ski-doo®

BRP

Shop Manual

2006
RT Series

484 200 074

2006
Shop Manual

RT SERIES

ski-doo®

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Technical Publications

Bombardier Recreational Products Inc. (BRP)

Valcourt (Québec) Canada

Printed in Canada

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2006 Ski-Doo snowmobiles. See model list below.

This edition was primarily published to be used by snowmobile mechanic technicians who are already familiar with all service procedures relating to BRP made snowmobiles. Mechanic technicians should attend continuous training courses given by BRP Training Dept.

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 them. It does not included dealer modifications, whether authorized or not by BRP, after manufacturing the product.

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.

Bombardier Recreational Products Inc. (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.

INTRODUCTION

This shop manual covers the following BRP made 2006 RT Series models:

TYPICAL — RT SERIES

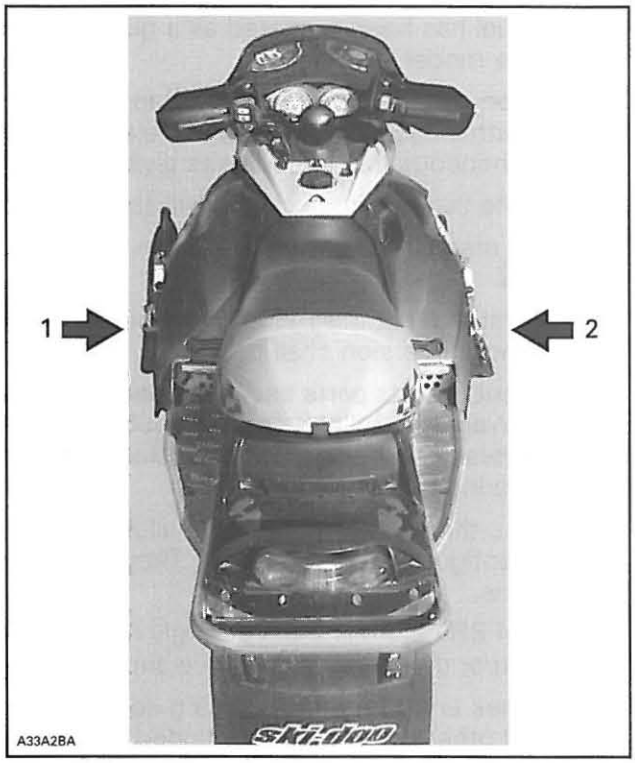
MODEL	ENGINE
Mach Z Adrenaline	1000 SDI
Mach Z X	1000 SDI
MX Z Renegade X	1000 SDI
Summit Highmark	1000 SDI
Summit Highmark X	1000 SDI

The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

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



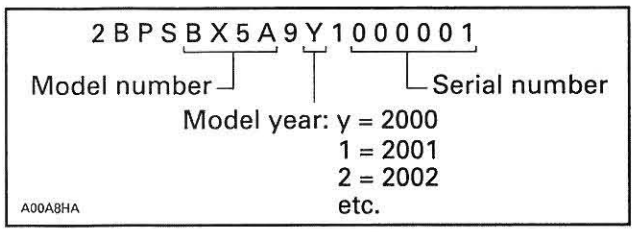
TYPICAL
1. Left
2. Right

VEHICLE IDENTIFICATION NUMBER

Vehicle Identification Number Location

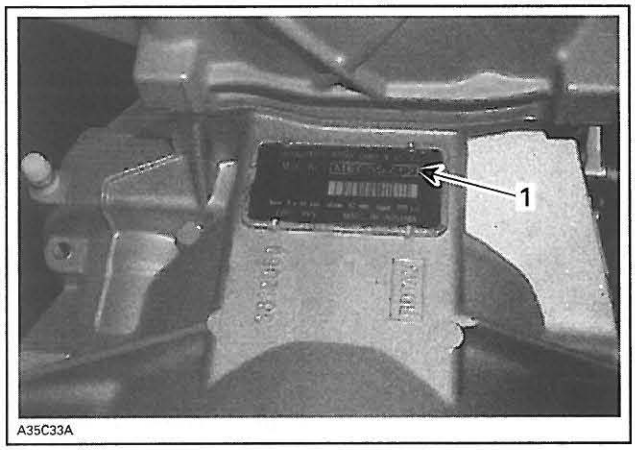
TYPICAL
1. Vehicle identification number

Identification Number Meaning



ENGINE SERIAL NUMBER

Engine Serial Number Location



1. Engine serial number

ARRANGEMENT OF THIS MANUAL, ILLUSTRATIONS AND PROCEDURES

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.

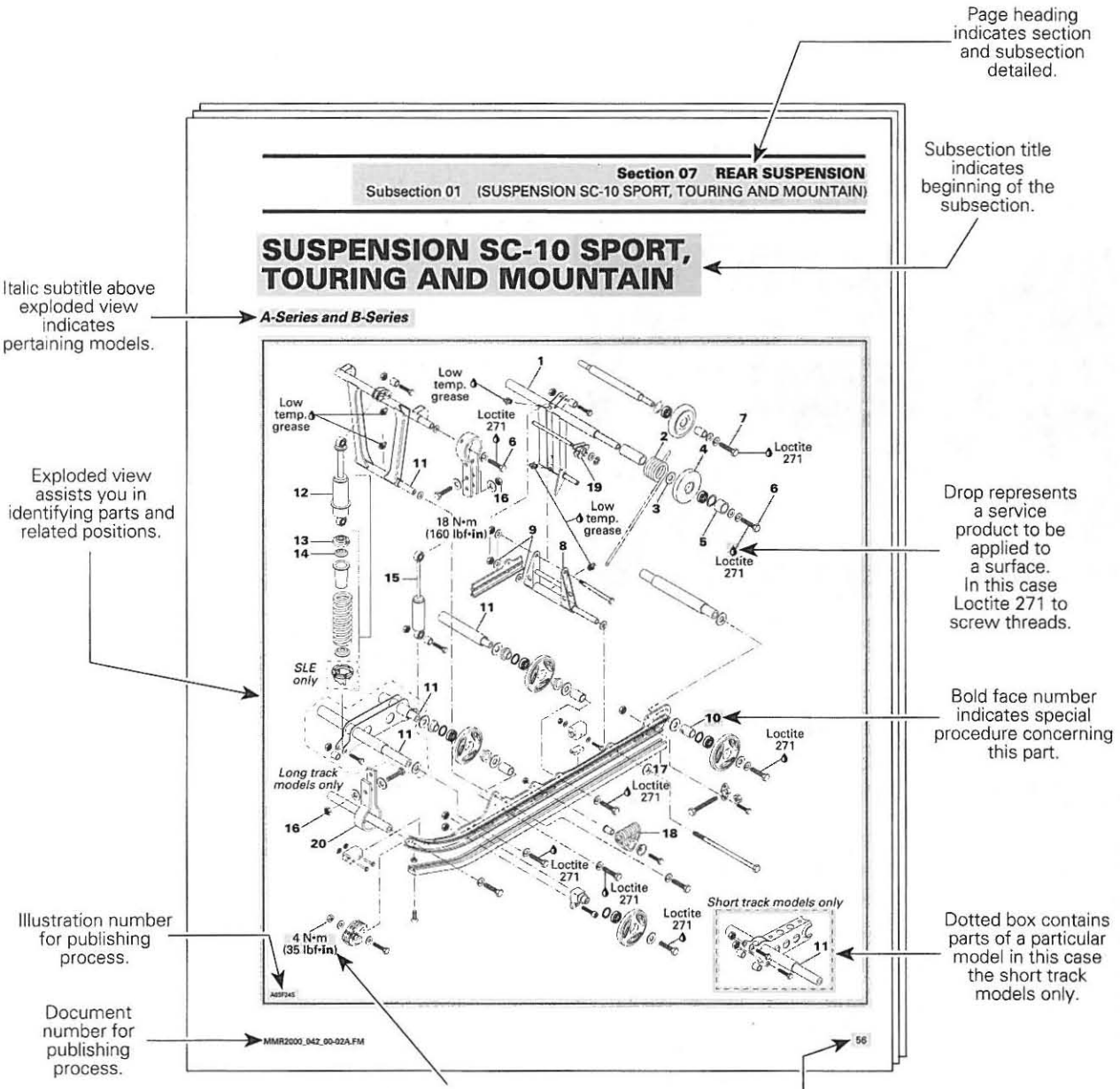
CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

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.

This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE

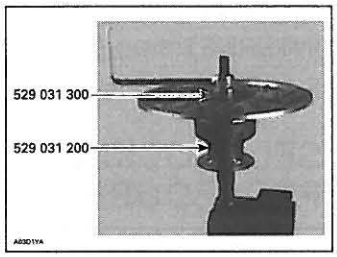


CAUTION: Pay attention to torque specifications. Some of these are in lbf•**in** instead of lbf•ft. Use appropriate torque wrench.

A00A7XS

TYPICAL PAGE

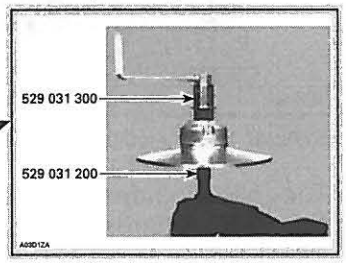
Turn puller handle and sliding half at once to extract the bushing.



IMPORTANT: Large bushing retaining screws and washers must be removed before small bushing installation.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Install bushing as following photo.



ASSEMBLY

Came Slider Shoe

When replacing slider shoes **no. 4**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 18** interior with anti-seize lubricant.

INSTALLATION

Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

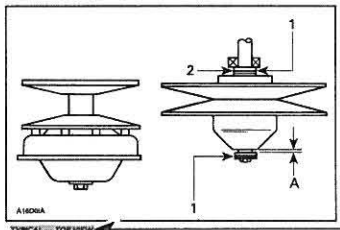
A-Series and B-Series Only

Should installation procedure be required, refer to BRAKE then look for **Brake Disc and Countershaft Bearing Adjustment**.

Reinstall the pulley on the countershaft by reversing the removal procedure.

All Models

Check end play of driven pulley on countershaft by pushing pulley towards outer housing so that the inner shims (P/N 504 108 200) contact it. Measure end play at the mounting screw end between shim(s) and puley. See illustration.



