring end gap	Rectangular	New	mm (in)	0.30 to 0.50 (.012 to .020)		
	Taper-face	New	mm (in)	0.30 to 0.50 (.012 to .020)		
	Oil scraper ring	New	mm (in)	0.30 to 0.50 (.012 to .020)		
	All	Wear limit	mm (in)	1.50 (.059)		
Ring/piston groove clearance	Rectangular	New	mm (in)	0.020 to 0.070 (.0008 to .0028)		
	Taper-face	New	mm (in)	0.015 to 0.060 (.0006 to .0024)		
	Oil scraper ring	New	mm (in)	0.020 to 0.055 (.0008 to .0021)		
	All	Wear limit	mm (in)	0.15 (.006)		
Piston/cylinder wall clearance		New	mm (in)	0.024 to 0.056 (.0010 to .0022)		
		Wear limit	mm (in)	0.100 (.0039)		
Cylinder taper		Wear limit	mm (in)	0.100 (.0039)		
Cylinder out of round (maximum)			mm (in)	0.015 (.0006)		
Camshaft bearing journal diameter	Front	New	mm (in)	24.939 to 24.960 (.9818 to .9827)		
		Wear limit	mm (in)	24.910 (.9807)		
	PTO and center	New	mm (in)	39.890 to 39.900 (1.5705 to 1.5709)		
		Wear limit	mm (in)	39.880 (1.5701)		
Camshaft bearing inner diameter	Front	New	mm (in)	25.000 to 25.010 (.9842 to .9846)		
		Wear limit	mm (in)	25.020 (.9850)		
	PTO and center	New	mm (in)	40.000 to 40.010 (1.5748 to 1.5752)		
		Wear limit	mm (in)	40.020 (1.5756)		
Cam lobe height	Intake	New	mm (in)	31.480 to 31.590 (1.2394 to 1.2437)		
		Wear limit	mm (in)	31.430 (1.2374)		
	Exhaust	New	mm (in)	31.690 to 31.800 (1.2476 to 1.2520)		
		Wear limit	mm (in)	31.650 (1.2461)		
Crankshaft deflection		Maximum	mm (in)	0.05 (.002)		
Crankshaft axial clearance		New	mm (in)	0.080 to 0.220 (.0031 to .0087)		
		Wear limit	mm (in)	0.35 (.014)		
Crankshaft bearing journal diameter		New	mm (in)	49.991 to 50.000 (1.9681 to 1.9685)		
		Wear limit	mm (in)	49.950 (1.9665)		
Crankshaft radial clearance		Wear limit	mm (in)	0.007 (.0028)		
Connecting rod big end diameter		Service limit	mm (in)	45.080 (1.7740)		
Connecting rod big end radial play		Service limit	mm (in)	0.090 (.0035)		
Connecting rod big end axial play		New	mm (in)	0.135 to 0.287 (.0053 to .0113)		
		Wear limit	mm (in)	0.500 (.0197)		
Connecting rod small end diameter		New	mm (in)	23.010 to 23.020 (.9059 to .9063)		
		Wear limit	mm (in)	23.070 (.9080)		
Piston pin diameter		New	mm (in)	22.996 to 23.000 (.9053 to .9055)		
		Wear limit	mm (in)	22.990 (.9051)		

MODEL			GTI	GTI SE	GTI RENTAL
ENGINE (cont'd)					
Connecting rod small end radial play	Wear limit	mm (in)	0.080 (.0035)		
Balance shaft journal diameter	New	mm (in)	31.980 to 32.000 (1.2591 to 1.2598)		
	Wear limit	mm (in)	31.950 (1.2579)		
Balance shaft radial clearance	Wear limit	mm (in)	0.070 (.0028)		
Balance shaft axial clearance	New	mm (in)	0.020 to 0.250 (.0008 to .0098)		
ENGINE COOLING SYSTEM					
Type			Closed loop cooling system		
Coolant			Ethylene-glycol and distilled water (50%/50%). Use premix coolant from BRP or a coolant specially formulated for aluminum engines		
Cooling system capacity		L (U.S. qt)	5.5 (4.8) total		
Thermostat		°C (°F)	87 (188)		
Monitoring beeper setting		°C (°F)	100 (212)		
EXHAUST SYSTEM					
Type			Water cooled/water injected (opened loop). Direct flow from jet pump		
Intake spark arrester			Tubular, wire screen		
Water injection in muffler		mm (in)	3 x 3.5 (.138) on exhaust pipe 1 x 3.5 (.138) on muffler		
ELECTRICAL SYSTEM					
Magneto generator output			360 W @ 6000 RPM		
Stator		Ω	0.1 to 1.0		
Battery			12 V, 30 A•h		
Ignition system type			DI (Digital Induction)		
Ignition timing			Not adjustable		
Spark plug	Make and type		NGK DCPR8E		
	Gap	mm (in)	0.7 to 0.8 (.028 to .031)		
Ignition coil	Primary	Ω	0.85 to 1.15		
	Secondary	KΩ	9.5 to 13.5		
Engine RPM limiter setting		RPM	7650		
Fuse	Information center	A	3		
	Beeper	A	3		
	Depth sounder	A	3 (installed but not in use)		
	Fuel level	A	3		
	VTS	A	7.5 (installed but not in use)		
	Fuel pump	A	10		
	Ignition coil and injection	A	3 x 10		
	TOPS	A	3		
	Diagnostic tool	A	15		
	Starter relay	A	10		
	CAPS	A	3		
	Charging system	A	30		
	Battery	A	30		

Section 10 TECHNICAL SPECIFICATIONS
Subsection 01 (1503 ENGINE (130 HP))

MODEL			GTI	GTI SE	GTI RENTAL
FUEL SYSTEM					
Fuel injection type			ROTAX EMS (Engine Management System). Multipoint fuel injection. Single throttle body (52 mm)		
Fuel pressure		kPa (PSI)	290 to 310 (42 to 45)		
Fuel injector	Quantity		3		
Fuel type	Inside North America ((RON + MON)/2)		87 or higher		
	Outside North America (RON)		92 or higher		
Fuel tank (including reserve)		L (U.S. gal)	60 (15.9)		
Fuel tank reserve (from low level signal)		L (U.S. gal)	15 (4)		
Idle speed		± 50 RPM	1750 (NOT ADJUSTABLE)		
PROPULSION SYSTEM					
Jet pump type			Axial flow single stage		
Jet pump grease type			Jet pump bearing grease (P/N 293 550 032)		
Impeller rotation (seen from rear)			Counterclockwise		
Transmission			Direct drive		
Coupling type			Crowned splines		
Reverse system			Yes		
O.P.A.S. system			Fixed		
Steering nozzle pivoting angle			20°		
Minimum required water level		cm (in)	90 (35) underneath the lowest rear portion of hull		
Drive shaft deflection (maximum)		mm (in)	0.5 (.020)		
Impeller outside diameter		mm (in)	155.5 ± 0.06 (6.122 ± .0024)		
Impeller/wear ring clearance	New	mm (in)	0 to 0.23 (0 to .009)		0.7 (.028) minimum
	Wear limit	mm (in)	0.35 (.0138)		0.8 (.032)
Impeller shaft end play (new)			0		
Impeller shaft side play			0		
Impeller pitch			11°/18°		
WEIGHT AND LOADING CAPACITY					
Dry weight		kg (lb)	332 (732)	339 (747)	
Number of passenger (driver incl.)			3		
Load limit (passenger and 10 kg (22 lb) luggage)		kg (lb)	272 (600)		
DIMENSIONS					
Overall length		cm (in)	322.5 (127)		
Overall width		cm (in)	124.5 (49)		
Overall height		cm (in)	117 (46)		
MATERIALS					
Hull			Composite fiberglass		
Inlet grate			Nylon		
Steering cover			Thermoplastic		
Impeller material			Stainless steel		
Impeller housing/stator			Plastic/plastic		Aluminum/aluminum
Venturi			Aluminum		
Nozzle			Aluminum		

MODEL		GTI	GTI SE	GTI RENTAL
MATERIALS (cont'd)				
Fuel tank		Polyethylene		
Seat		Polyurethane/foam		
PERFORMANCE				
Estimated pump power	kW (HP)	46.3 (62)		
Maximum fuel consumption at wide open throttle	L/h (U.S. gal/h)	40.8 (10.8)		
Cruising time at full throttle	Fuel tank without reserve	± 70 minutes		
	Fuel tank reserve (from low level signal)	± 21 minutes		

1503 ENGINE (155 HP)

MODEL				GTI SE	GTX	WAKE	RXP
ENGINE							
Engine type				ROTAX 1503 4-TEC, 4-stroke, Single Over Head Camshaft (SOHC)			
Induction				Naturally aspirated			
Number of cylinders				3			
Number of valves				12 valves with hydraulic lifters (no adjustment)			
Bore		Standard	mm (in)	100 (3.9)			
		1st Oversize	mm (in)	100.25 (3.95)			
Stroke			mm (in)	63.4 (2.49)			
Displacement			cm^3 (in^3)	1493.8 (91)			
Compression ratio				10.6:1			
Maximum HP			RPM	7300 ± 50			
Lubrication		Type		Dry sump (2 oil pumps). Replaceable oil filter. Water-cooled oil cooler			
		Oil type		10W40 4-stroke oil API service classification SM, SL or SJ			
		Capacity	L (U.S. qt)	3 (2.7) oil change w/filter 4.5 (4.1) total			
Intake valve opening				0° BTDC			
Intake valve closing				50 ABDC			
Exhaust valve opening				50° BBDC			
Exhaust valve closing				0° ATDC			
Valve stem diameter	Intake	New	mm (in)	5.961 to 5.975 (.2347 to .2352)			
		Wear limit	mm (in)	5.930 (.2330)			
	Exhaust	New	mm (in)	5.946 to 5.960 (.2341 to .2346)			
		Wear limit	mm (in)	5.930 (.2330)			
Valve guide diameter		New	mm (in)	5.990 to 6.010 (.2358 to .2366)			
		Wear limit	mm (in)	6.060 (.2386)			
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)			
		Wear limit	mm (in)	38.80 (1.499)			
	Outer	New	mm (in)	45.45 (1.789)			
		Wear limit	mm (in)	43.00 (1.693)			
Valve seat contact width	Intake	New	mm (in)	1.10 to 1.30 (.043 to .051)			
		Wear limit	mm (in)	1.60 (.063)			
	Exhaust	New	mm (in)	1.25 to 1.55 (.049 to .061)			
		Wear limit	mm (in)	1.80 (.071)			
Rocker arm inner diameter		New	mm (in)	20.000 to 20.020 (.7874 to .7882)			
		Wear limit	mm (in)	20.030 (.7886)			
Rocker arm shaft diameter		New	mm (in)	19.980 to 19.990 (.7866 to .7870)			
		Wear limit	mm (in)	19.960 (.7858)			
Cylinder head maximum warpage		Service limit	mm (in)	0.15 (.006)			

MODEL				GTI SE	GTX	WAKE	RXP
ENGINE (cont'd)							
Piston ring type		1st		Upper compression ring, rectangular			
		2nd		Lower compression ring, tapered face			
		3rd		Oil scraper ring			
Ring end gap	Rectangular	New	mm (in)	0.30 to 0.50 (.012 to .020)			
	Taper-face	New	mm (in)	0.30 to 0.50 (.012 to .020)			
	Oil scraper ring	New	mm (in)	0.30 to 0.50 (.012 to .020)			
	All	Wear limit	mm (in)	1.50 (.059)			
Ring/piston groove clearance	Rectangular	New	mm (in)	0.020 to 0.070 (.0008 to .0028)			
	Taper-face	New	mm (in)	0.0150 to 0.060 (.0006 to .0024)			
	Oil scraper ring	New	mm (in)	0.020 to 0.055 (.0008 to .0021)			
	All	Wear limit	mm (in)	0.15 (.006)			
Piston/cylinder wall clearance		New	mm (in)	0.024 to 0.056 (.0010 to .0022)			
		Wear limit	mm (in)	0.100 (.0039)			
Cylinder taper		Wear limit	mm (in)	0.100 (.0039)			
Cylinder out of round (maximum)			mm (in)	0.015 (.0006)			
Camshaft bearing journal diameter	Front	New	mm (in)	24.939 to 24.960 (.9818 to .9827)			
		Wear limit	mm (in)	24.910 (.9807)			
	PTO and center	New	mm (in)	39.890 to 39.900 (1.5705 to 1.5709)			
		Wear limit	mm (in)	39.880 (1.5701)			
Camshaft bearing inner diameter	Front	New	mm (in)	25.000 to 25.010 (.9842 to .9846)			
		Wear limit	mm (in)	25.020 (.9850)			
	PTO and center	New	mm (in)	40.000 to 40.010 (1.5748 to 1.5752)			
		Wear limit	mm (in)	40.020 (1.5756)			
Cam lobe height	Intake	New	mm (in)	31.480 to 31.590 (1.2394 to 1.2437)			
		Wear limit	mm (in)	31.430 (1.2374)			
	Exhaust	New	mm (in)	31.690 to 31.800 (1.2476 to 1.2520)			
		Wear limit	mm (in)	31.650 (1.2461)			
Crankshaft deflection		Maximum	mm (in)	0.050 (.002)			
Crankshaft axial clearance		New	mm (in)	0.080 to 0.220 (.0031 to .0087)			
		Wear limit	mm (in)	0.35 (.014)			
Crankshaft bearing journal diameter		New	mm (in)	49.9910 to 50.000 (1.9681 to 1.9685)			
		Wear limit	mm (in)	49.950 (1.9665)			
Crankshaft radial clearance		Wear limit	mm (in)	0.007 (.0028)			
Connecting rod big end diameter		Service limit	mm (in)	45.080 (1.7740)			
Connecting rod big end radial play		Service limit	mm (in)	0.090 (.0035)			
Connecting rod big end axial play		New	mm (in)	0.135 to 0.287 (.0053 to .0113)			
		Wear limit	mm (in)	0.500 (.0197)			
Connecting rod small end diameter		New	mm (in)	23.010 to 23.020 (.9059 to .9063)			
		Wear limit	mm (in)	23.070 (.9080)			
Connecting rod small end radial play		Wear limit	mm (in)	0.080 (.0035)			