TYPICAL — TOP VIEW

Torque retaining screw **no. 13** to 25 N•m (18 lbf•ft).

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height between pulley halves to obtain specified belt deflection.

Title indicates main procedure to be carried-out.

Italic bold face type setting indicates a particular procedure concerning a model.

Italic bold face setting in this case indicates that particular procedure for A and B-Series is finished, so from this point, all models are concerned.

"TYPICAL" caption indicates a general view which does not represent full detail. "TOP VIEW" caption helps you in understanding illustration.

Illustration always follows text to which it pertains.

Call-outs for above illustration.

Reference to look up a certain section and subsection. In this case it concerns pulleys adjustment.

Subtitle indicates a particular procedure for the named part.

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

A00A7YS

ENGINE EMISSIONS INFORMATION

Manufacturer's Responsibility

Manufacturers of 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 snowmobiles 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

Some Ski-Doo snowmobiles manufactured by BRP are certified to the EPA as conforming to the requirements of the regulations for the control of air pollution from new snowmobiles 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 snowmobiles products. For more detailed information on this subject, you may contact the following locations:

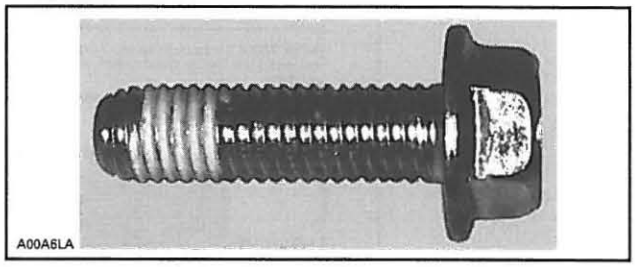
FOR ALL COURIER SERVICES:
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
1310 L Street NW
Washington D.C. 20005

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

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.

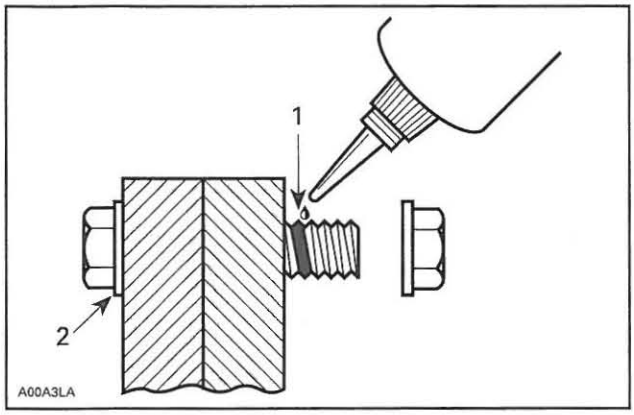
LOCTITE APPLICATION PROCEDURE

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

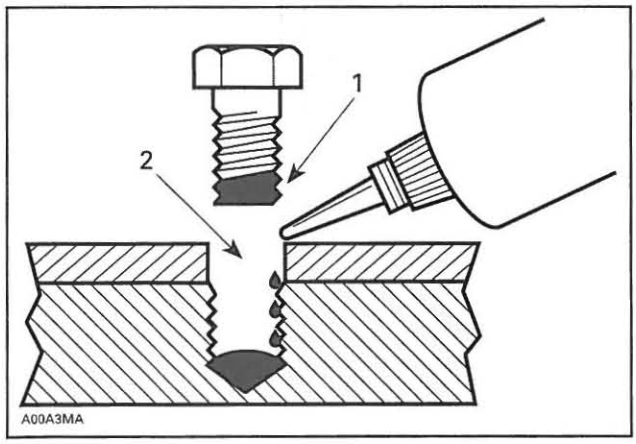
Uncovered Holes (bolts and nuts)



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.

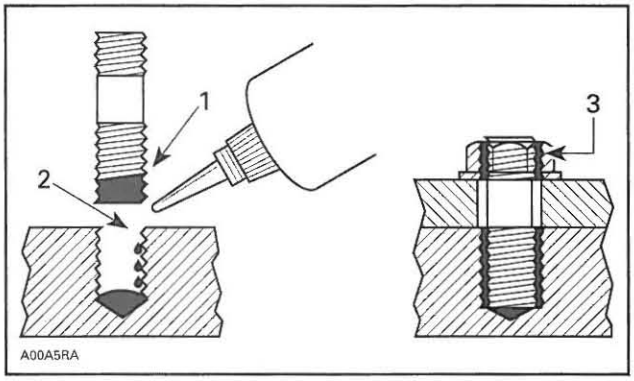
Blind Holes



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.

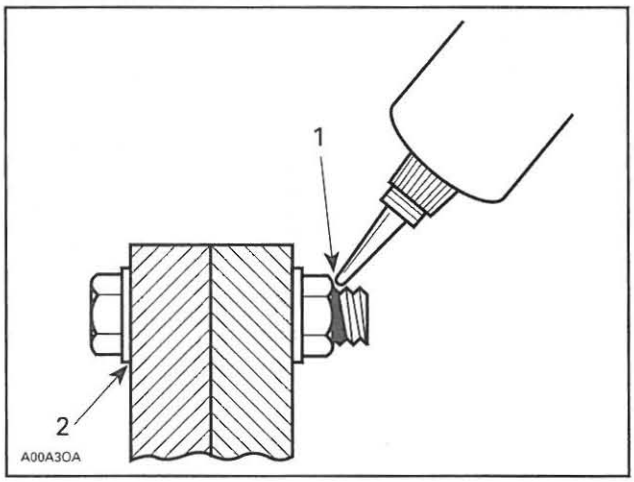
Stud in Blind Holes



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 several drops of proper strength Loctite threadlocker on female threads and in hole.
- 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.

Preassembled Parts

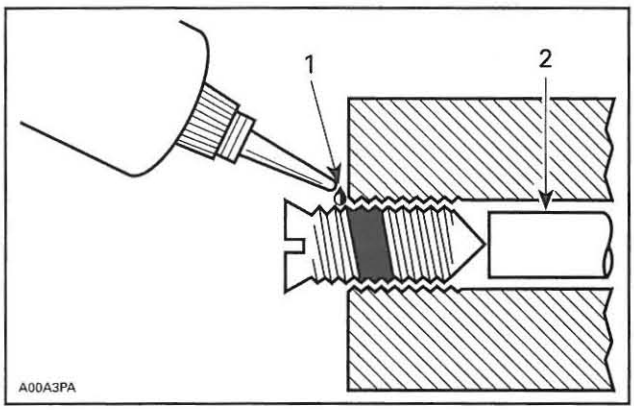


1. Apply here
2. Do not apply

- 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

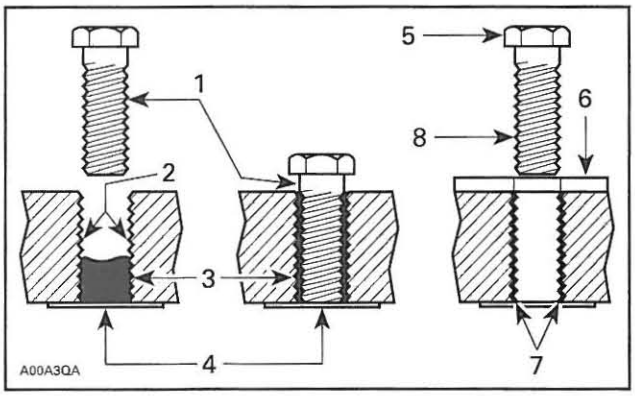


1. Apply here
2. Plunger

- 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

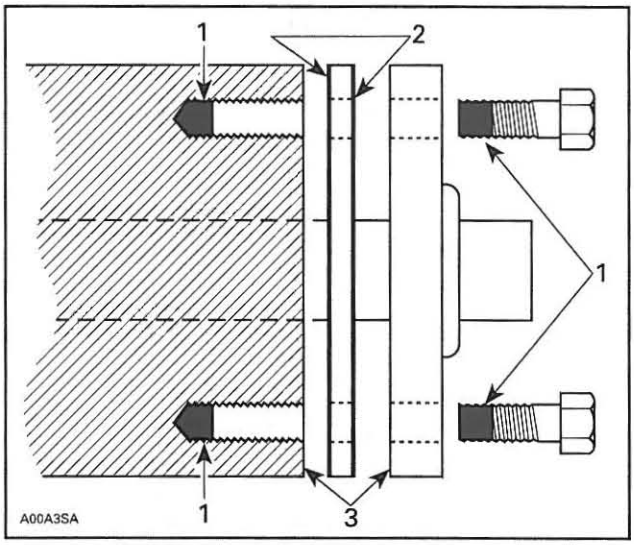
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

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 Gasket Eliminator 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 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 GASKET ELIMINATOR 518 (P/N 293 800 038) on both sides of gasket, using a clean applicator.

– Place gasket on mating surfaces and assemble immediately.

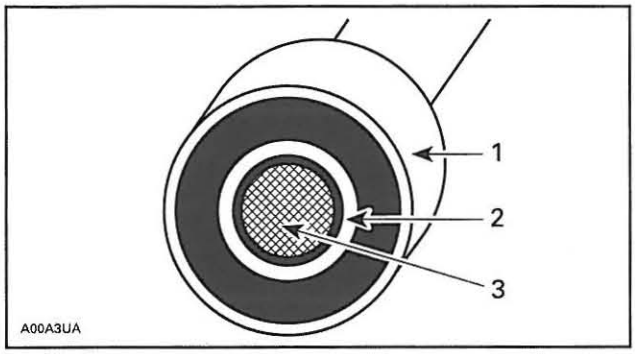
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

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.

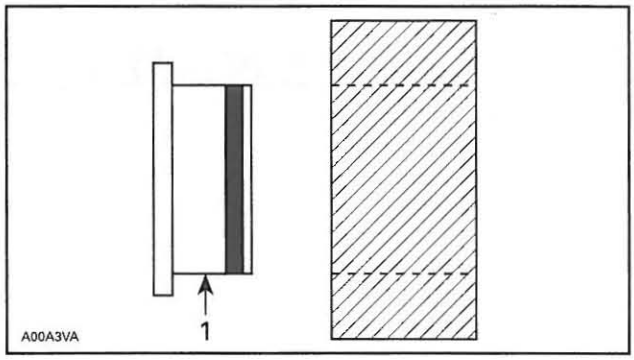
– DO NOT use antiseize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

1. Apply retaining compound on internal element bore.
2. 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.

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table. The table also gives the metric conversion.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

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

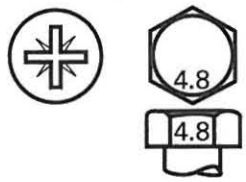
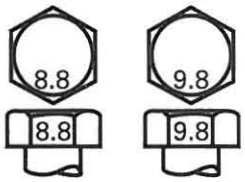
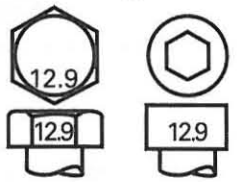
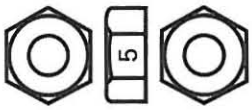
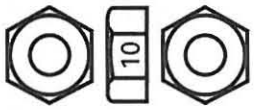
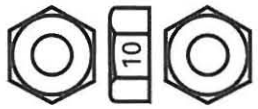
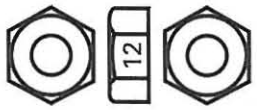
- Manually screw all screws, bolts and/or nuts.
- Apply the half of the recommended torque value.

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 criss-cross sequence.

Property class and head markings	4.8 	8.8 9.8 	10.9 	12.9 
Property class and nut markings A00A8BS	5 	10 	10 	12 

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 (11 lbf•ft)	24.5 N•m (18 lbf•ft)	31.5 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)	72.5 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	127.5 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)

MAINTENANCE CHART

A: ADJUST
C: CLEAN
I: INSPECT
L: LUBRICATE
R: REPLACE
T: PROCEED WITH TASK

SYSTEM	10-HOUR OR 500 KM (300 mi) INSPECTION [1]	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	ONCE A YEAR OR EVERY 6000 KM (3700 mi)	STORAGE [1]	PRESEASON PREPARATION [1]	REFER TO
ENGINE								
Rewind starter and rope						I,L,C	I	Rewind Starter
Engine motor mounts	I			I		I		Engine Removal and Installation
Exhaust system [2]	I		I			I		Exhaust System
Exhaust manifold screws	I					I	I	Exhaust System
Engine lubrication						T		Storage Procedures
Cooling system	I			I			I	Cooling System
Coolant	I					R		Cooling System
Crankshaft PTO Seal [2]						I		Bottom End
E-RAVE actuator [2]	A			A				E-RAVE System
LUBRICATION SYSTEM								
Injection oil filter			I			R		Oil Injection System
Oil injection pump	A			A			A	Oil Injection Pump
FUEL SYSTEM								
Fuel stabilizer						T		Storage Procedures
Fuel filter							R	Preseason Preparation
Fuel lines, fuel rail and connections	I						I	Components Inspection, Replacement and Adjustment
Throttle cable	I			I			I	Carburetors, Throttle and Choke Cables
Air filter [2]			C				C	Air Intake System
Throttle body [2]							C	Components Inspection, Replacement and Adjustment
Air intake system [2]							I,C	Air Intake System
DRIVE SYSTEM								
Drive belt	I	I					I	Drive Belt
Drive and driven pulley	I		I	C		I	C	Drive Pulley and Driven Pulley
Tightening torque of drive pulley screw	I			I			I	Drive Pulley
Tightening torque of ring gear screws							I	Drive Pulley
Brake fluid	I	I				R	I	Countershaft and brake
Drive pulley ramp and roller				I			I	Drive Pulley
Brake hose, pads and disk	I	I					I	Countershaft and brake
Drive chain tension	A[5]		A[5]			I		Chaincase
Chaincase oil	I		I			R	I	Chaincase
Drive axle end bearing [3]	L		L			L		Drive Axle
Countershaft [3]	L		L			L		Countershaft and brake
Track	I		I			I		Track

A: ADJUST
C: CLEAN
I: INSPECT
L: LUBRICATE
R: REPLACE
T: PROCEED WITH TASK

SYSTEM	10-HOUR OR 500 KM (300 mi) INSPECTION (1)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	ONCE A YEAR OR EVERY 6000 KM (3700 mi)	STORAGE (1)	PRESEASON PREPARATION (1)	REFER TO
Track tension and alignment	A	AS REQUIRED						Track
STEERING								
Steering (3)	I,L		I	L		I,L		Steering and Handlebar
Wear and condition of skis and runners	I	I				I		R.A.S. Front Suspension
SUSPENSION								
Front suspension mechanism (3)	I,L		I	L		I,L		R.A.S. Front Suspension
A-arm bushings							I,L	R.A.S. Front Suspension
Rear suspension (3)	I		I,L			I,L		SC Rear Suspension and SC 4 Rear Suspension
Suspension stopper strap				I		I		
ELECTRICAL								
EMS fault codes (2)	I				I			EMS Diagnostic and Communication Tools
TPS closed throttle reset	T							Components Inspection, Replacement and Adjustment
Spark plugs (2) (4)	I		I				R	Ignition System
Battery (if so equipped)	I		I			I	I	Charging System
Wiring harnesses, cables and lines (2)	I		I			I		Electrical Connectors
Operation of lighting system (HI/LO beam, brake light, etc.) test operation of engine cut-out switch and tether cut-out switch	I	I				I		Operator's Guide and Lights, Instruments and Accessories
VEHICLE								
Headlamp beam aiming				A			A	Lights, Instruments and Accessories
Rags in air intake and exhaust system						T	T	Storage Procedures and Preseason Preparation
Engine compartment	C		C			C		Storage Procedures
Vehicle cleaning and protection	C		C			C		Storage Procedures

(1) To be performed by an authorized Ski-Doo dealer.

(2) Emission-related.

(3) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

(4) Before installing new spark plugs at preseason preparation, it is suggested to burn excess storage oil by starting the engine with the old spark plugs. Only perform this operation in a well-ventilated area.

(5) MX Z Renegade X and Summit models.

STORAGE PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
cleat remover	529 028 700	5
narrow-cleat installer	529 028 800	5

SERVICE PRODUCTS

Description	Part Number	Page
BOMBARDIER LUBE	293 600 016	4–5
fuel stabilizer	413 408 600	4
heavy duty cleaner	293 110 001	5
Loctite 767 (antiseize lubricant)	293 800 070	4
plastic & vinyl cleaner	413 711 200	5
scratch remover kit	861 774 800	5
storage oil	413 711 600	4
storage oil	413 711 900	4
suspension grease	293 550 033	4–5

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from *MAINTENANCE CHART* jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts should be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

ENGINE

Rewind Starter and Rope

For inspection, cleaning and lubrication, refer to *REWIND STARTER* section.

Engine Motor Mounts

Check if engine supports are cracked, bent or damaged. Replace if necessary.

Check rubber mount on engine supports. Replace them if brittle, cracked or damaged.

Exhaust System

Check and replace if necessary:
- tuned pipe shield for damages
- tuned pipe ends for cracks or damages
- manifold for cracks or damages.

Engine

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period.

NOTE: Be sure to add fuel stabilizer before starting the engine.

Proceed as follows:
- Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

⚠ WARNING

Ensure the track is free of particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

- Stop the engine.
- Remove air silencer to spray storage oil into each carburetor/throttle body.

- Restart engine and run at idle speed.
- Inject storage oil until the engine stalls or until a sufficient quantity of oil has entered the engine (approximately half a can).
- With the engine stopped, remove the spark plug and spray storage oil (P/N 413 711 600) (Canada) or storage oil (P/N 413 711 900) (USA) into each cylinder.
- Crank slowly 2 or 3 revolutions to lubricate cylinders.
- Reinstall the spark plugs and air silencer.

⚠ WARNING

This procedure must only be performed in a well-ventilated area. Do not run engine during storage period.

Crankshaft PTO Seal

Make sure there is no grease coming out from crankshaft PTO seal, if so replace seal, refer to *BOTTOM END* section.

Cooling System

For coolant replacement, refer to *COOLING SYSTEM* section.

LUBRICATION SYSTEM

Injection Oil Filter

Replace injection oil filter, refer to *OIL INJECTION SYSTEM* section.

FUEL SYSTEM

Fuel Stabilizer

It is critical to use the fuel stabilizer (P/N 413 408 600) (250 mL) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank prior to starting engine for internal parts lubrication so that stabilizer flows everywhere in fuel system. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

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

Do not drain fuel system.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure carburetor protection against varnish deposit.

⚠ WARNING

Fuel is flammable 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. Never use an open flame to check fuel level. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle. Periodically inspect fuel system.

DRIVE SYSTEM

Drive and Driven Pulley

After inspection and interior cleaning of pulleys, spray BOMBARDIER LUBE (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

Brake Fluid

Replace brake fluid, refer to *COUNTERSHAFT AND BRAKE* section.

Drive Chain

MX Z Renedage X and Summit Models

Check drive chain tension and adjust if necessary, refer to *CHAINCASE* section.

Mach Z

There is no adjustment possible on this model, refer to *DRIVE SYSTEM* section for details.

Chaincase Oil

Replace chaincase oil, refer to *CHAINCASE* section.

Drive Axle End Bearing

Lubricate end housing bearing with suspension grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.

Countershaft

Driven pulley and brake disc must be floating on the countershaft for efficient operation. Lubricate with Loctite 767 (antiseize lubricant) (P/N 293 800 070).

CAUTION: Do not lubricate excessively as lubricant could contact and soil brake pads and/or drive belt.

Track

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

If track is damaged or rods are broken, replace track, refer to *TRACK* section.

For damaged or missing cleats, replace by new ones, using cleat remover (P/N 529 028 700) and narrow-cleat installer (P/N 529 028 800).

NOTE: Do not release track tension.

STEERING

Steering Mechanism

Lubricate the steering mechanism if needed. **Inspect all components for tightness.**

Skis and Runners

Inspect skis and runners for wear, deterioration or damage, replace if necessary.

SUSPENSION

Front Suspension

Inspect the front suspension for wear or damages, replace if necessary.

Lubricate R.A.S. front suspension mechanism if needed with suspension grease (P/N 293 550 033).

Rear Suspension

Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace if necessary.

Lubricate front and rear arms at grease fittings using suspension grease (P/N 293 550 033).