MODEL			GTI SE	GTX	WAKE	RXP
ENGINE (cont'd)						
Piston pin diameter	New	mm (in)	22.996 to 23.000 (.9053 to .9055)			
	Wear limit	mm (in)	22.990 (.9051)			
Balance shaft journal diameter	New	mm (in)	31.980 to 32.000 (1.2591 to 1.2598)			
	Wear limit	mm (in)	31.950 (1.2579)			
Balance shaft radial clearance	Wear limit	mm (in)	0.070 (.0028)			
Balance shaft axial clearance	New	mm (in)	0.020 to 0.250 (.0008 to .0098)			
ENGINE COOLING SYSTEM						
Type			Closed loop cooling system			
Coolant			Ethylene-glycol and distilled water (50%/50%). Use premix coolant from BRP or a coolant specially formulated for aluminum engines			
Cooling system capacity		L (U.S. qt)	5.5 (4.8) total			
Thermostat		°C (°F)	87 (188)			
Monitoring beeper setting		°C (°F)	100 (212)			
EXHAUST SYSTEM						
Type			Water cooled/water injected (opened loop). Direct flow from jet pump			
Intake spark arrester			Tubular, wire screen			
Water injection in muffler		mm (in)	3 x 3.5 (.138) on exhaust pipe 1 x 3.5 (.138) on muffler			
ELECTRICAL SYSTEM						
Magneto generator output			360 W @ 6000 RPM			
Stator		Ω	0.1 to 1.0			
Battery			12 V, 30 A•h			
Ignition system type			DI (Digital Induction)			
Ignition timing			Not adjustable			
Spark plug	Make and type		NGK DCPR8E			
	Gap	mm (in)	0.7 to 0.8 (.028 to .031)			
Ignition coil	Primary	Ω	0.85 to 1.15			
	Secondary	KΩ	9.5 to 13.5			
Engine RPM limiter setting		RPM	7750			
Fuse	Information center	A	3			
	Beeper	A	3			
	Depth sounder	A	3			
	Fuel level	A	3			
	VTS	A	7.5			
			Not used	Not used	Used	Not used
	Fuel pump	A	10			
	Ignition coil and injection	A	3 x 10			
	TOPS	A	3			
	Diagnostic tool	A	15			
	Starter relay	A	10			
	CAPS	A	3			
	Charging system	A	30			
	Battery	A	30			

MODEL			GTI SE	GTX	WAKE	RXP
FUEL SYSTEM						
Fuel injection type			ROTAX EMS (Engine Management System). Multipoint fuel injection. Single throttle body (52 mm)			
Fuel pressure		kPa (PSI)	290 to 310 (42 to 45)			
Fuel injector	Quantity		3			
Fuel type	Inside North America ((RON + MON)/2)		87 or higher			
	Outside North America (RON)		92 or higher			
Fuel tank (including reserve)		L (U.S. gal)	60 (15.9)			
Fuel tank reserve (from low level signal)		L (U.S. gal)	15 (4)			
Idle speed		± 50 RPM	1800 (NOT ADJUSTABLE)			
PROPULSION SYSTEM						
Jet pump type			Axial flow single stage			
Jet pump grease type			Jet pump bearing grease (P/N 293 550 032)			
Impeller rotation (seen from rear)			Counterclockwise			
Transmission			Direct drive			
Coupling type			Crowned splines			
Reverse system			Yes			
O.P.A.S. system			Fixed	25.4 mm (1 in) stroke		Fixed
Steering nozzle pivoting angle			20°			
Minimum required water level		cm (in)	90 (35) underneath the lowest rear portion of hull			
Drive shaft deflection (maximum)		mm (in)	0.5 (.020)			
Impeller outside diameter		mm (in)	155.5 ± 0.06 (6.122 ± .0024)			
Impeller/wear ring clearance	New	mm (in)	0 to 0.23 (0 to .009)			
	Wear limit	mm (in)	0.35 (.0138)			
Impeller shaft end play (new)			0			
Impeller shaft side play			0			
Impeller pitch			10°/21°			
WEIGHT AND LOADING CAPACITY						
Dry weight		kg (lb)	339 (747)	361 (795)	382 (840)	340 (750)
Number of passenger (driver incl.)			3			2
Load limit (passenger and 10 kg (22 lb) luggage)		kg (lb)	272 (600)			181 (400)
DIMENSIONS						
Overall length		cm (in)	322.5 (127)	331 (130)		307 (121)
Overall width		cm (in)	124.5 (49)	122 (48)		
Overall height		cm (in)	117 (46)	120 (47)		118 (46.6)
MATERIALS						
Hull			Composite fiberglass			
Inlet grate			Nylon	Aluminum		
Steering cover			Thermoplastic			
Impeller material			Stainless steel			
Impeller housing/stator			Plastic/plastic			
Venturi			Aluminum			
Nozzle			Aluminum			

MODEL		GTI SE	GTX	WAKE	RXP
MATERIALS (cont'd)					
Fuel tank		Polyethylene			
Seat		Polyurethane/foam			
PERFORMANCE					
Estimated pump power	kW (HP)	52.6 (70.5)			
Maximum fuel consumption at wide open throttle	L/h (U.S. gal/h)	43.1 (11.4)			
Cruising time at full throttle	Fuel tank without reserve	± 63 minutes			
	Fuel tank reserve (from low level signal)	± 20 minutes			

1503 ENGINE (215 HP)

MODEL				GTX	GTX LIMITED	WAKE	RXT	RXP
ENGINE								
Engine type				ROTAX 1503 4-TEC, 4-stroke, Single Over Head Camshaft (SOHC)				
Induction				Supercharged intercooled				
Number of cylinders				3				
Number of valves				12 valves with hydraulic lifters (no adjustment)				
Bore		Standard	mm (in)	100 (3.9)				
		1st Oversize	mm (in)	100.25 (3.95)				
Stroke			mm (in)	63.4 (2.49)				
Displacement			cm^3 (in^3)	1493.8 (91)				
Compression ratio				8.4:1				
Maximum HP			RPM	8000				
Lubrication		Type		Dry sump (2 oil pumps). Replaceable oil filter. Water-cooled oil cooler				
		Oil type		XP-S 10W40 4-stroke oil (P/N 219 700 346) or an approved equivalent				
		Capacity	L (U.S. qt)	3 (2.7) oil change w/filter 4.5 (4.1) total				
Intake valve opening				0° BTDC				
Intake valve closing				50 ABDC				
Exhaust valve opening				50° BBDC				
Exhaust valve closing				0° ATDC				
Valve stem diameter	Intake	New	mm (in)	5.961 to 5.975 (.2347 to .2352)				
		Wear limit	mm (in)	5.930 (.2330)				
	Exhaust	New	mm (in)	5.946 to 5.960 (.2341 to .2346)				
		Wear limit	mm (in)	5.930 (.2330)				
Valve guide diameter		New	mm (in)	5.990 to 6.010 (.2358 to .2366)				
		Wear limit	mm (in)	6.060 (.2386)				
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)				
		Wear limit	mm (in)	38.80 (1.499)				
	Outer	New	mm (in)	45.45 (1.789)				
		Wear limit	mm (in)	43.00 (1.693)				
Valve seat contact width	Intake	New	mm (in)	1.10 to 1.30 (.043 to .051)				
		Wear limit	mm (in)	1.60 (.063)				
	Exhaust	New	mm (in)	1.25 to 1.55 (.049 to .061)				
		Wear limit	mm (in)	1.80 (.071)				
Rocker arm inner diameter		New	mm (in)	20.000 to 20.020 (.7874 to .7882)				
		Wear limit	mm (in)	20.030 (.7886)				
Rocker arm shaft diameter		New	mm (in)	19.980 to 19.990 (.7866 to .7870)				
		Wear limit	mm (in)	19.960 (.7858)				
Cylinder head maximum warpage		Service limit	mm (in)	0.15 (.006)				

MODEL				GTX	GTX LIMITED	WAKE	RXT	RXP
ENGINE (cont'd)								
Piston ring type		1st		Upper compression ring, rectangular				
		2nd		Lower compression ring, tapered face				
		3rd		Oil scraper ring				
Ring end gap	Rectangular	New	mm (in)	0.30 to 0.50 (.012 to .020)				
	Taper-face	New	mm (in)	0.30 to 0.50 (.012 to .020)				
	Oil scraper ring	New	mm (in)	0.30 to 0.50 (.012 to .020)				
	All	Wear limit	mm (in)	1.50 (.059)				
Ring/piston groove clearance	Rectangular	New	mm (in)	0.020 to 0.070 (.0008 to .0028)				
	Taper-face	New	mm (in)	0.020 to 0.060 (.0008 to .0024)				
	Oil scraper ring	New	mm (in)	0.020 to 0.055 (.0008 to .0021)				
	All	Wear limit	mm (in)	0.15 (.006)				
Piston/cylinder wall clearance		New	mm (in)	0.040 (.0016)				
		Wear limit	mm (in)	0.100 (.0039)				
Cylinder taper		Wear limit	mm (in)	0.100 (.0039)				
Cylinder out of round (maximum)			mm (in)	0.015 (.0006)				
Camshaft bearing journal diameter	Front	New	mm (in)	24.939 to 24.960 (.9818 to .9827)				
		Wear limit	mm (in)	24.910 (.9807)				
	PTO and center	New	mm (in)	39.890 to 39.900 (1.5705 to 1.5709)				
		Wear limit	mm (in)	39.880 (1.5701)				
Camshaft bearing inner diameter	Front	New	mm (in)	25.000 to 25.010 (.9842 to .9846)				
		Wear limit	mm (in)	25.020 (.9850)				
	PTO and center	New	mm (in)	40.000 to 40.010 (1.5748 to 1.5752)				
		Wear limit	mm (in)	40.020 (1.5756)				
Cam lobe height	Intake	New	mm (in)	31.690 to 31.800 (1.2476 to 1.2520)				
		Wear limit	mm (in)	31.650 (1.2461)				
	Exhaust	New	mm (in)	31.480 to 31.590 (1.2394 to 1.2437)				
		Wear limit	mm (in)	31.430 (1.2374)				
Crankshaft deflection		Maximum	mm (in)	0.05 (.002)				
Crankshaft axial clearance		New	mm (in)	0.080 to 0.220 (.0031 to .0087)				
		Wear limit	mm (in)	0.35 (.014)				
Crankshaft bearing journal diameter		New	mm (in)	49.991 to 50.000 (1.9681 to 1.9685)				
		Wear limit	mm (in)	49.950 (1.9665)				
Crankshaft radial clearance		Wear limit	mm (in)	0.007 (.0028)				
Connecting rod big end diameter		Service limit	mm (in)	45.080 (1.7740)				
Connecting rod big end radial play		Service limit	mm (in)	0.090 (.0035)				
Connecting rod big end axial play		New	mm (in)	0.135 to 0.287 (.0053 to .0113)				
		Wear limit	mm (in)	0.500 (.0197)				
Connecting rod small end diameter		New	mm (in)	23.010 to 23.020 (.9059 to .9063)				
		Wear limit	mm (in)	23.070 (.9080)				
Connecting rod small end radial play		Wear limit	mm (in)	0.080 (.0035)				

MODEL			GTX	GTX LIMITED	WAKE	RXT	RXP
ENGINE (cont'd)							
Piston pin diameter	New	mm (in)	22.996 to 23.000 (.9053 to .9055)				
	Wear limit	mm (in)	22.990 (.9051)				
Balance shaft journal diameter	New	mm (in)	31.980 to 32.000 (1.2591 to 1.2598)				
	Wear limit	mm (in)	31.950 (1.2579)				
Balance shaft radial clearance	Wear limit	mm (in)	0.070 (.0028)				
Balance shaft axial clearance	New	mm (in)	0.020 to 0.250 (.0008 to .0098)				
Supercharger shaft driven plate journal depth	New	mm (in)	14.460 to 14.500 (.5692 to .5709)				
	Wear limit	mm (in)	14.600 (.5748)				
Supercharger drive gear thickness	New	mm (in)	11.000 to 11.050 (.4331 to .4350)				
	Wear limit	mm (in)	10.900 (.4291)				
Supercharger lock washer thickness	New	mm (in)	4.050 to 4.150 (.1594 to .1634)				
	Wear limit	mm (in)	3.950 (.1555)				
Supercharger spring washer package height (uncompressed)	New	mm (in)	10.700 to 10.700 (.4213 to .4219)				
	Wear limit	mm (in)	10.200 (.4016)				
ENGINE COOLING SYSTEM							
Type			Closed loop cooling system				
Coolant			Ethylene-glycol and distilled water (50%/50%). Use premix coolant from BRP or a coolant specially formulated for aluminum engines				
Cooling system capacity		L (U.S. qt)	5.5 (4.8) total				
Thermostat		°C (°F)	87 (188)				
Monitoring beeper setting		°C (°F)	100 (212)				
EXHAUST SYSTEM							
Type			Water cooled/water injected (opened loop). Direct flow from jet pump				
Intake spark arrester			Tubular, wire screen				
Water injection in muffler		mm (in)	3 x 3.5 (.138) on exhaust pipe 1 x 3.5 (.138) on muffler				
ELECTRICAL SYSTEM							
Magneto generator output			360 W @ 6000 RPM				
Stator		Ω	0.1 to 1.0				
Battery			12 V, 30 A•h				
Ignition system type			DI (Digital Induction)				
Ignition timing			Not adjustable				
Spark plug	Make and type		NGK DCPR8E				
	Gap	mm (in)	0.7 to 0.8 (.028 to .031)				
Ignition coil	Primary	Ω	0.85 to 1.15				
	Secondary	KΩ	9.5 to 13.5				
Engine RPM limiter setting		RPM	8300				