ELECTRICAL

Battery (if so equipped)

Remove battery, clean its tray and close area with water and baking soda.

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery.

Charge battery as explained in *CHARGING SYSTEM* section.

Wiring Harnesses, Cables and Lines

Inspect for wear, deterioration or damage, replace defective parts if necessary.

Lighting System and Switches

Check operation of lighting system (HI/LO beam, brake light, etc.). Repair or replace as required.

Check if all switches work properly (engine and tether cord cutout switches, start switch, etc). Repair or replace as required.

VEHICLE

Engine Compartment

Keep clean of grass, twigs, cloth, etc. These are combustible under certain conditions.

Cleaning

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle.

Remove any dirt or rust.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (P/N 293 110 001).

CAUTION: Do not use Heavy duty cleaner on decals or vinyl.

For vinyl and plastic parts use plastic & vinyl cleaner (P/N 413 711 200).

To remove scratches on windshield or hood use scratch remover kit (P/N 861 774 800).

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched off.

Spray all bare metal parts including shock rods with BOMBARDIER LUBE (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection. Use a non-abrasive wax such as silicone wax.

NOTE: Apply non-abrasive wax on glossy finish only.

Protection

Block air intake hole and exhaust system hole using clean rags.

Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

PRESEASON PREPARATION

SERVICE PRODUCTS

Description	Part Number	Page
pulley flange cleaner	413 711 809	7–8
XP-S synthetic chaincase oil	413 803 300	8

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than one month.

Refer to preseason preparation column from *MAINTENANCE CHART* jointly with the present preseason preparation procedure in order to cover each and every aspect of the snowmobile preseason preparation procedure.

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 for preparation procedure.

ENGINE

Rewind Starter and Rope

Check if rope is fraying, replace if so.

When pulling starter grip, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

Exhaust Manifold

Check exhaust manifold screws to ensure they are tight. Retorque if necessary to 11 N•m (97 lbf•**in**).

Muffler

Remove rags that were installed during storage preparation.

Cooling System

Inspect cooling system for leaks, to perform a cooling system leak test, refer to *COOLING SYSTEM* section.

Check coolant level in coolant reservoir. Add coolant if necessary.

If engine is cold, refill up to 15 mm (5/8 in) over COLD level line.

If engine is hot, refill up to 25 mm (1 in) over COLD level line.

AIR INTAKE SYSTEM

Air Filter and Air Intake Silencer

Remove rag that was installed during storage preparation.

Check that inside of air intake silencer is clean and dry then properly reinstall the filter, refer to *AIR INTAKE SYSTEM*.

CAUTION: These snowmobiles have been calibrated with the filter installed. Operating the snowmobile without it, may cause engine damage.

Throttle Body

Using the pulley flange cleaner (P/N 413 711 809), clean the throttle plates and throttle body bores.

NOTE: To ease cleaning, throttle body should be partially pulled from engine, without disconnecting throttle cable or coolant hose.

CAUTION: Ensure the cleaner does not enter engine intake.

LUBRICATION SYSTEM

Oil Injection Pump

Make sure oil injection pump is properly adjusted, refer to *OIL INJECTION PUMP* section.

FUEL SYSTEM

In-Line Fuel Filter

Replace the in-line fuel filter, refer to *FUEL TANK AND FUEL PUMP* section.

Fuel Lines, Fuel Rails and Connections

Inspect fuel system for leaks, to perform a fuel system pressurization, refer to *FUEL TANK AND FUEL PUMP*.

Throttle Cable

Make sure that throttle cable operate freely, replace if necessary, refer to *ENGINE MANAGEMENT*.

DRIVE SYSTEM

Drive Belt

Inspect belt for cracks, fraying or abnormal wear. Replace if necessary.

Make sure to install the proper belt with arrow printed on belt pointing front of vehicle.

Drive and Driven Pulley

Clean drive and driven pulleys sheaves with pulley flange cleaner (P/N 413 711 809).

Retorque drive and driven pulley. Refer to *DRIVE PULLEY* and *DRIVEN PULLEY.*

Check drive pulley ramps and rollers for wear, refer to *DRIVE SYSTEM.*

Brake Fluid

Check brake fluid in reservoir for proper level. Add fluid (DOT 4) as required.

CAUTION: Use only (DOT 4) brake fluid from a sealed container. Do not store or use a started bottle of brake fluid.

Brake Hose, Pads and Disk

Inspect brake hose for wear, deterioration or damage, replace if necessary.

Inspect brake pads for proper thickness. Refer to *COUNTERSHAFT AND BRAKE.*

Remove any rust built-up on braking surfaces. Clean brake disk braking surfaces with pulley flange cleaner (P/N 413 711 809).

Chaincase

Check chaincase oil for proper level. Add XP-S synthetic chaincase oil (P/N 413 803 300) chaincase oil as required.

Track

Verify track tension and alignment, refer to *TRACK.*

NOTE: Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

ELECTRICAL SYSTEM

Battery

Verify that battery is fully charged, if not, refer to the appropriate charging procedure in *CHARGING SYSTEM* section.

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

Headlamp

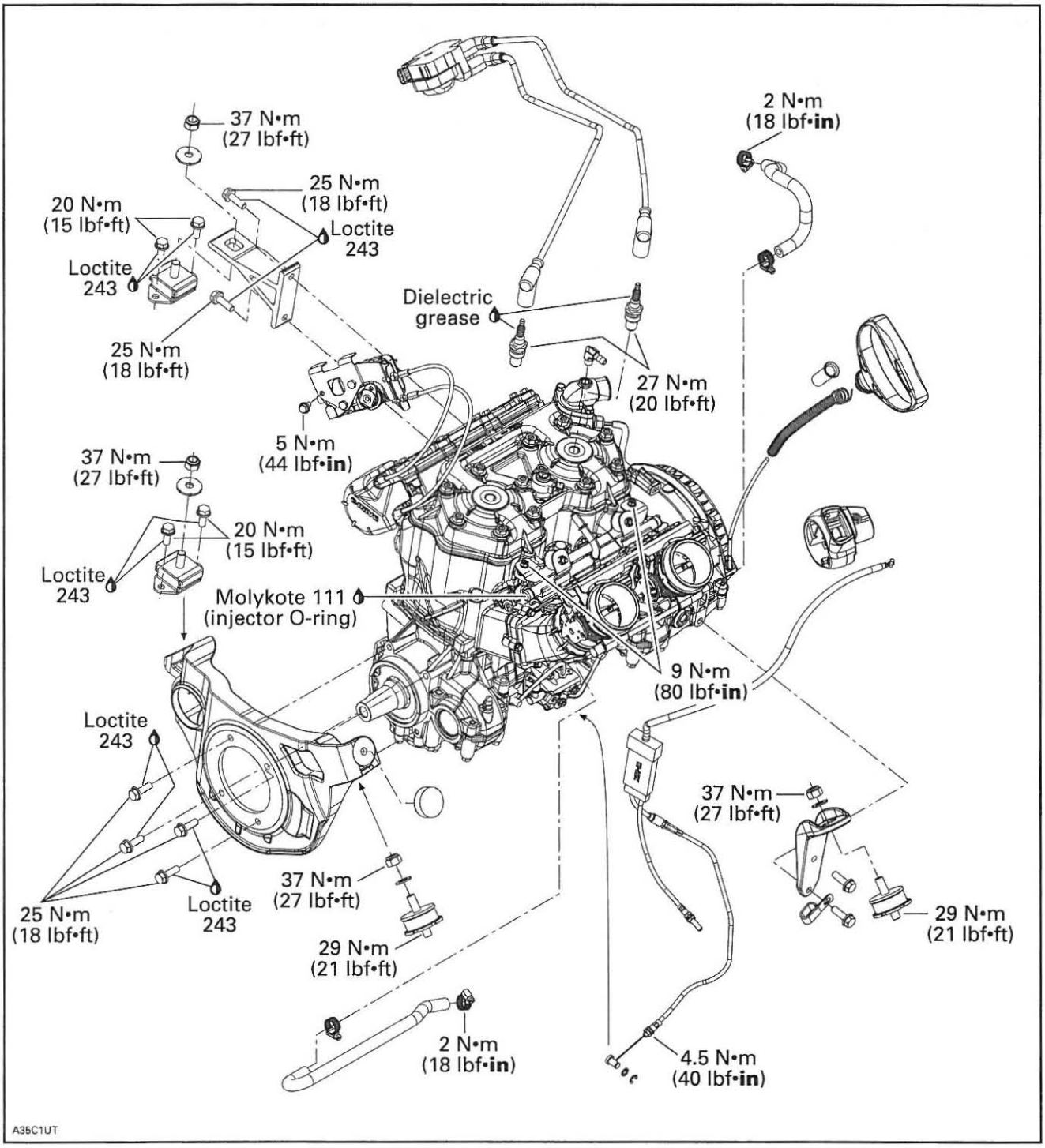
Verify beam aim and adjust if necessary, refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES* section.