MODEL			GTX	GTX LIMITED	WAKE	RXT	RXP
ELECTRICAL SYSTEM (cont'd)							
Fuse	Information center	A	3				
	Beeper	A	3				
	Depth sounder	A	3				
	Fuel level	A	3				
	VTS	A	7.5				
			Not used	Not used	Used	Not used	Used
	Fuel pump	A	10				
	Ignition coil and injection	A	3 x 10				
	TOPS	A	3				
	Diagnostic tool	A	15				
	Starter relay	A	10				
	CAPS	A	3				
	Charging system	A	30				
	Battery	A	30				
FUEL SYSTEM							
Fuel injection type			ROTAX EMS (Engine Management System). Multipoint fuel injection. Single throttle body (52 mm)				
Fuel pressure		kPa (PSI)	386 to 414 (56 to 60)				
Fuel injector	Quantity		3				
Fuel type	Inside North America ((RON + MON)/2)		91 or higher				
	Outside North America (RON)		95 or higher				
Fuel tank (including reserve)		L (U.S. gal)	60 (15.9)				
Fuel tank reserve (from low level signal)		L (U.S. gal)	15 (4)				
Idle speed		± 50 RPM	1800 (NOT ADJUSTABLE)				
PROPULSION SYSTEM							
Jet pump type			Axial flow single stage				
Jet pump grease type			Jet pump bearing grease (P/N 293 550 032)				
Impeller rotation (seen from rear)			Counterclockwise				
Transmission			Direct drive				
Coupling type			Crowned splines				
Reverse system			Yes				
O.P.A.S. system			25.4 mm (1 in) stroke				Fixed
Steering nozzle pivoting angle			20°				
Minimum required water level		cm (in)	90 (35) underneath the lowest rear portion of hull				
Drive shaft deflection (maximum)		mm (in)	0.5 (.020)				
Impeller outside diameter		mm (in)	159 ± 0.06 (6.260 ± .0024)				
Impeller/wear ring clearance	New	mm (in)	0 to 0.23 (0 to .009)				
	Wear limit	mm (in)	0.35 (.0138)				
Impeller shaft end play (new)			0				
Impeller shaft side play			0				
Impeller pitch			10°/21°				

MODEL		GTX	GTX LIMITED	WAKE	RXT	RXP
WEIGHT AND LOADING CAPACITY						
Dry weight	kg (lb)	366 (805)	366 (805)	388 (853)	363 (801)	350 (771)
Number of passenger (driver incl.)		3				2
Load limit (passenger and 10 kg (22 lb) luggage)	kg (lb)	272 (600)				181 (400)
DIMENSIONS						
Overall length	cm (in)	331 (130)				307 (121)
Overall width	cm (in)	122 (48)				
Overall height	cm (in)	120 (47)				118 (46.6)
MATERIALS						
Hull		Composite fiberglass				
Inlet grate		Aluminum				
Steering cover		Thermoplastic				
Impeller material		Stainless steel				
Impeller housing/stator		Aluminum/aluminum				
Venturi		Aluminum				
Nozzle		Aluminum				
Fuel tank		Polyethylene				
Seat		Polyurethane/foam				
PERFORMANCE						
Estimated pump power	kW (HP)	85 (114)				77.5 (104)
Maximum fuel consumption at wide open throttle	L/h (U.S. gal/h)	69 (18.2)				
Cruising time at full throttle	Fuel tank without reserve	± 40 minutes				
	Fuel tank reserve (from low level signal)	± 13 minutes				

1503 ENGINE (255 HP)

MODEL				RXT	RXP
ENGINE					
Engine type				ROTAX 1503 4-TEC, 4-stroke, Single Over Head Camshaft (SOHC)	
Induction				Supercharged intercooled	
Number of cylinders				3	
Number of valves				12 valves with hydraulic lifters (no adjustment)	
Bore		Standard	mm (in)	100 (3.9)	
		1st Oversize	mm (in)	100.25 (3.95)	
Stroke			mm (in)	63.4 (2.49)	
Displacement			cm^3 (in^3)	1493.8 (91)	
Compression ratio				8.4:1	
Maximum HP			RPM	8000	
Lubrication		Type		Dry sump (2 oil pumps). Replaceable oil filter. Water-cooled oil cooler	
		Oil type		XP-S 10W40 4-stroke oil (P/N 219 700 346) or an approved equivalent	
		Capacity	L (U.S. qt)	3 (2.7) oil change w/filter 4.5 (4.1) total	
Intake valve opening				0° BTDC	
Intake valve closing				50° ABDC	
Exhaust valve opening				50° BBDC	
Exhaust valve closing				0° ATDC	
Valve stem diameter	Intake	New	mm (in)	5.961 to 5.975 (.2347 to .2352)	
		Wear limit	mm (in)	5.930 (.2330)	
	Exhaust	New	mm (in)	5.946 to 5.960 (.2341 to .2346)	
		Wear limit	mm (in)	5.930 (.2330)	
Valve guide diameter		New	mm (in)	5.990 to 6.010 (.2358 to .2366)	
		Wear limit	mm (in)	6.060 (.2386)	
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)	
		Wear limit	mm (in)	38.80 (1.499)	
	Outer	New	mm (in)	45.45 (1.789)	
		Wear limit	mm (in)	43.00 (1.693)	
Valve seat contact width	Intake	New	mm (in)	1.10 to 1.30 (.043 to .051)	
		Wear limit	mm (in)	1.60 (.063)	
	Exhaust	New	mm (in)	1.25 to 1.55 (.049 to .061)	
		Wear limit	mm (in)	1.80 (.071)	
Rocker arm inner diameter		New	mm (in)	20.000 to 20.020 (.7874 to .7882)	
		Wear limit	mm (in)	20.030 (.7886)	
Rocker arm shaft diameter		New	mm (in)	19.980 to 19.990 (.7866 to .7870)	
		Wear limit	mm (in)	19.960 (.7858)	
Cylinder head maximum warpage		Service limit	mm (in)	0.15 (.006)	

MODEL				RXT	RXP
ENGINE (cont'd)					
Piston ring type		1st		Upper compression ring, rectangular	
		2nd		Lower compression ring, tapered face	
		3rd		Oil scraper ring	
Ring end gap	Rectangular	New	mm (in)	0.30 to 0.50 (.012 to .020)	
	Taper-face	New	mm (in)	0.30 to 0.50 (.012 to .020)	
	Oil scraper ring	New	mm (in)	0.30 to 0.50 (.012 to .020)	
	All	Wear limit	mm (in)	1.50 (.059)	
Ring/piston groove clearance	Rectangular	New	mm (in)	0.020 to 0.070 (.0008 to .0028)	
	Taper-face	New	mm (in)	0.020 to 0.060 (.0008 to .0024)	
	Oil scraper ring	New	mm (in)	0.020 to 0.055 (.0008 to .0021)	
	All	Wear limit	mm (in)	0.15 (.006)	
Piston/cylinder wall clearance		New	mm (in)	0.040 (.0016)	
		Wear limit	mm (in)	0.100 (.0039)	
Cylinder taper		Wear limit	mm (in)	0.100 (.0039)	
Cylinder out of round (maximum)			mm (in)	0.015 (.0006)	
Camshaft bearing journal diameter	Front	New	mm (in)	24.939 to 24.960 (.9818 to .9827)	
		Wear limit	mm (in)	24.910 (.9807)	
	PTO and center	New	mm (in)	39.890 to 39.900 (1.5705 to 1.5709)	
		Wear limit	mm (in)	39.880 (1.5701)	
Camshaft bearing inner diameter	Front	New	mm (in)	25.000 to 25.010 (.9842 to .9846)	
		Wear limit	mm (in)	25.020 (.9850)	
	PTO and center	New	mm (in)	40.000 to 40.010 (1.5748 to 1.5752)	
		Wear limit	mm (in)	40.020 (1.5756)	
Cam lobe height	Intake	New	mm (in)	31.690 to 31.800 (1.2476 to 1.2520)	
		Wear limit	mm (in)	31.650 (1.2461)	
	Exhaust	New	mm (in)	31.480 to 31.590 (1.2394 to 1.2437)	
		Wear limit	mm (in)	31.430 (1.2374)	
Crankshaft deflection		Maximum	mm (in)	0.05 (.002)	
Crankshaft axial clearance		New	mm (in)	0.080 to 0.220 (.0031 to .0087)	
		Wear limit	mm (in)	0.35 (.014)	
Crankshaft bearing journal diameter		New	mm (in)	49.991 to 50.000 (1.9681 to 1.9685)	
		Wear limit	mm (in)	49.950 (1.9665)	
Crankshaft radial clearance		Wear limit	mm (in)	0.007 (.0028)	
Connecting rod big end diameter		Service limit	mm (in)	45.080 (1.7740)	
Connecting rod big end radial play		Service limit	mm (in)	0.090 (.0035)	
Connecting rod big end axial play		New	mm (in)	0.135 to 0.287 (.0053 to .0113)	
		Wear limit	mm (in)	0.500 (.0197)	
Connecting rod small end diameter		New	mm (in)	23.010 to 23.020 (.9059 to .9063)	
		Wear limit	mm (in)	23.070 (.9080)	
Connecting rod small end radial play		Wear limit	mm (in)	0.080 (.0035)	

MODEL			RXT	RXP
ENGINE (cont'd)				
Piston pin diameter	New	mm (in)	22.996 to 23.000 (.9053 to .9055)	
	Wear limit	mm (in)	22.990 (.9051)	
Balance shaft journal diameter	New	mm (in)	31.980 to 32.000 (1.2591 to 1.2598)	
	Wear limit	mm (in)	31.950 (1.2579)	
Balance shaft radial clearance	Wear limit	mm (in)	0.070 (.0028)	
Balance shaft axial clearance	New	mm (in)	0.020 to 0.250 (.0008 to .0098)	
Supercharger shaft driven plate journal depth	New	mm (in)	14.460 to 14.500 (.5692 to .5709)	
	Wear limit	mm (in)	14.600 (.5748)	
Supercharger drive gear thickness	New	mm (in)	11.000 to 11.050 (.4331 to .4350)	
	Wear limit	mm (in)	10.900 (.4291)	
Supercharger lock washer thickness	New	mm (in)	4.050 to 4.150 (.1594 to .1634)	
	Wear limit	mm (in)	3.950 (.1555)	
Supercharger spring washer package height (uncompressed)	New	mm (in)	10.900 to 10.700 (.4291 to .4213)	
	Wear limit	mm (in)	10.200 (.4016)	
ENGINE COOLING SYSTEM				
Type			Closed loop cooling system	
Coolant			Ethylene-glycol and distilled water (50%/50%). Use premix coolant from BRP or a coolant specially formulated for aluminum engines	
Cooling system capacity		L (U.S. qt)	5.5 (4.8) total	
Thermostat		°C (°F)	87 (188)	
Monitoring beeper setting		°C (°F)	100 (212)	
EXHAUST SYSTEM				
Type			Water cooled/water injected (opened loop). Direct flow from jet pump	
Intake spark arrester			Tubular, wire screen	
Water injection in muffler		mm (in)	3 x 3.5 (.138) on exhaust pipe 1 x 3.5 (.138) on muffler	
ELECTRICAL SYSTEM				
Magneto generator output			360 W @ 6000 RPM	
Stator		Ω	0.1 to 1.0	
Battery			12 V, 30 A•h	
Ignition system type			DI (Digital Induction)	
Ignition timing			Not adjustable	
Spark plug	Make and type		NGK DCPR8E	
	Gap	mm (in)	0.7 to 0.8 (.028 to .031)	
Ignition coil	Primary	Ω	0.85 to 1.15	
	Secondary	KΩ	9.5 to 13.5	
Engine RPM limiter setting		RPM	8300	

MODEL			RXT	RXP
ELECTRICAL SYSTEM (cont'd)				
Fuse	Information center	A	3	
	Beeper	A	3	
	Depth sounder	A	3	
	Fuel level	A	3	
	VTS	A	7.5	
	Fuel pump	A	10	
	Ignition coil and injection	A	3 x 10	
	TOPS	A	3	
	Diagnostic tool	A	15	
	Starter relay	A	10	
	CAPS	A	3	
	Charging system	A	30	
	Battery	A	30	
FUEL SYSTEM				
Fuel injection type			ROTAX EMS (Engine Management System). Multipoint fuel injection. Single throttle body (52 mm)	
Fuel pressure		kPa (PSI)	386 to 414 (56 to 60)	
Fuel injector	Quantity		3	
Fuel type	Inside North America ((RON + MON)/2)		91 or higher	
	Outside North America (RON)		95 or higher	
Fuel tank (including reserve)		L (U.S. gal)	60 (15.9)	
Fuel tank reserve (from low level signal)		L (U.S. gal)	15 (4)	
Idle speed		± 50 RPM	1800 (NOT ADJUSTABLE)	
PROPULSION SYSTEM				
Jet pump type			Axial flow single stage	
Jet pump grease type			Jet pump bearing grease (P/N 293 550 032)	
Impeller rotation (seen from rear)			Counterclockwise	
Transmission			Direct drive	
Coupling type			Crowned splines	
Reverse system			Yes	
O.P.A.S. system			25.4 mm (1 in) stroke	Fixed
Steering nozzle pivoting angle			20°	
Minimum required water level		cm (in)	90 (35) underneath the lowest rear portion of hull	
Drive shaft deflection (maximum)		mm (in)	0.5 (.020)	
Impeller outside diameter		mm (in)	159 ± 0.06 (6.260 ± .0024)	
Impeller/wear ring clearance	New	mm (in)	0 to 0.23 (0 to .009)	
	Wear limit	mm (in)	0.35 (.0138)	
Impeller shaft end play (new)			0	
Impeller shaft side play			0	
Impeller pitch			14°/25°	

MODEL		RXT	RXP
WEIGHT AND LOADING CAPACITY			
Dry weight	kg (lb)	365 (804)	351 (774)
Number of passenger (driver incl.)		3	2
Load limit (passenger and 10 kg (22 lb) luggage)	kg (lb)	272 (600)	181 (400)
DIMENSIONS			
Overall length	cm (in)	331 (130)	307 (121)
Overall width	cm (in)	122 (48)	
Overall height	cm (in)	118 (46.6)	116 (45.8)
MATERIALS			
Hull		Composite fiberglass	
Inlet grate		Aluminum	
Steering cover		Thermoplastic	
Impeller material		Stainless steel	
Impeller housing/stator		Aluminum/aluminum	
Venturi		Aluminum	
Nozzle		Aluminum	
Fuel tank		Polyethylene	
Seat		Polyurethane/foam	
PERFORMANCE			
Estimated pump power	kW (HP)	93 (125)	89 (119)
Maximum fuel consumption at wide open throttle	L/h (U.S. gal/h)	75.8 (19.5)	
Cruising time at full throttle	Fuel tank without reserve	± 37 minutes	
	Fuel tank reserve (from low level signal)	± 12 minutes	

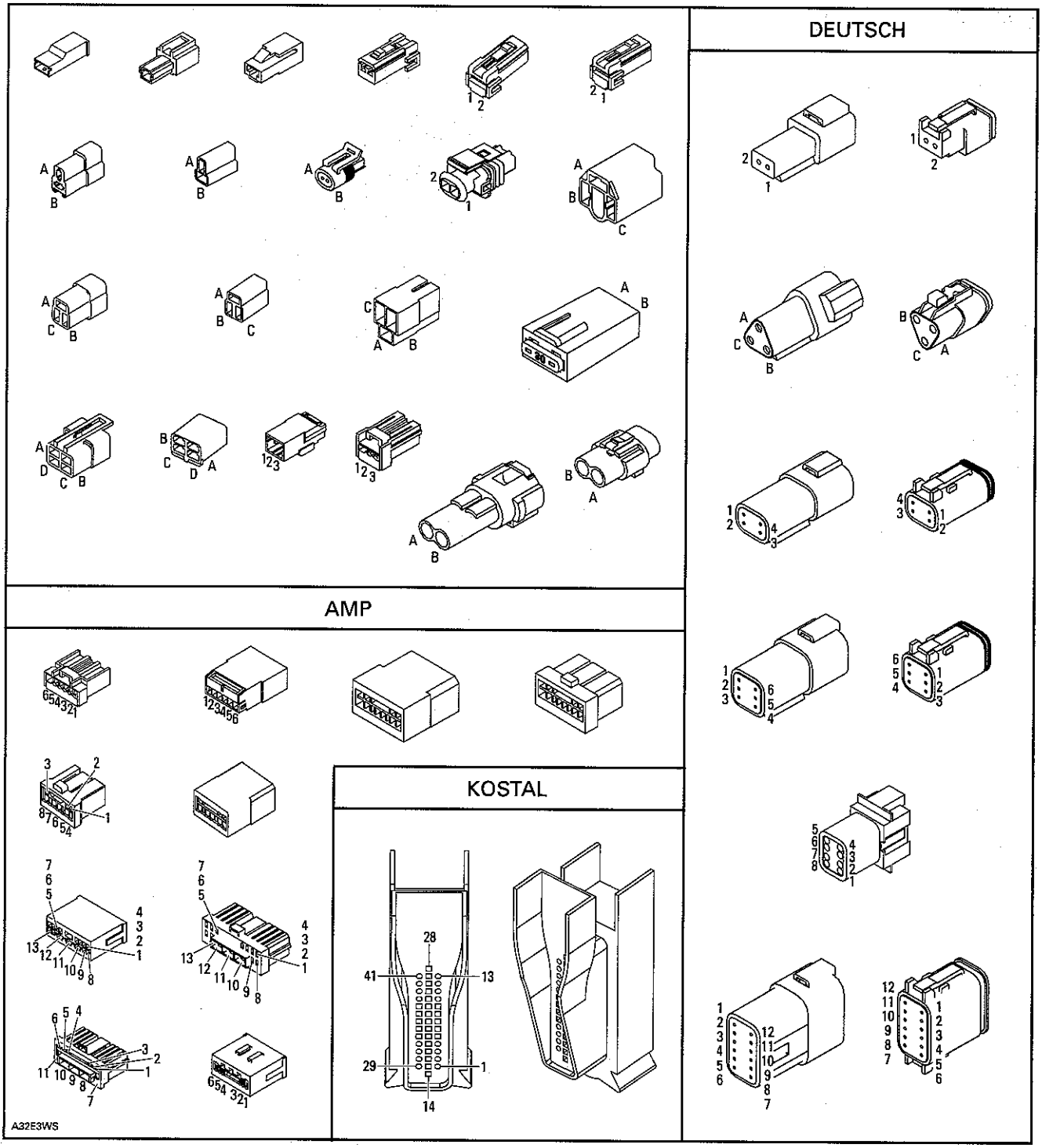
ELECTRICAL CONNECTORS

SERVICE TOOLS

Description	Part Number	Page
crimping pliers	529 035 730	520
crimper die	529 035 906	519
crimping tool	529 035 909	519

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
Snap-on terminal remover tool	TT600-1	518
Snap-on terminal remover tool	TT600-4	517

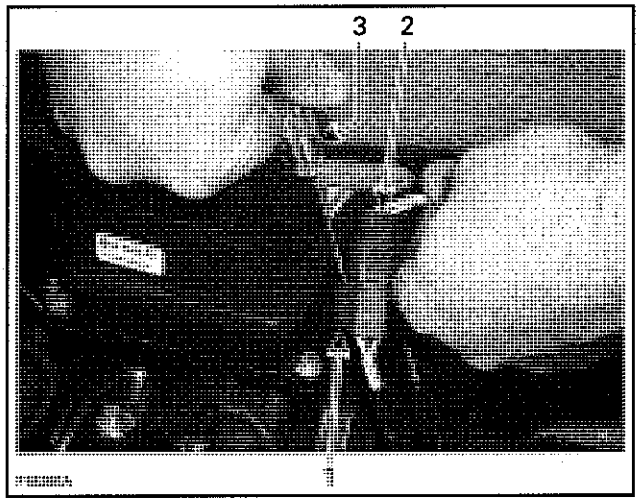


PROCEDURES

DEUTSCH CONNECTOR

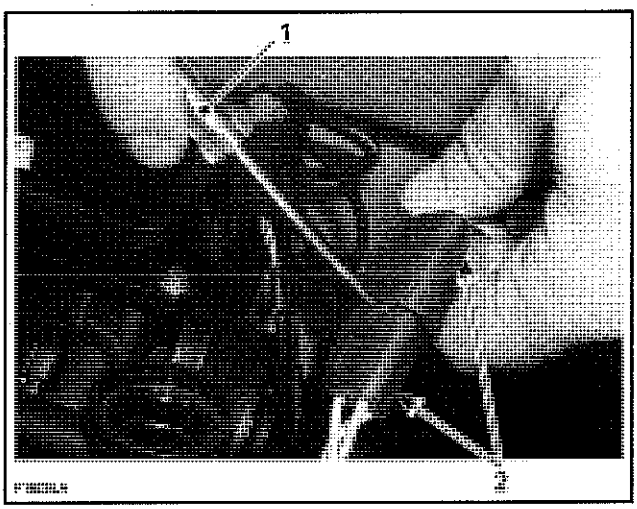
Connector Removal from Support

Slide a flat screwdriver between the support and the Deutsch connectors and remove connectors.

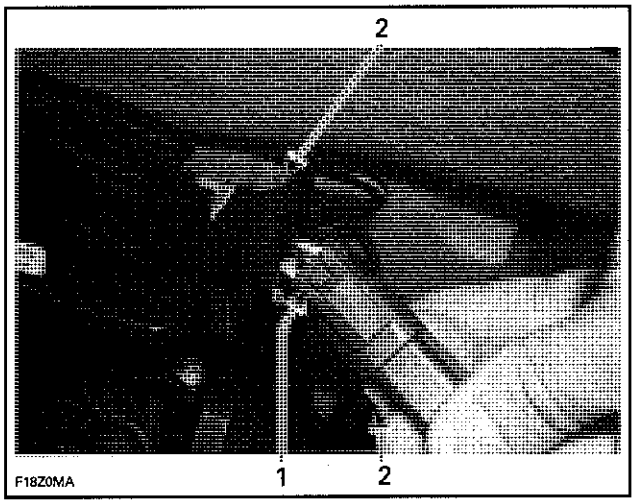


1. *Support*
2. *Deutsch connectors*
3. *Flat screwdriver*

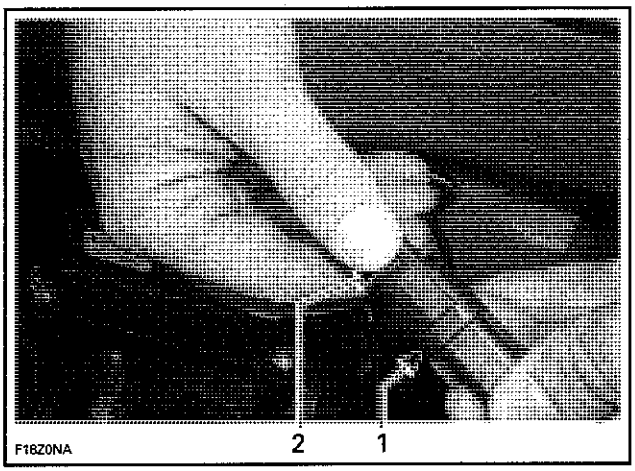
To disconnect the Deutsch connectors, slide a flat screwdriver between each housing to disengage, press the release button and disconnect them.



1. *Flat screwdriver*
2. *Deutsch connectors*

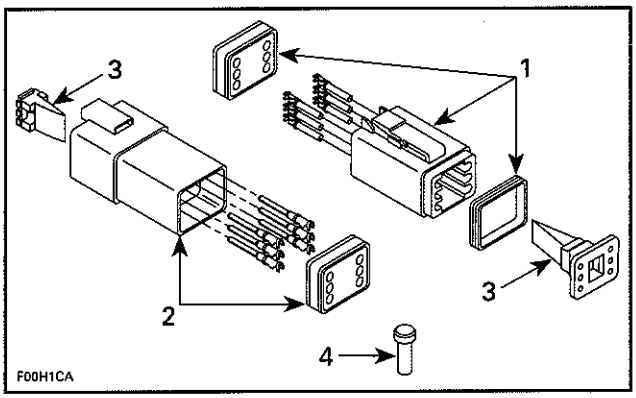


1. *Release button*
2. *Deutsch connectors*



1. *Deutsch connectors*
2. *Press release button*

Connector Disassembly

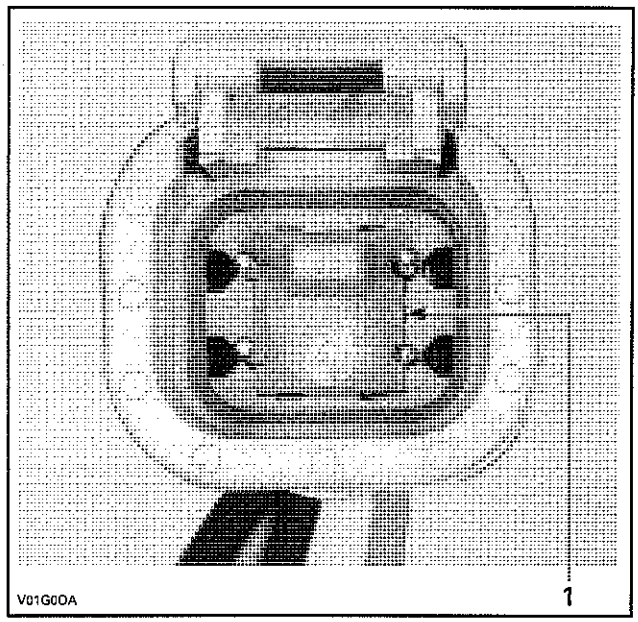


1. *Male connector*
2. *Female connector*
3. *Secondary lock*
4. *Sealing cap*

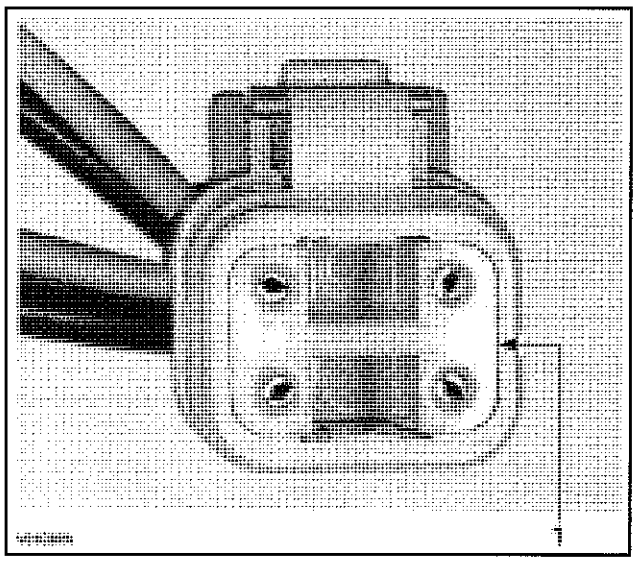
CAUTION: Do not apply dielectric grease on terminal inside connector.

To remove terminals from connector, proceed as follows:

– Using a long nose pliers, pull out the lock.