Spark Plugs

Once preseason preparation is done, start engine with the old spark plugs to burn excess storage oil. Then, install new properly gapped spark plugs.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS


37 N•m
(27 lbf•ft)
25 N•m
(18 lbf•ft)
20 N•m
(15 lbf•ft)
Loctite
243
Loctite
243
25 N•m
(18 lbf•ft)
2 N•m
(18 lbf•in)
Dielectric
grease
27 N•m
(20 lbf•ft)
5 N•m
(44 lbf•in)
37 N•m
(27 lbf•ft)
20 N•m
(15 lbf•ft)
Loctite
243
Molykote 111
(injector O-ring)
9 N•m
(80 lbf•in)
Loctite
243
37 N•m
(27 lbf•ft)
37 N•m
(27 lbf•ft)
25 N•m
(18 lbf•ft)
Loctite
243
29 N•m
(21 lbf•ft)
29 N•m
(21 lbf•ft)
2 N•m
(18 lbf•in)
4.5 N•m
(40 lbf•in)
A35C1UT

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

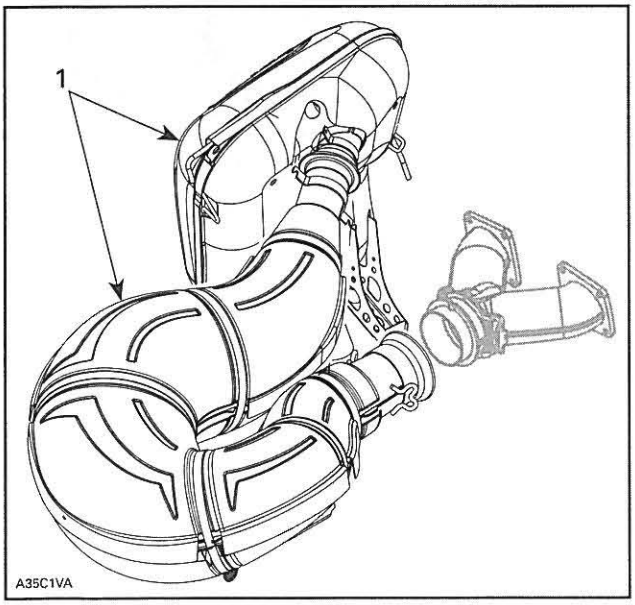
REMOVAL FROM VEHICLE

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

Open hood and remove side panels (refer to *BODY).*

Using B.U.D.S., release fuel pressure from fuel system. Refer to *COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.*

Remove tuned pipe and muffler. Refer to *EXHAUST SYSTEM.*



REMOVE
1. Tuned pipe and muffler

On Right Side of Vehicle, do the Following:

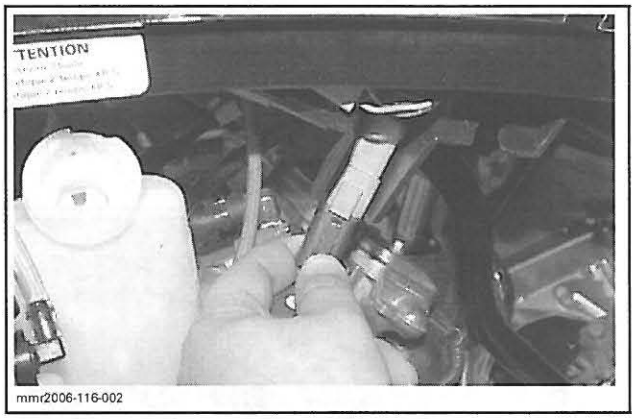
Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

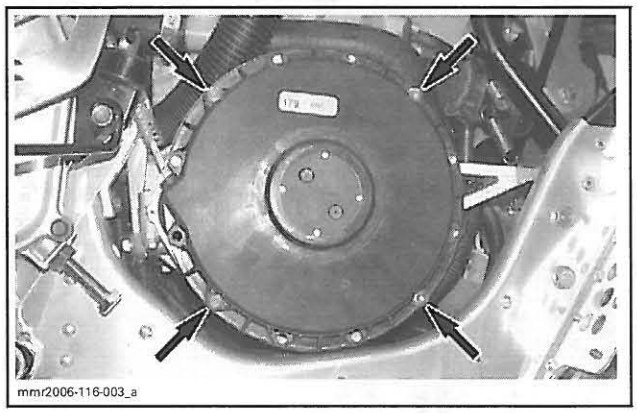
Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Drain cooling system. Refer to *COOLING SYSTEM.*

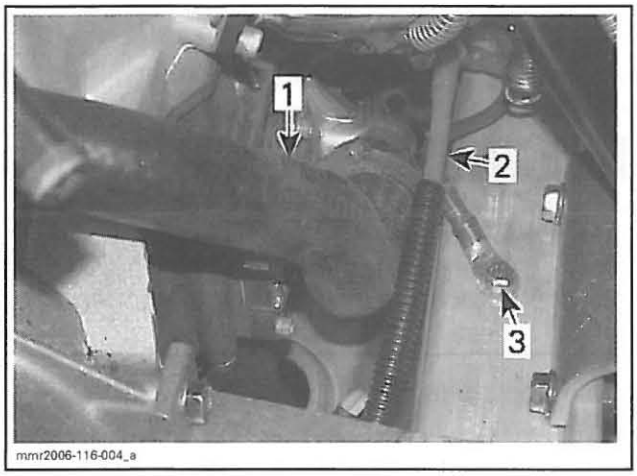
Unplug coolant temperature sensor (CTS).



Remove rewind starter housing screws then move housing aside.

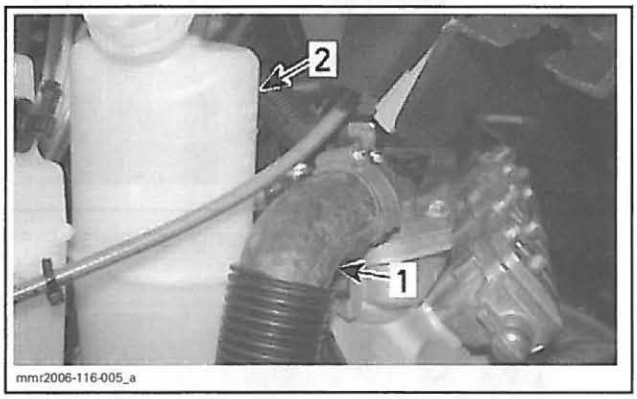


Unplug:
– engine cooling inlet hose



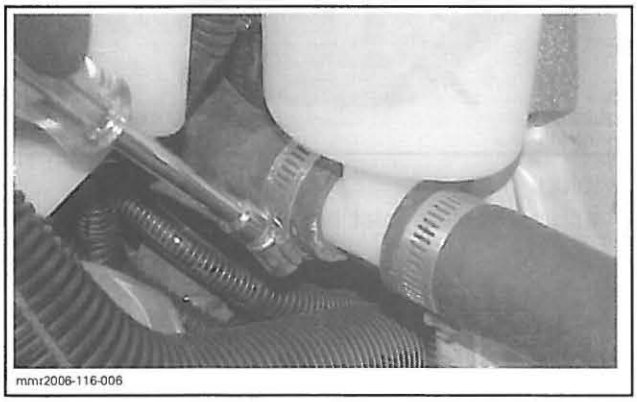
LOCATED TO FRONT SIDE OF ENGINE
1. *Engine cooling inlet hose*
2. *Starter cable*
3. *Ground cable*

– engine cooling outlet hose from cylinder head then install a large hose pincher (P/N 529 032 500) to block it



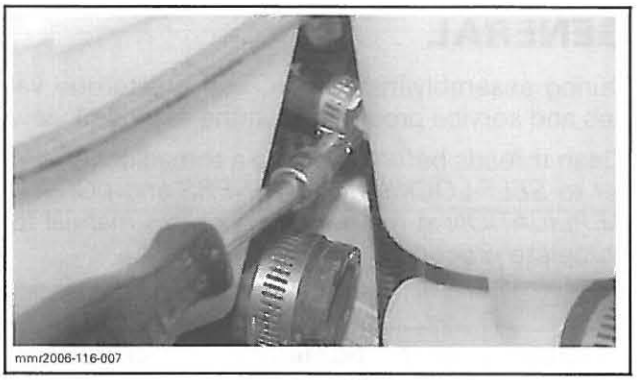
1. *Engine cooling outlet hose*
2. *Coolant reservoir*

– radiator outlet hose then install a large hose pincher (P/N 529 032 500) to block it.



Lift coolant reservoir out of its support.

Unplug throttle body cooling hose from reservoir.

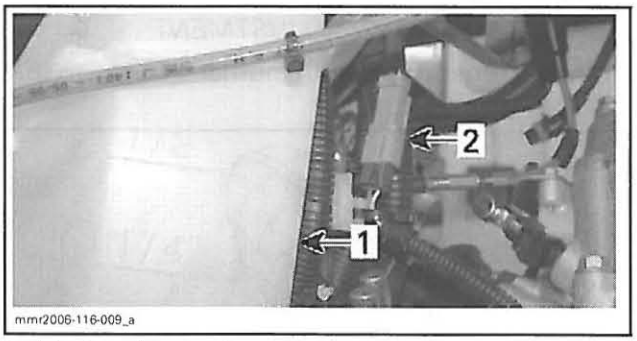


Remove bleed hose from reservoir.

Remove reservoir from vehicle.

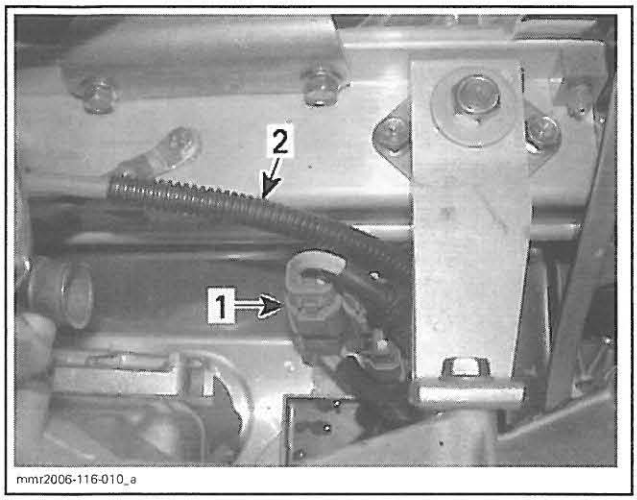
Disconnect:

– crankshaft position sensor (CPS)



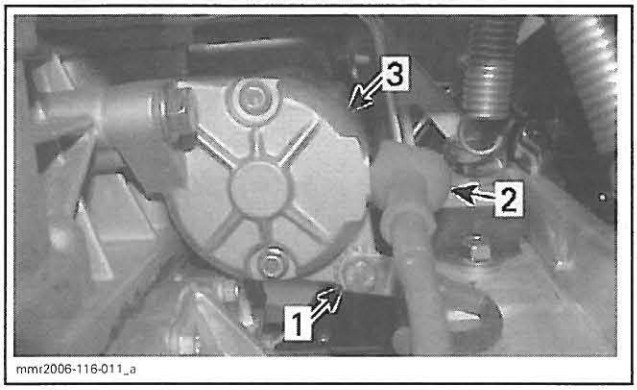
1. *Injection oil reservoir*
2. *CPS connector*

– magneto.



1. Starter cable
2. Magneto connector

Detach the ground cable and starter cable from starter.