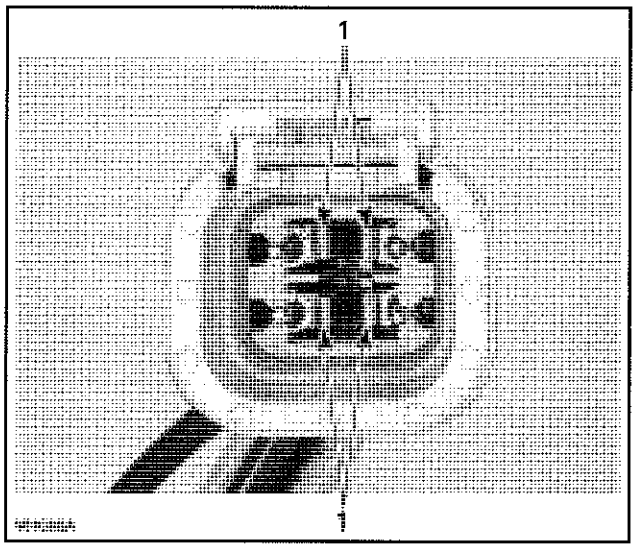
FEMALE CONNECTOR
1. Female lock



MALE CONNECTOR
1. Male lock

NOTE: Before extraction, push wire forward to relieve pressure on retaining tab.

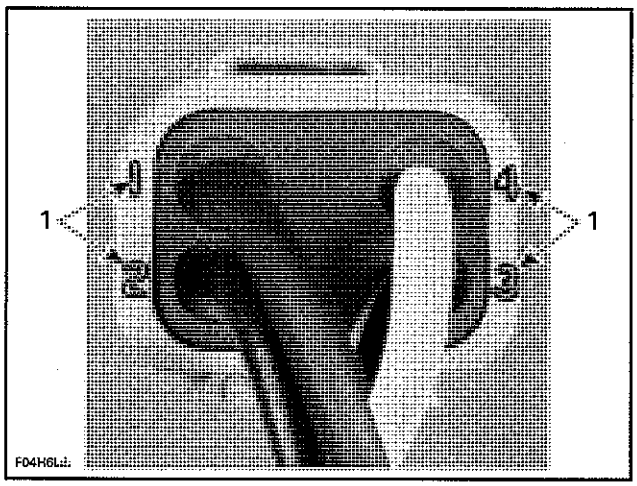
– Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
– Pry back the retaining tab while gently pulling wire back until terminal is removed.



FEMALE CONNECTOR
1. Retaining tabs

To install:

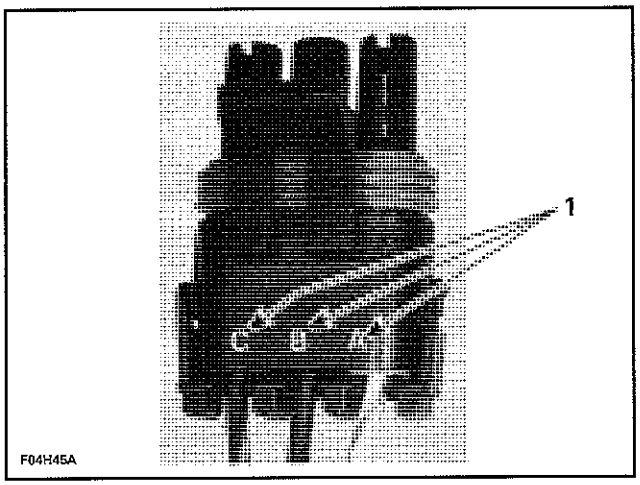
– For insertion of a terminal, make sure the lock is removed.
– Insert terminal into appropriate cavity and push as far as it will go.
– Pull back on the terminal wire to be sure the retention fingers are holding the terminal.
– After all required terminals have been inserted, the lock must be installed.



1. Wire identification numbers

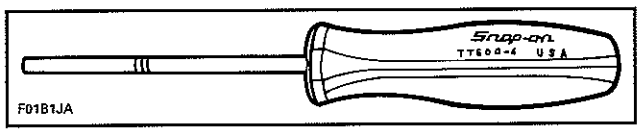
PACKARD CONNECTOR

Packard connectors are used to connect electrical harnesses and gauges.



VIEW OF A 3-PIN PACKARD CONNECTOR
1. Identification letters

To remove terminal from Packard connector, use Snap-on terminal remover tool (P/N TT600-4).

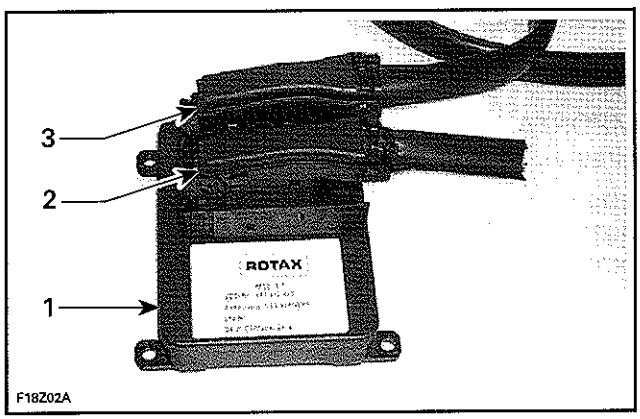


⚠ WARNING

Ensure all terminals are properly crimped on wires and connector are properly fastened.

KOSTAL CONNECTOR (ECM)

There are two Kostal connectors used on the 4-TEC models and they are connected on the ECM. The engine harness female connector is connected on the module male connector A and the watercraft system control harness female connector is connected to the module male connector B. The ECM connectors have 41 pins.



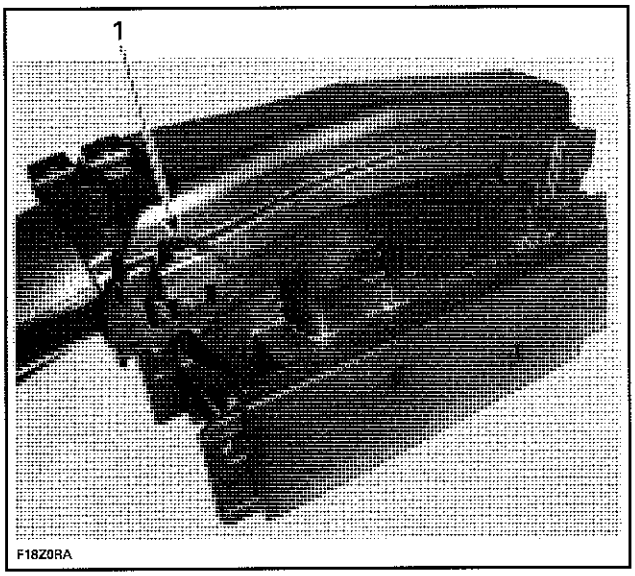
1. ECM
2. Connector A (engine harness)
3. Connector B (watercraft harness)

For probing techniques and tool, refer to *ENGINE MANAGEMENT*.

CAUTION: Do not disconnect the ECM connectors needlessly. They are not designed to be disconnected/reconnected frequently.

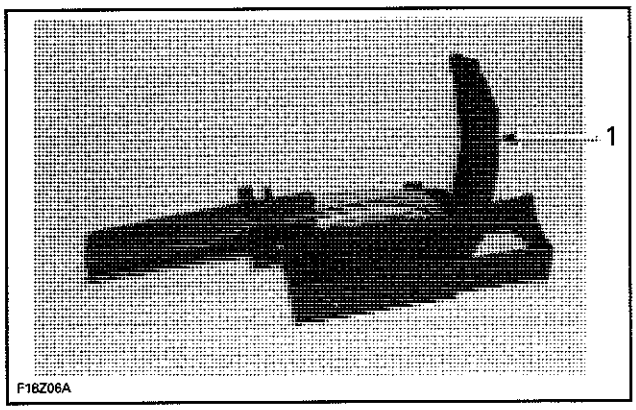
Terminal Removal

Unlock the connector cover by pushing in the tabs on top of the connector with a flat screwdriver to be able to flip the top cover up.



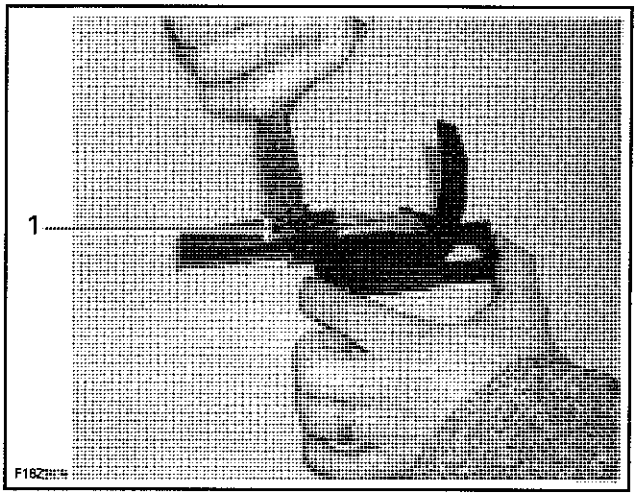
1. Push in tab

Lift the cover by pushing it forward.



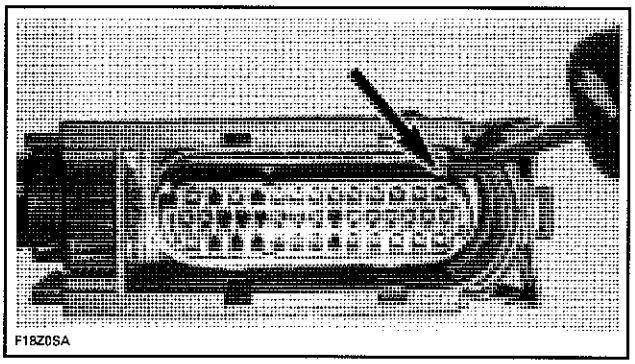
1. Cover

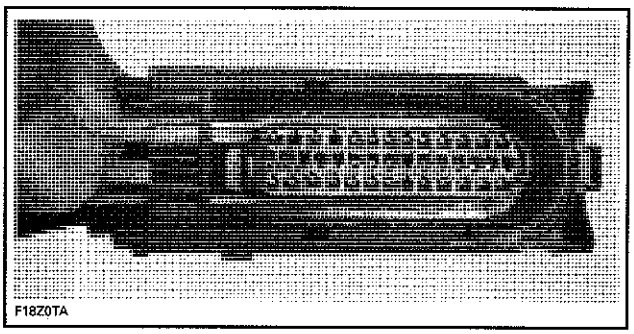
Cut both tie raps that secure the harness to the connector.



1. Tie raps

Turn the connector over and remove the orange locking tab by pushing and then pulling toward the wire harness.

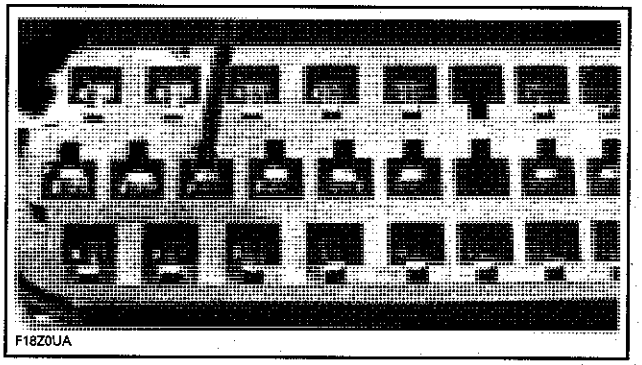


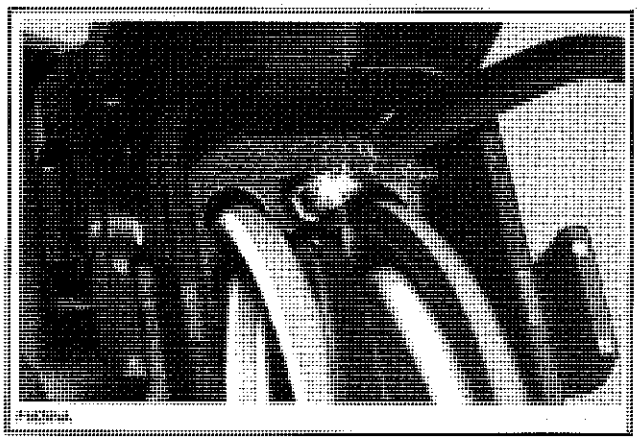


Use Snap-on terminal remover tool (P/N TT600-1) or equivalent (or a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit) must be inserted into the terminal cavity to release the locking tab from the connector.

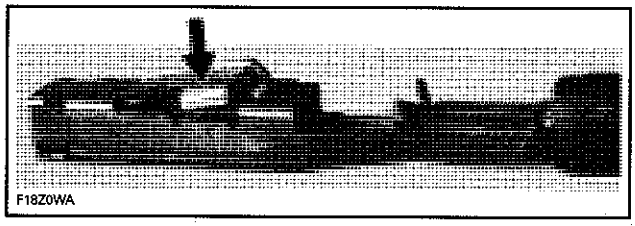
CAUTION: Using a tool tip larger than 0.76 mm (.030 in) may damage the terminal.

Insert the tool tip into the terminal cavity as shown, and locate its wire in the back of the connector. You may have to pry the tool tip against the locking tab to release it, then remove the terminal from the connector.





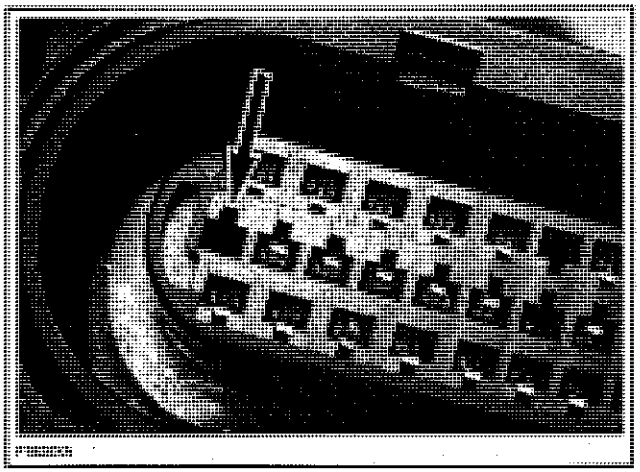
Check the locking tab on the terminal, it may have to be bent out a little so it will lock in its cavity when it is re-inserted.