1. Ground cable
2. Starter cable
3. Starter

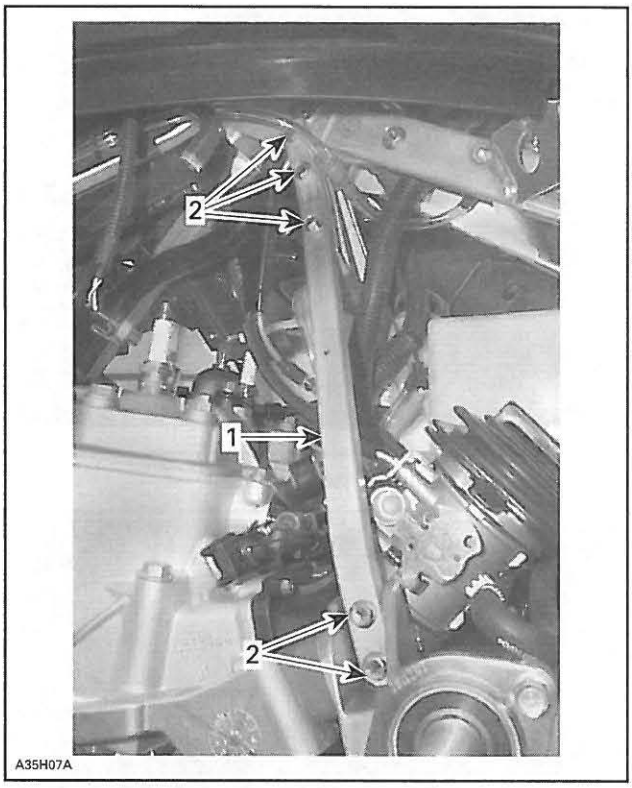
Unscrew and remove engine mounting nuts with washers.

On Left Side of Vehicle, do the Following:

Remove:

- belt guard
- drive belt
- drive pulley (refer to *DRIVE PULLEY*)
- driven pulley (refer to *DRIVEN PULLEY*)
- primary air intake silencer, refer to *AIR INTAKE SYSTEM*.

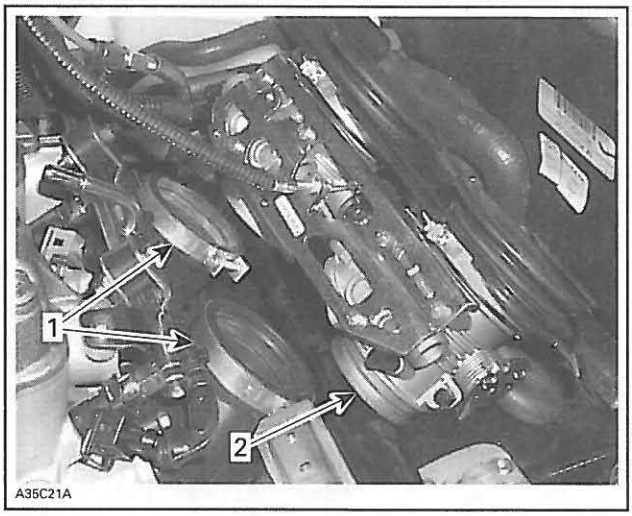
Remove LH handlebar support.



1. Handlebar support
2. Bolts

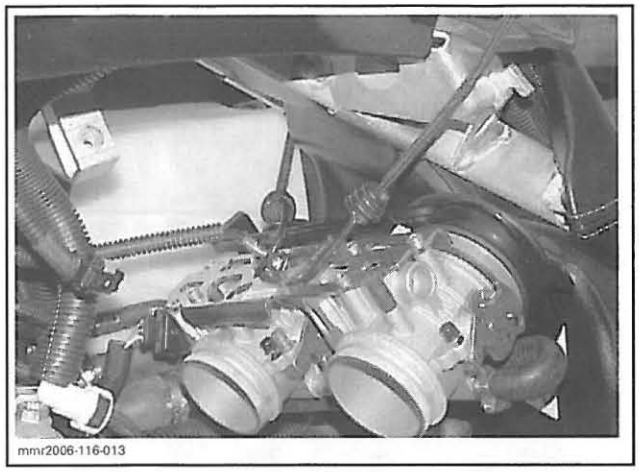
Unscrew throttle body clamps.

Remove throttle body from intake adapters with throttle cable and TPS connector in place.



1. Clamps
2. Throttle body

Using a cord, attach throttle body out of way.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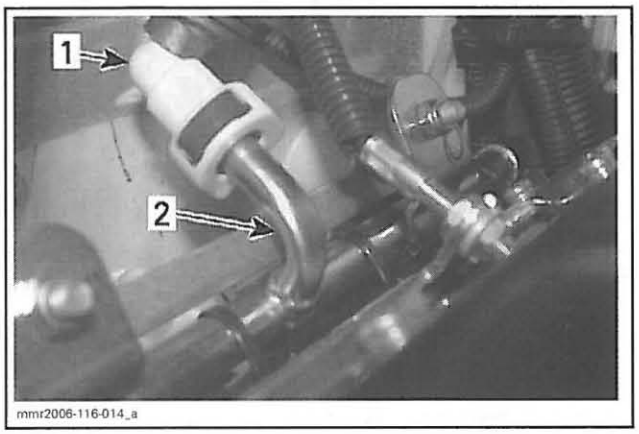
Disconnect fuel line from fuel rail.



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1. Fuel line connector
2. Fuel rail

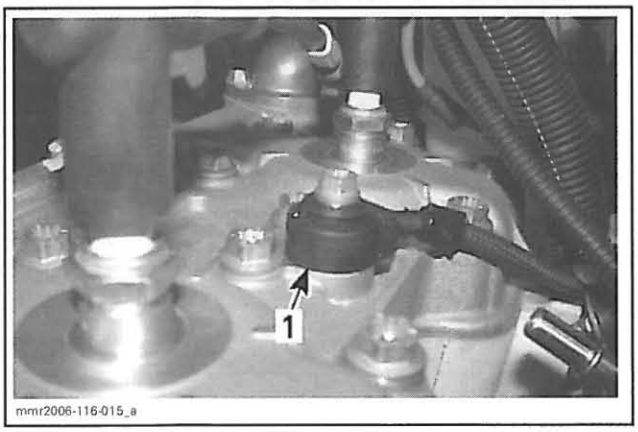
Unplug all injector connectors.

Remove harness support from fuel rail.

Put harness support aside.

Unscrew knock sensor from cylinder head.

Unplug spark plug cables.



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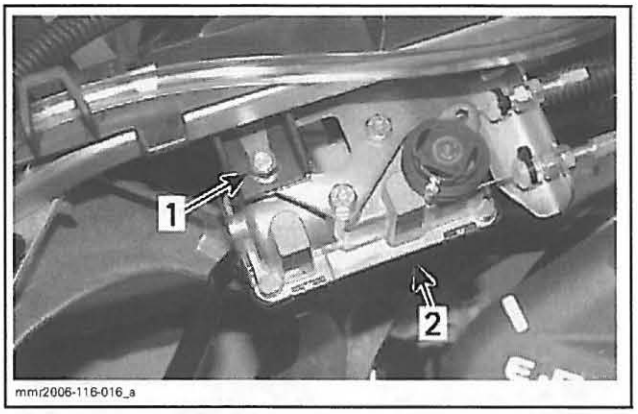
1. Knock sensor

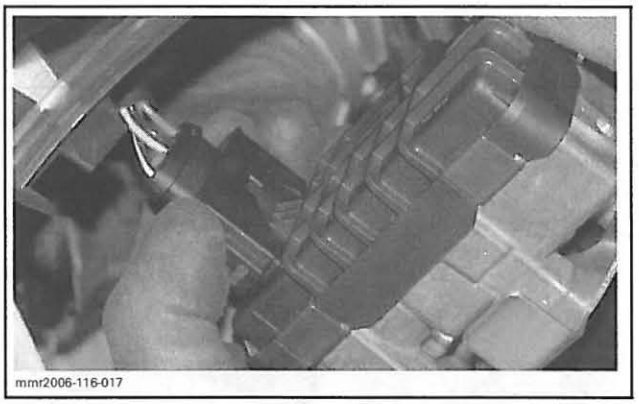
Unscrew E-RAVE actuator from frame.



mmr2006-116-016_a

1. Bolt to remove
2. Actuator

Unplug connector and put E-RAVE actuator on top of engine.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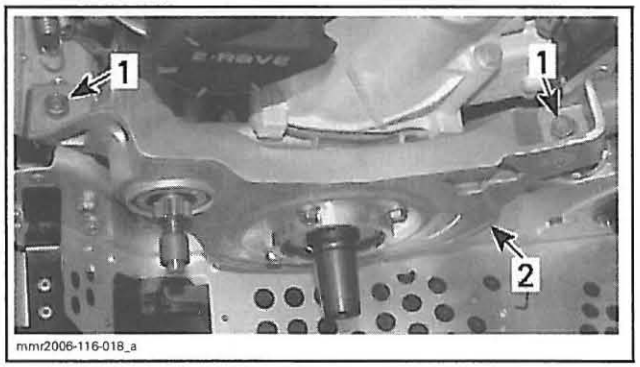
Remove LH engine support nuts.



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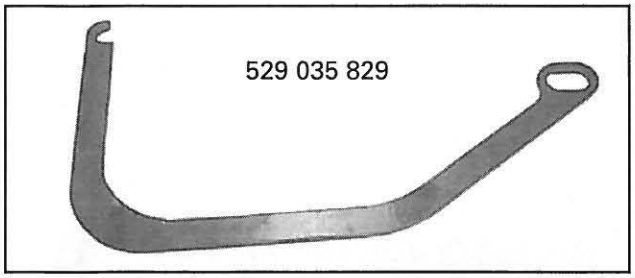
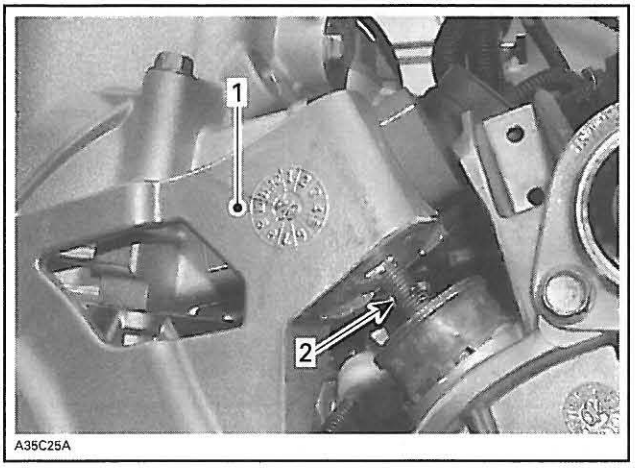
1. Nuts
2. Engine support

Remove both spark plugs.

Install in the MAG side spark plug hole the spark plug lift ring (P/N 529 035 830).

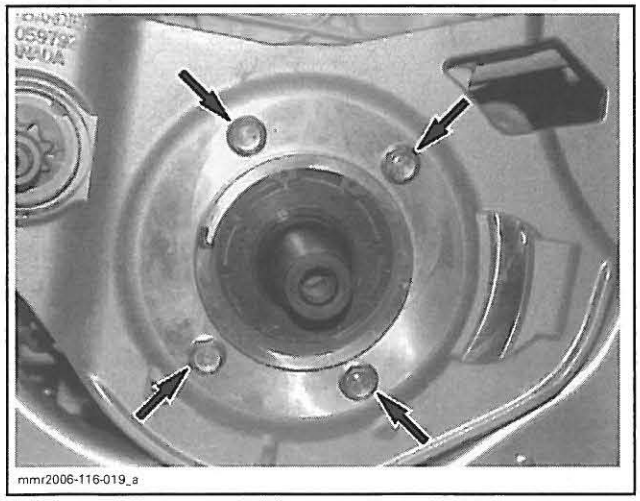
Using the engine removal hook (P/N 529 035 829), lift engine until engine supports are free from rubber mount studs.





PTO ENGINE SUPPORT LIFTED
1. *Engine support*
2. *Rubber mount stud*

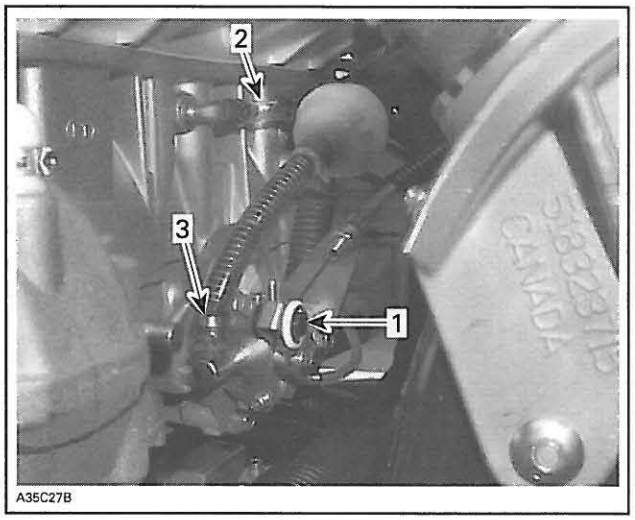
Remove PTO engine support bolts then remove the support from engine.



Detach oil pump cable from oil pump.

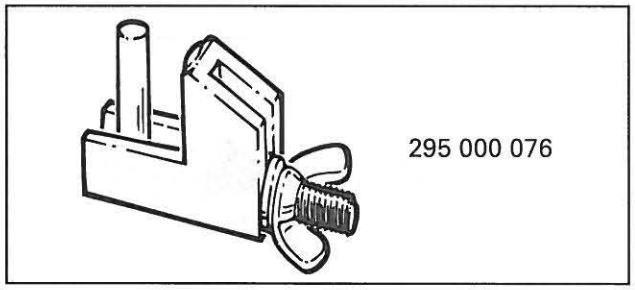
Unplug oil outlet hose.

Unplug oil inlet hose.

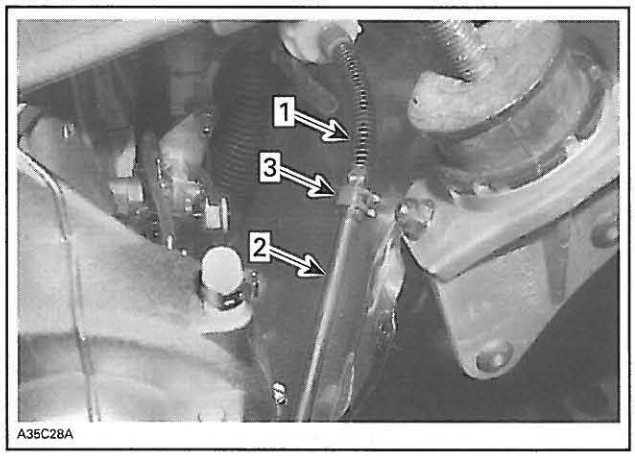


DETACH AND UNPLUG
1. *Detach oil pump cable*
2. *Unplug oil return hose*
3. *Unplug oil inlet hose*

NOTE: For oil outlet hose, install a small hose pincher (P/N 295 000 076) to avoid oil spillage.

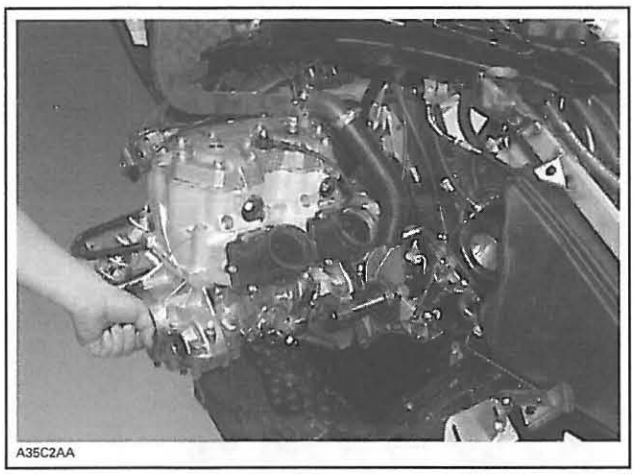


NOTE: For oil inlet hose, use a standard 1/4 inch ratchet extension to block up hose. Secure hose with existing clamp.



BLOCK UP OIL INLET HOSE
1. *Oil inlet hose*
2. *Standard 1/4 inch ratchet extension*
3. *Spring clamp*

Remove engine from vehicle.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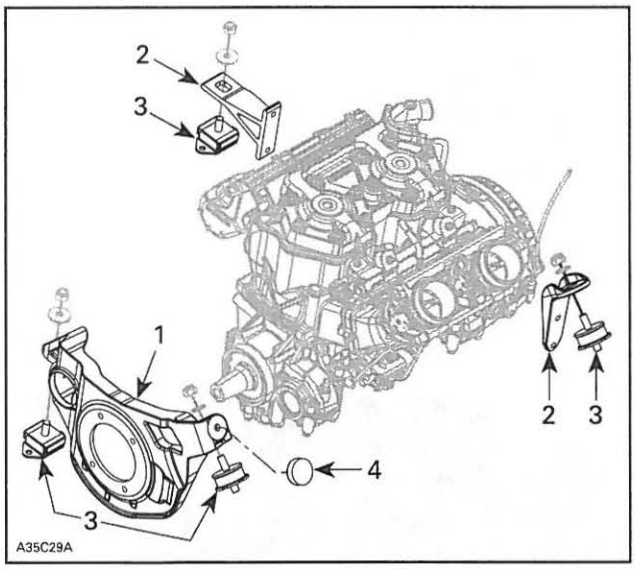
INSPECTION

Check if engine supports are cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mounts and engine stopper on engine support. Replace them if brittle, cracked or otherwise damaged.



A35C29A

ENGINE SUPPORTS
1. *LH support*
2. *RH supports*
3. *Rubber mounts*
4. *Engine stopper*

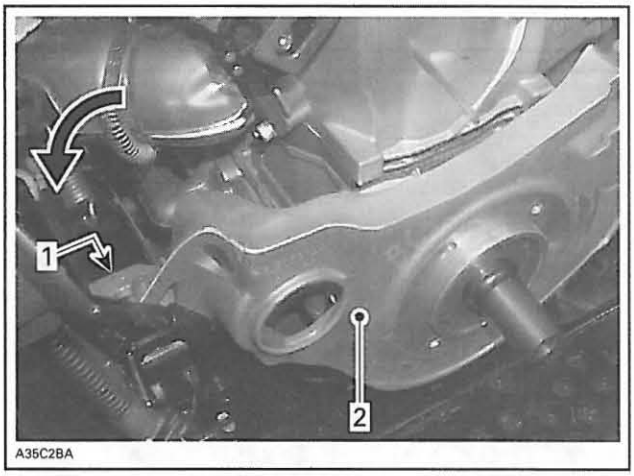
INSTALLATION

Reinstall all removed parts by using the appropriate component/system reinstallation procedures as described in this manual. However, pay attention to the following.

PTO Engine Support

Lower engine as close as possible to its original position.

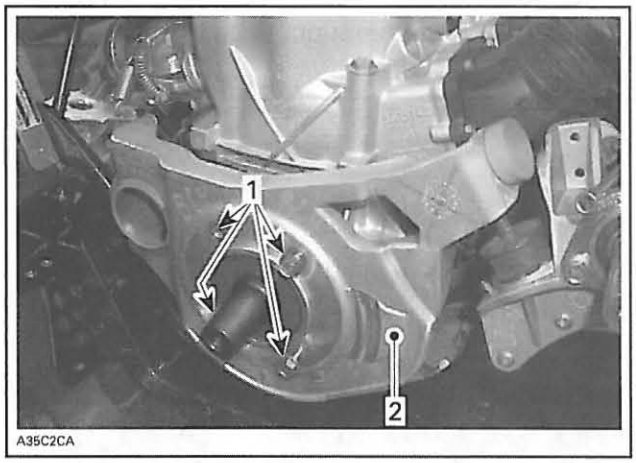
First, position PTO engine support on engine and insert front tab of PTO engine support on rubber mount.



A35C2BA

INSERT FRONT TAB FIRST
1. *Front tab*
2. *PTO engine support*

Secure PTO engine support.