If the wire is in good condition but the terminal is rusted or corroded, remove defective terminal and crimp a new one. If wire and terminal are defective, replace with a new genuine wire and new terminal and crimp them together as explained below.

IMPORTANT: Use genuine wires only. Otherwise wires will not fit properly.

When re-inserting the terminal, the locking tab must be installed facing the smaller cutout of the terminal cavity.

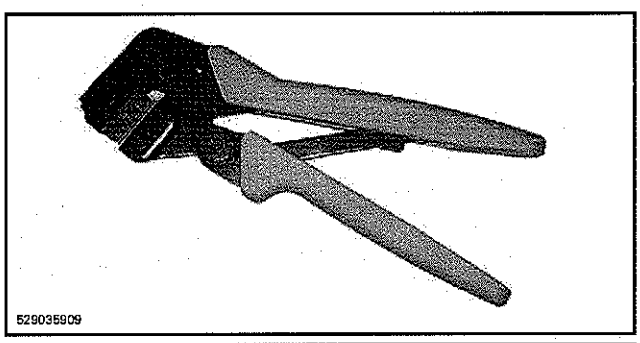


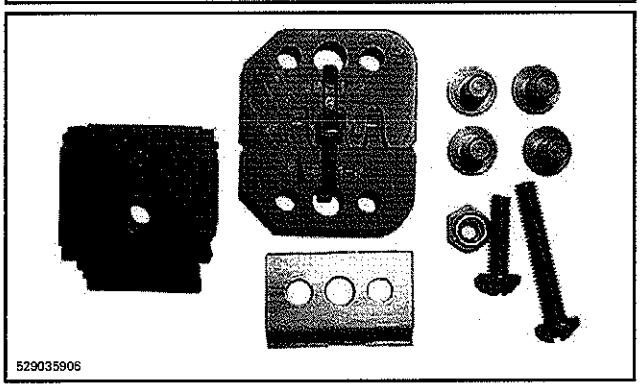
Insert the terminal, ensuring the locking tab snaps into its cavity.

Re-install the orange locking tab, attach the 2 tie raps, and close the connector cover.

Terminal Crimping

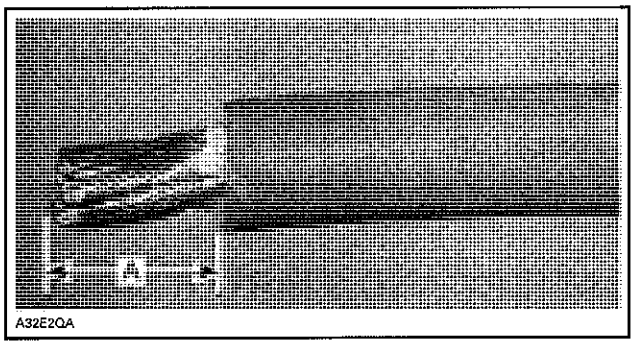
To crimp a new connector terminal, use the crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).





To properly crimp the wires, strictly follow this procedure.

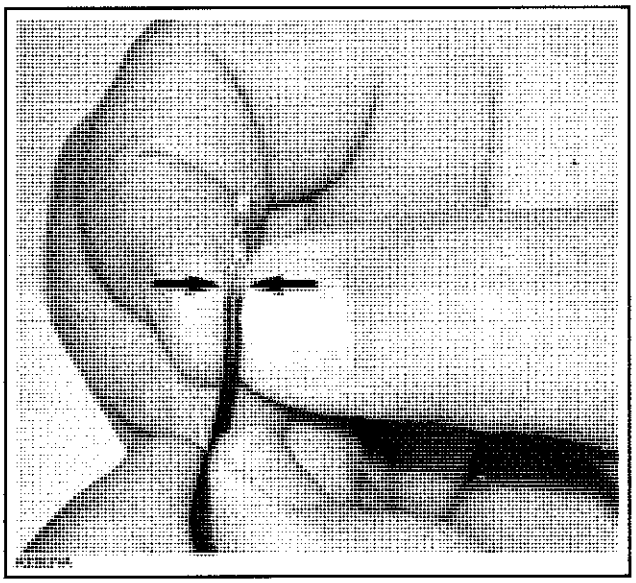
Strip the wire to a maximum of 3 mm (1/8 in).



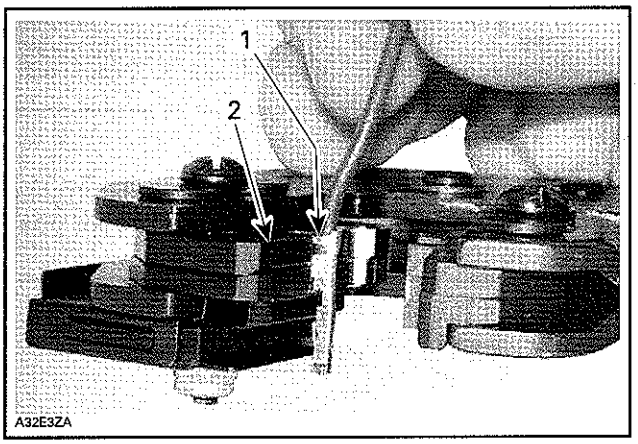
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.



Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



1. *Top of terminal tabs*
2. *Align tabs with pliers edge*

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

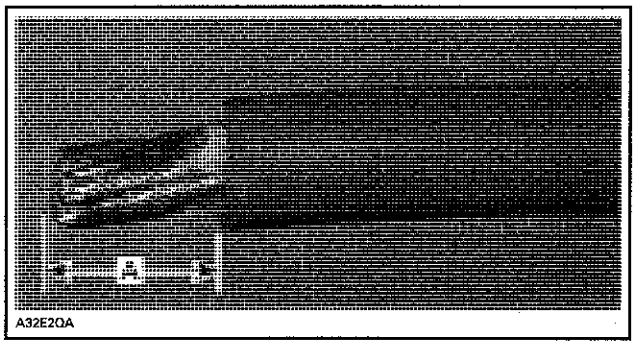
Lubrication

Do not apply any product to the pins of the connector on the ECM.

BATTERY AND STARTER CABLE TERMINALS

Crimping

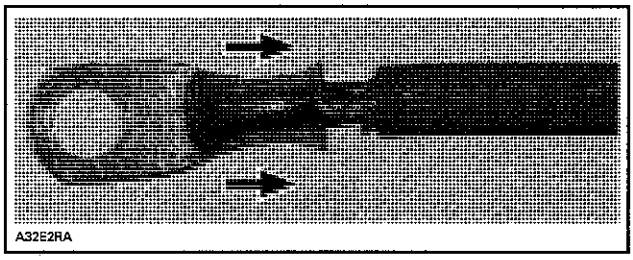
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (3/8 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG.*

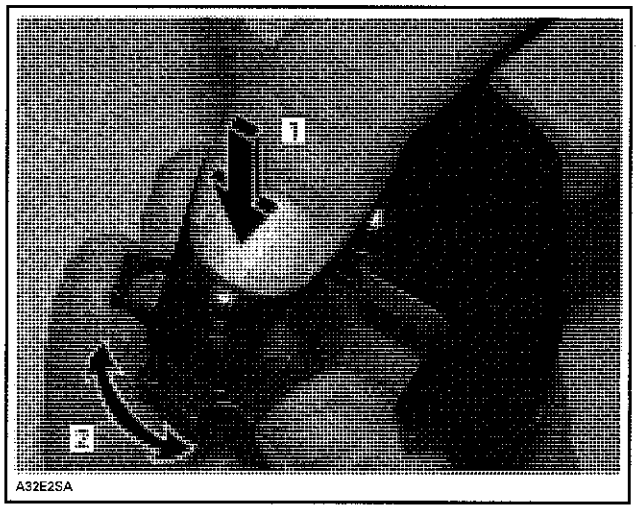


INSTALLATION OF TERMINAL

Follow the instructions provided with the crimping pliers (P/N 529 035 730) to select the proper position of the tool.

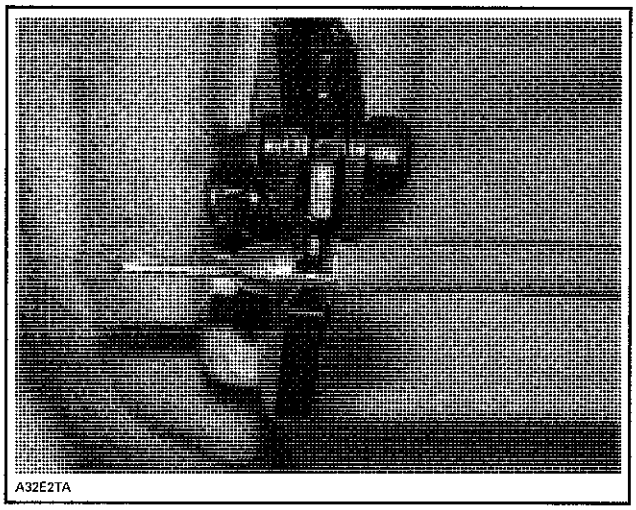
529 035 730

NOTE: Different wires require different crimping pliers settings, so make sure to follow the instruction supplied with the tool.

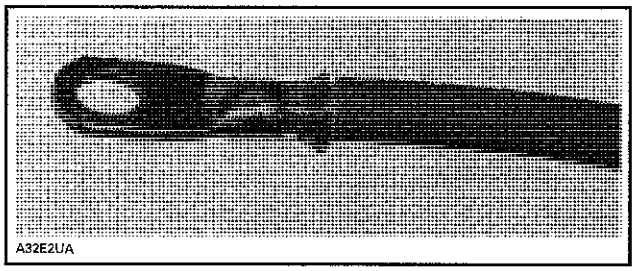


POSITIONING THE CRIMPING PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimping pliers, crimp the terminal already installed on wire.



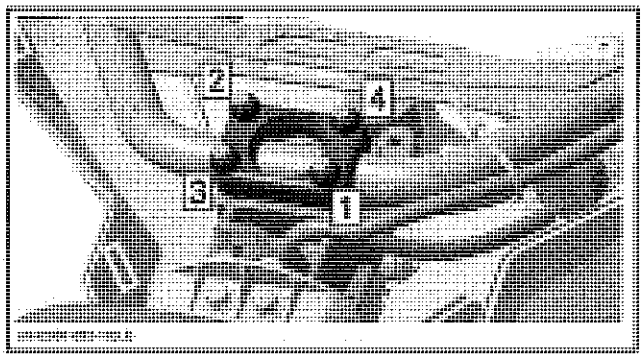
CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

CAUTION: Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.



STEERING CABLE SUPPORT

Cable Support Removal

All Models except GTI Series and X Packages

Open front storage cover and remove basket.

Remove glove box. Refer to *BODY* section.

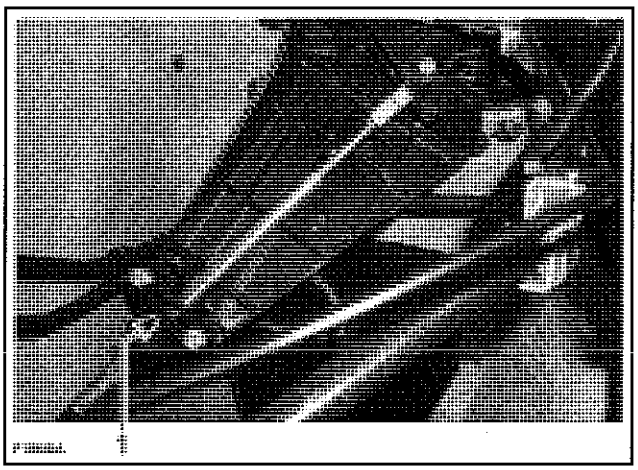
On **RXP models**, remove front vent tube.

GTI Series

Remove glove box and console. Refer to *BODY* section.

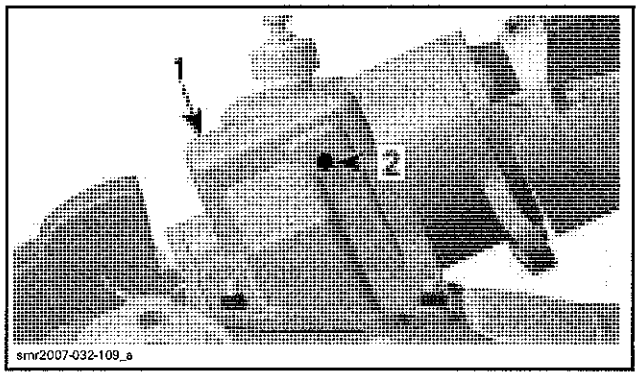
All Models except 255 HP

Unscrew bolts securing retaining block then remove it from steering cable support.

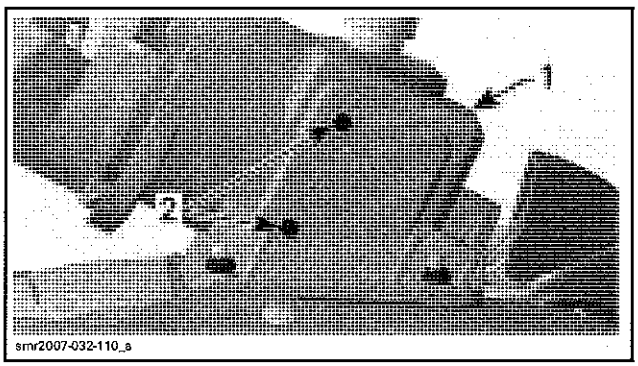


1. Retaining block

Loosen screws each side of steering support.

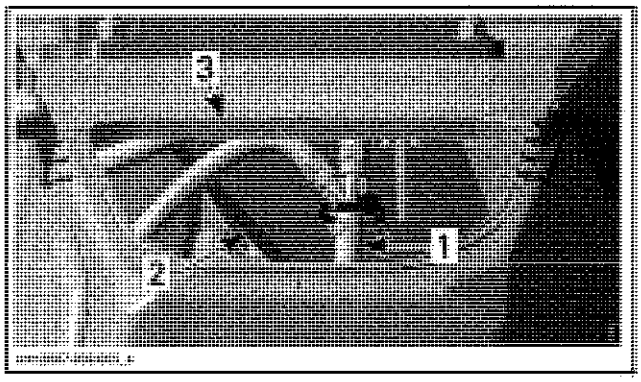


RIGHT SIDE
1. Steering support
2. Screw



LEFT SIDE
1. Steering support
2. Screws

Detach fuel lines from steering cable support.



TYPICAL
1. Fuel line
2. Steering cable support
3. Glove box location

Remove steering cable support.

Cable Support Installation

For installation, reverse the removal procedure.

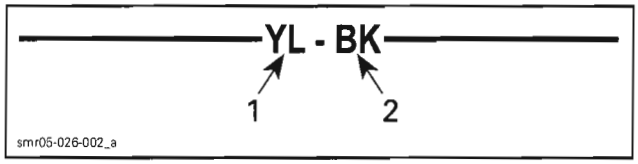
Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

WIRING DIAGRAM

NOTE: The wiring diagram is in the back cover pocket.

WIRE COLOR CODES

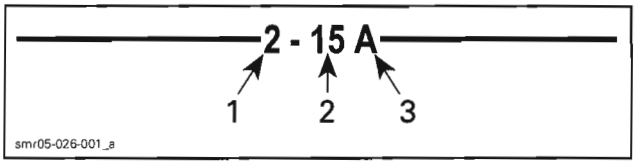


1. *Wire main color*
2. *Tracer (thin colored line)*

General Wire Color Use

COLOR	USE
RED	Battery power (12 Vdc directly connected to battery)
RED + tracer	Fused 12 Vdc (from battery)
PURPLE	Continuous power (when there is a programmed key on DESS post)
PURPLE + tracer	Switched power (when there is a programmed key on DESS post)
BLACK	Ground
BLACK + tracer	Switched ground (by DESS post, ECM)

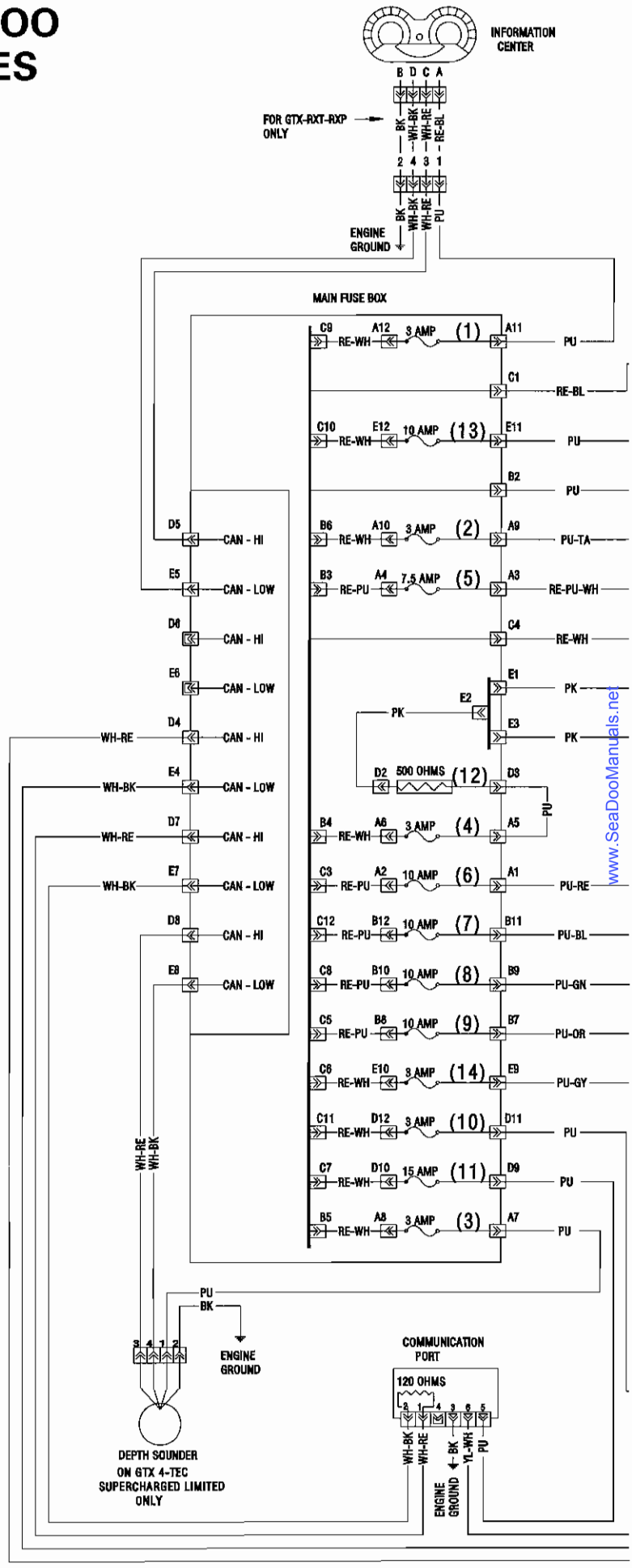
WIRE DIGIT CODES

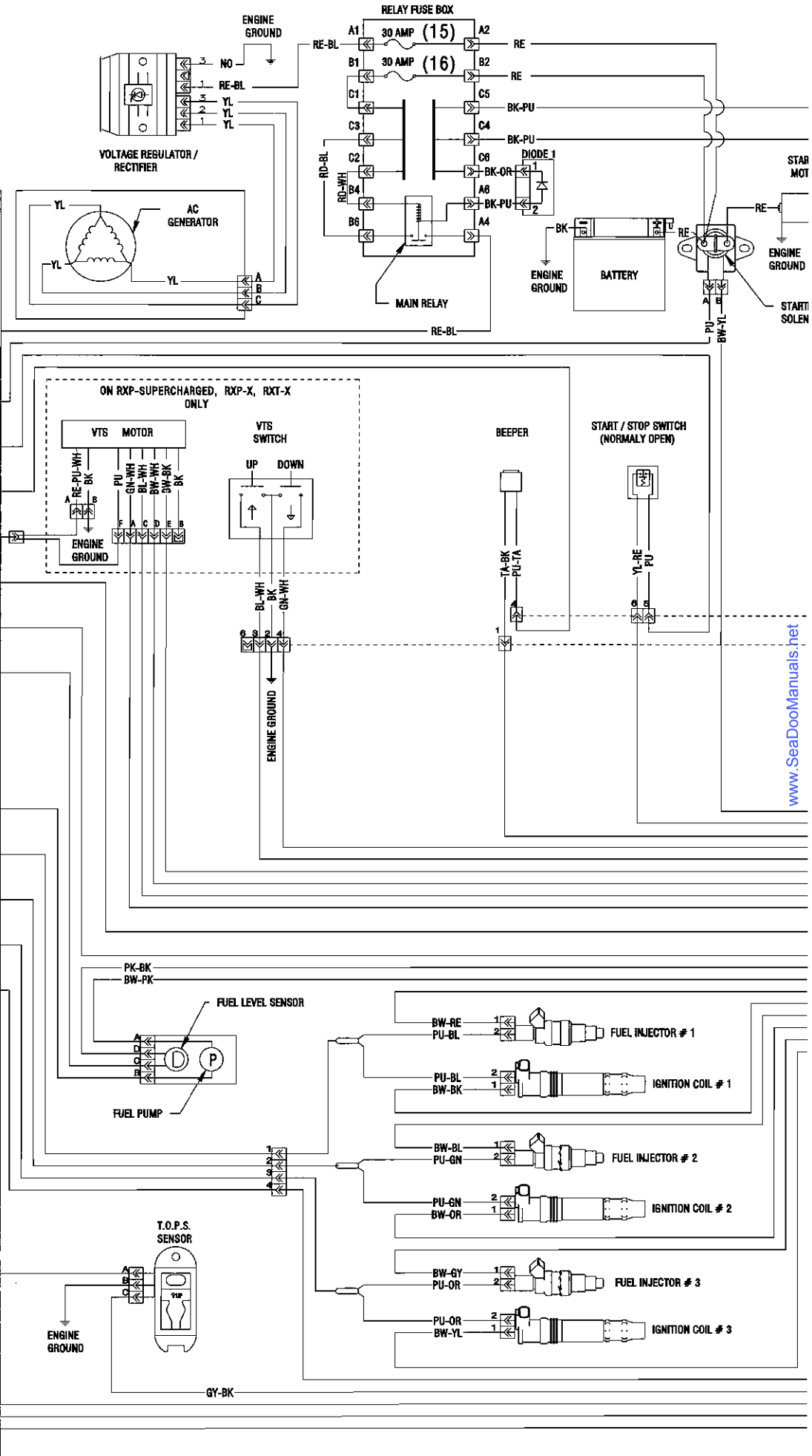


1. *Connector the wire is plugged in*
2. *Position number of the wire in the connector*
3. *Common circuit in the MPEM with another wire having the same letter (if applicable)*

NOTE: ECM connectors are identified by the letters A and B.

2008 SEA-DOO 4-TEC SERIES



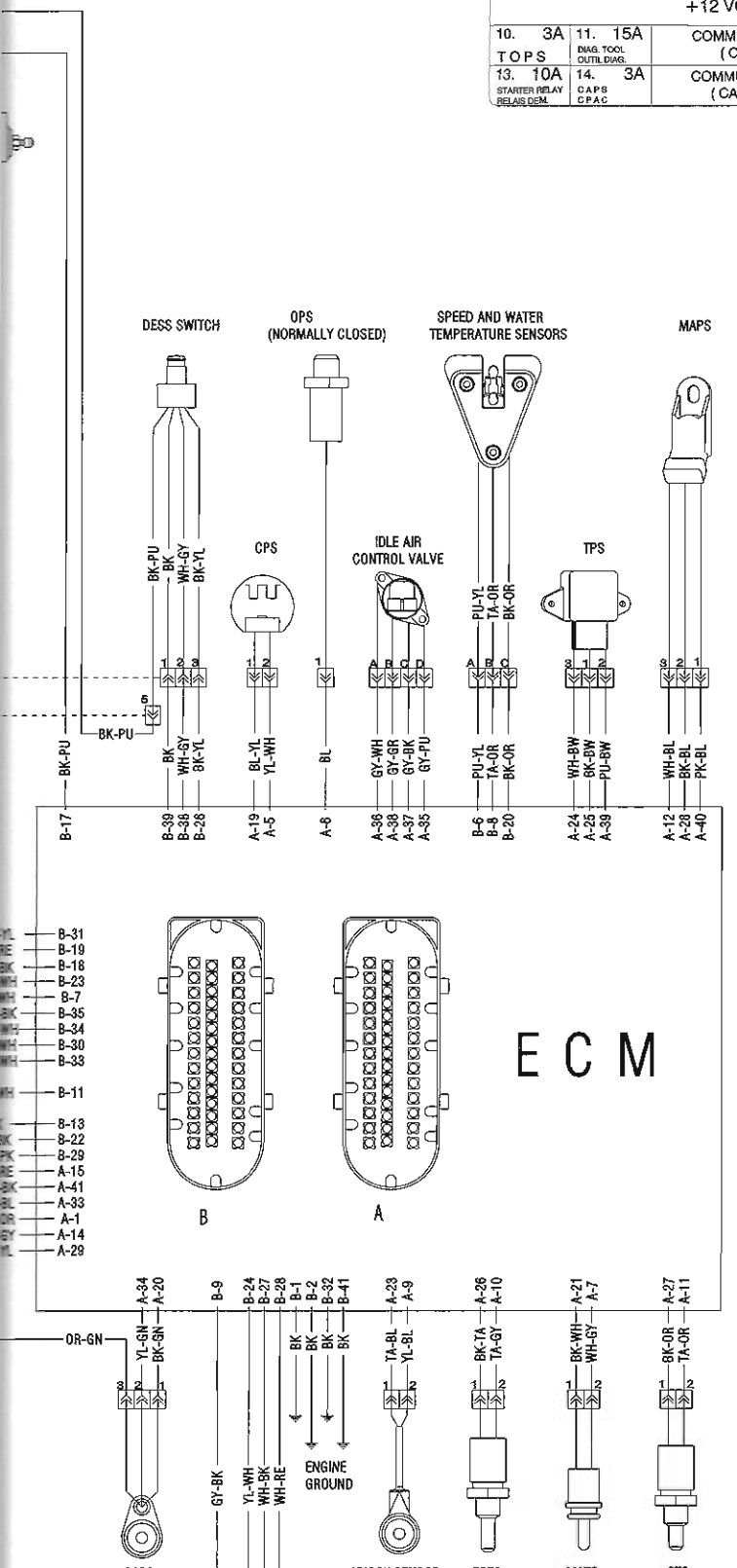


FUSE BOX 1

1. 3A GAUGE CADRAN	2. 3A BEEPER AVERTISSEUR	3. 3A DEPTH SOUNDER ECHOSONDEUR	4. 3A FUEL LEVEL NIVEAU ESSENCE	5. 7.5A VTS	6. 10A FUEL PUMP POMPE ESSENCE
7. 10A CYL.1	8. 10A CYL.2	9. 10A CYL.3	+12 VOLTS		
+12 VOLTS					
10. 3A TOPS	11. 15A DIAG. TOOL OUTIL DIAG.	COMMUNICATION (CAN HI)		12. 500 Ω FUEL LEVEL NIVEAU ESSENCE	
13. 10A STARTER RELAY RELAIS DEM.	14. 3A CAPS CPAC	COMMUNICATION (CAN LOW)		FUEL LEVEL NIVEAU ESSENCE	

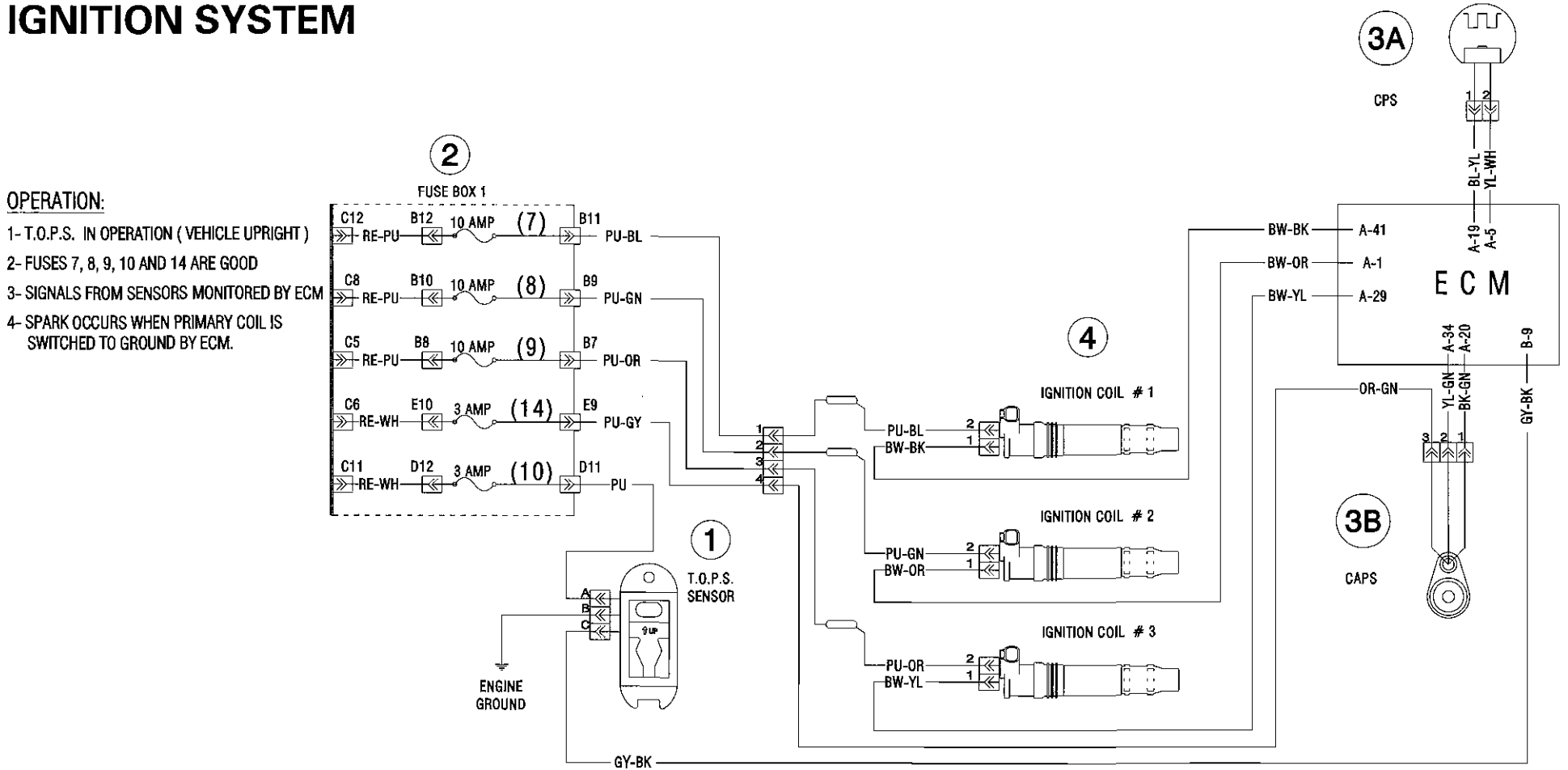
FUSE BOX 2

RELAIS RELAY	15. 30A CHARGE
	16. 30A BATT.
MASSE RELAIS RELAY GROUND	+12 VOLTS



COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TA = TAN
GN = GREEN	BW = BROWN
GY = GREY	BL = BLUE
PK = PINK	OR = ORANGE

IGNITION SYSTEM



CHARGING SYSTEM

1

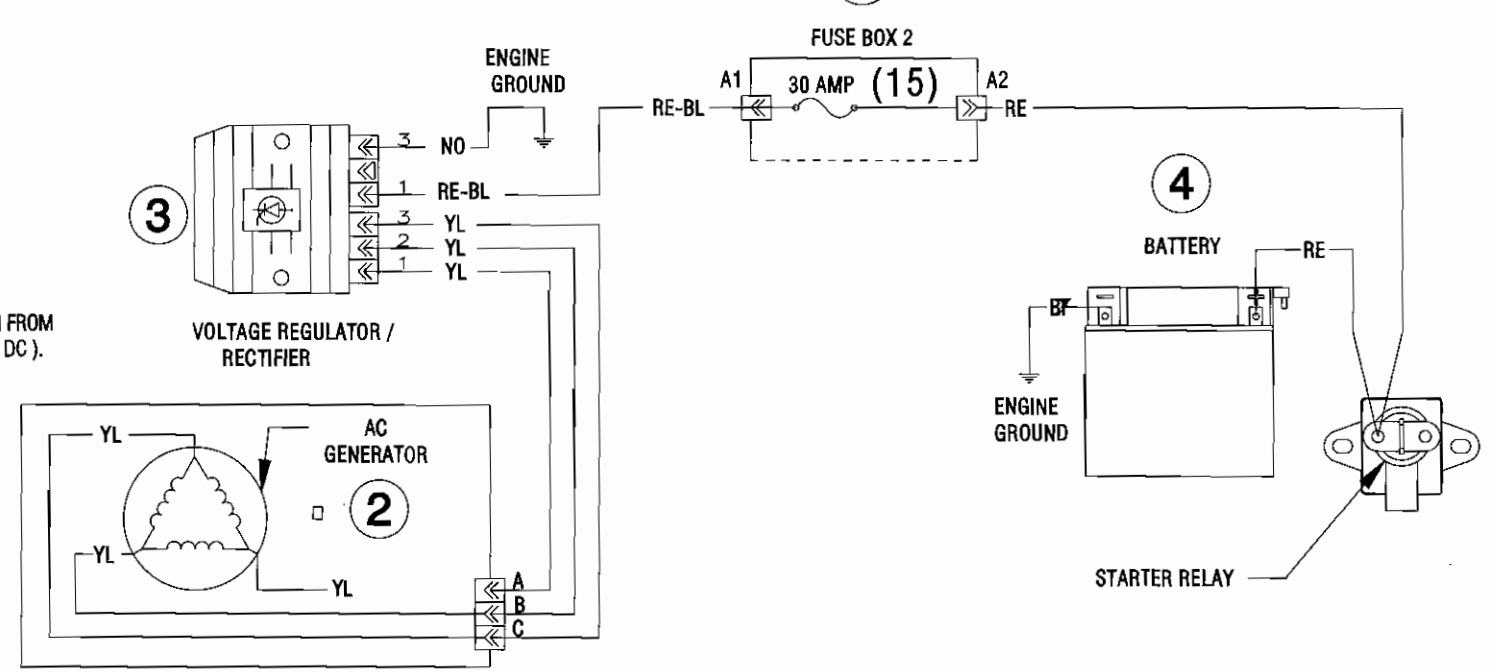
OPERATION:

1- FUSE (15) IS GOOD.

2- ACG SENDS CURRENT TO VOLTAGE REGULATOR / RECTIFIER

3- VOLTAGE REGULATION AND CURRENT RECTIFICATION FROM ALTERNATIVE CURRENT (AC) TO DIRECT CURRENT (DC).

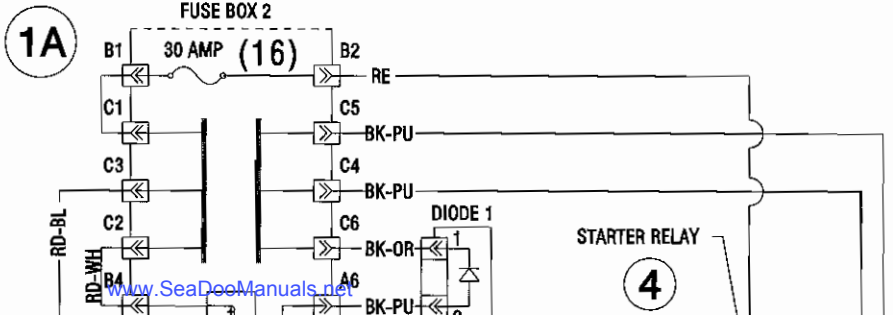
4- DIRECT CURRENT CHARGES BATTERY.



STARTING SYSTEM

OPERATION:

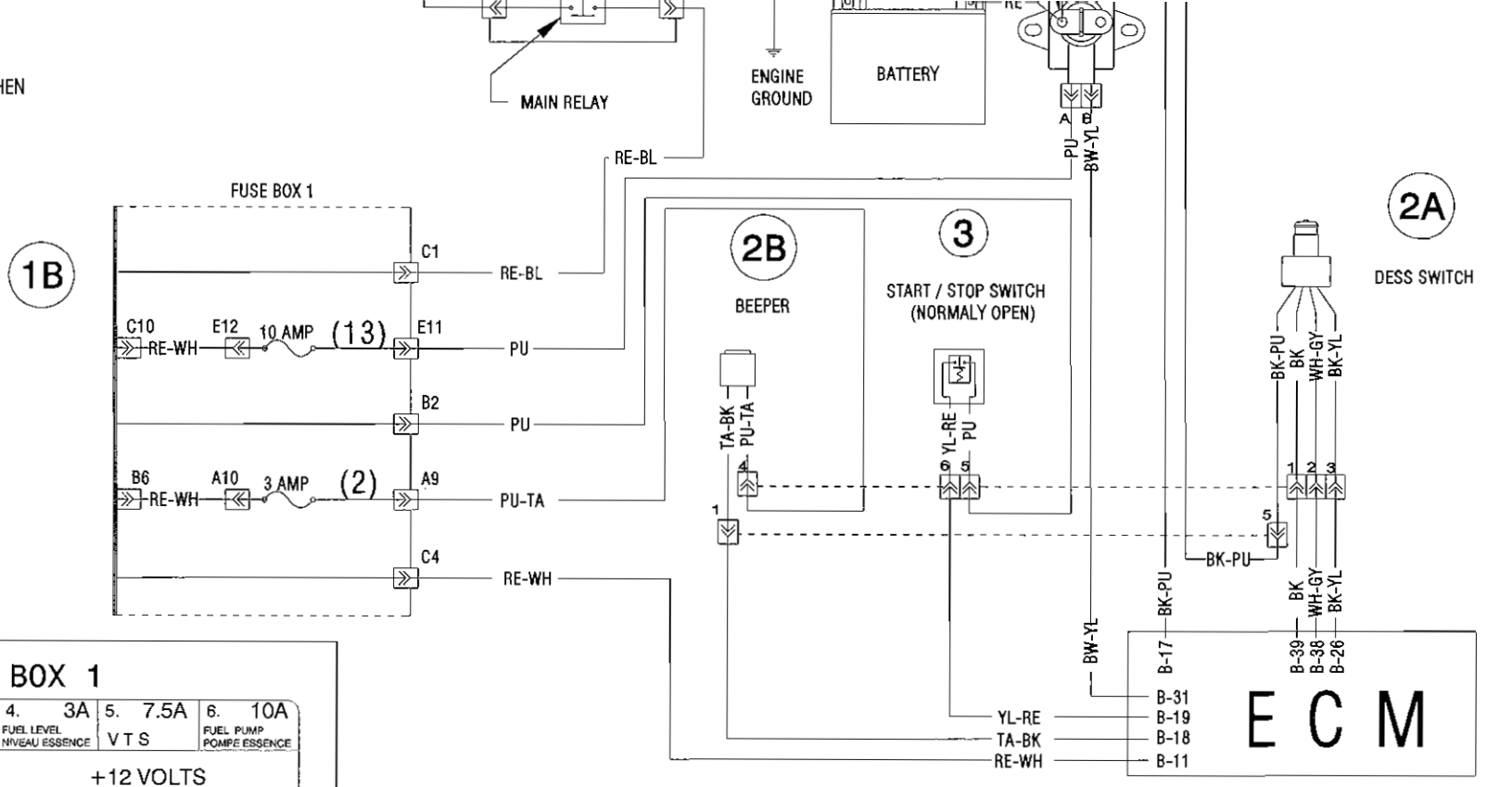
1- FUSES (2), (13) AND (16) ARE GOOD.



BEEPER SHOULD SOUND TWICE.

3- PRESS " START/STOP " BUTTON.

4- STARTER SOLENOID IS ACTIVATED WHEN GROUND IS SWITCHED BY ECM



FUSE BOX 1

1. 3A GAUGE CADRAN	2. 3A BEEPER AVERTISSEUR	3. 3A DEPTH SOUNDER ECHOSONDEUR	4. 3A FUEL LEVEL NIVEAU ESSENCE	5. 7.5A VTS	6. 10A FUEL PUMP POMPE ESSENCE
7. 10A CYL.1	8. 10A CYL.2	9. 10A CYL.3	+12 VOLTS		
+12 VOLTS					
10. 3A TOPS	11. 15A DIAG. TOOL OUTIL DIAG.	COMMUNICATION (CAN HI)	12. 500 Ω FUEL LEVEL NIVEAU ESSENCE		
13. 10A STARTER RELAY RELAIS DEM.	14. 3A CAPS CPAC	COMMUNICATION (CAN LOW)	FUEL LEVEL NIVEAU ESSENCE		

FUSE BOX 2

RELAIS RELAY	15. 30A CHARGE	
	16. 30A BATT.	
MASSE RELAIS RELAY GROUND	+12 VOLTS	

COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TA = TAN
GN = GREEN	BW = BROWN
GY = GREY	BL = BLUE
PK = PINK	OR = ORANGE

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