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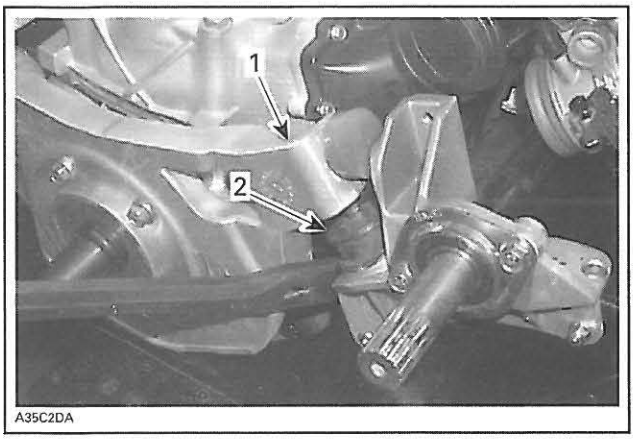
1. *Secure*
2. *PTO engine support*

Using a pry bar, position rear tab of PTO engine support in place on rubber mount.

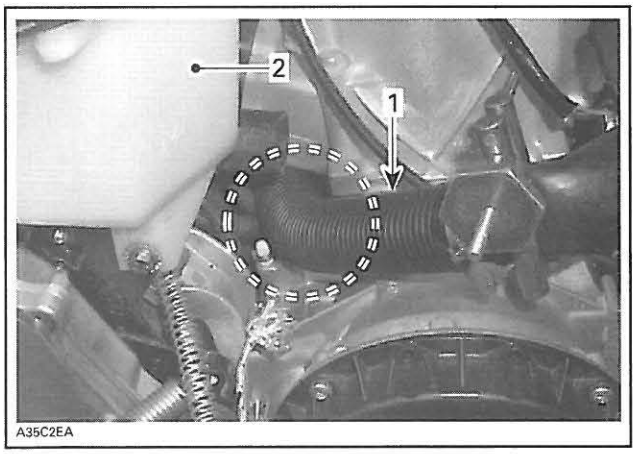


INSERT REAR TAB
1. *Rear tab*
2. *Rubber mount*

Make sure RH side engine supports are properly positioned on rubber mounts.

Radiator Outlet Hose

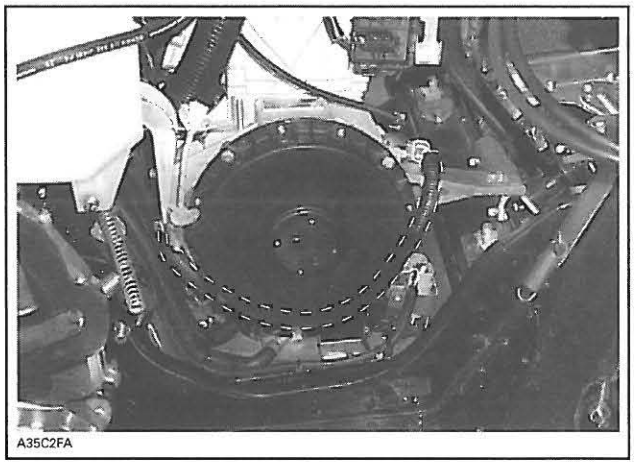
Make sure that radiator outlet hose is routed as per photo.



RH SIDE — RADIATOR OUTLET HOSE ROUTING
1. *Radiator outlet hose*
2. *Oil tank*

Magneto Harness

Make sure to position magneto harness in place before lowering engine.



RH SIDE — MAGNETO HARNESS ROUTING

Oil Pump Adjustment

After engine installation, verify oil pump adjustment, adjust if necessary. Refer to *OIL INJECTION PUMP*.

LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
intake plugs	529 036 000	19
manifold plug	529 035 961	19
vacuum/pressure pump	529 021 800	20

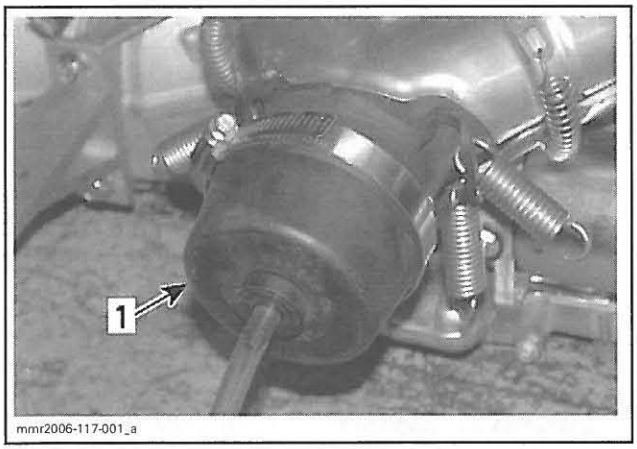
Prior to take apart an engine, it is important to proceed with a leak test to diagnose engine problems. A leak test should be performed also after engine reassembly.

PREPARATION

Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION*.

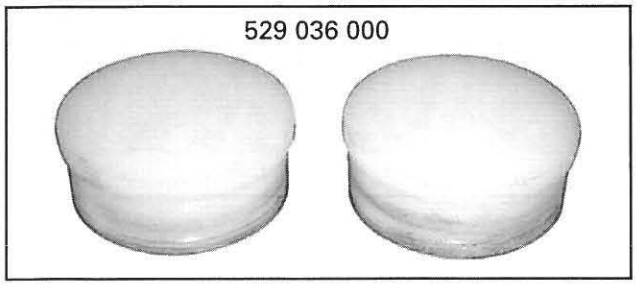
Remove exhaust gasket on exhaust manifold. Clean all residues of RTV sealant from the end of exhaust manifold.

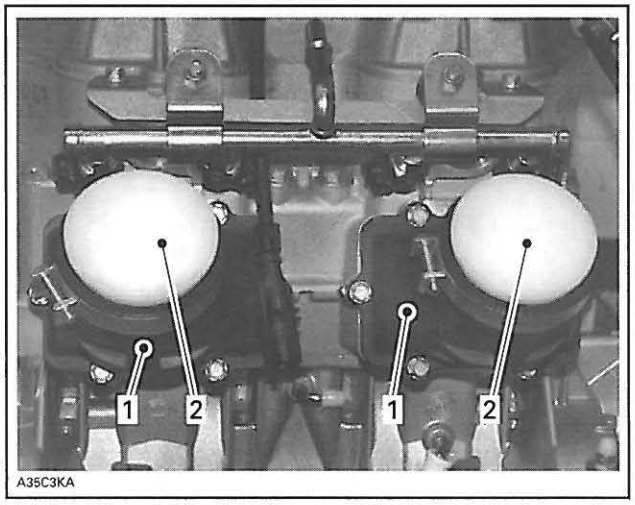
Install manifold plug (P/N 529 035 961) over exhaust manifold.



1. Manifold plug

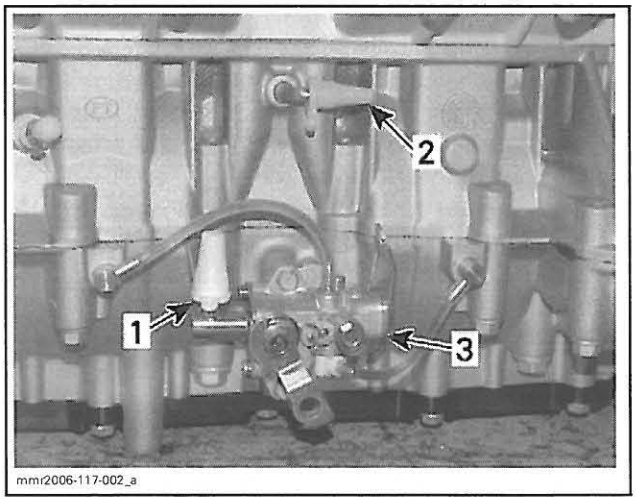
Install intake plugs (P/N 529 036 000) in the intake adapters.





1. Intake adapters
2. Intake plugs

Block inlet and outlet fitting of oil injection system with rubber cap.



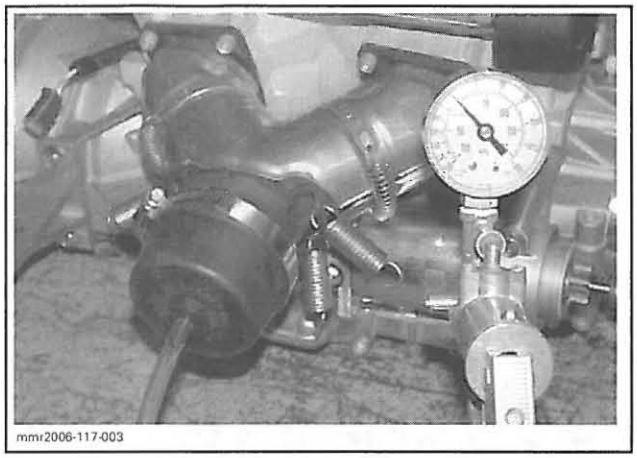
1. Inlet fitting
2. Outlet fitting
3. Oil injection pump

Install spark plugs.

PROCEDURE

NOTE: A diagnostic flow chart has been prepared as a visual reference. See last page of this section.

Install vacuum/pressure pump (P/N 529 021 800) on manifold plug.



Activate pump and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.

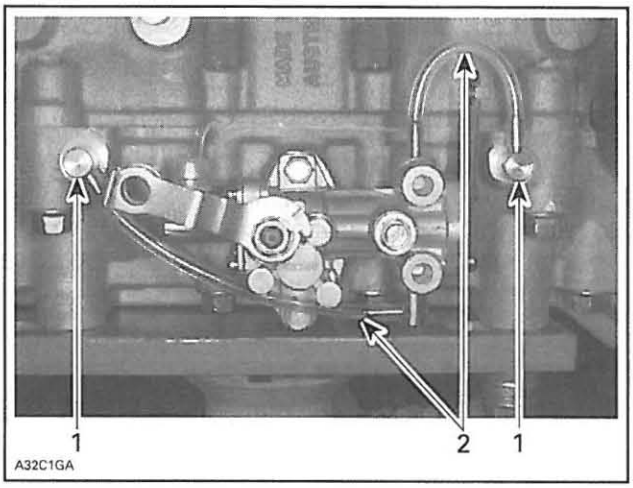
Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, spray a soapy solution on tester kit (manifold and intake plugs, vacuum/pressure pump and its hose).

- If tester kit (manifold plug, intake plug, pump, etc) is leaking, bubbles will indicate where leak comes from.
- If tester kit is not leaking, check engine, see below for procedure.
- If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.
- If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

Engine

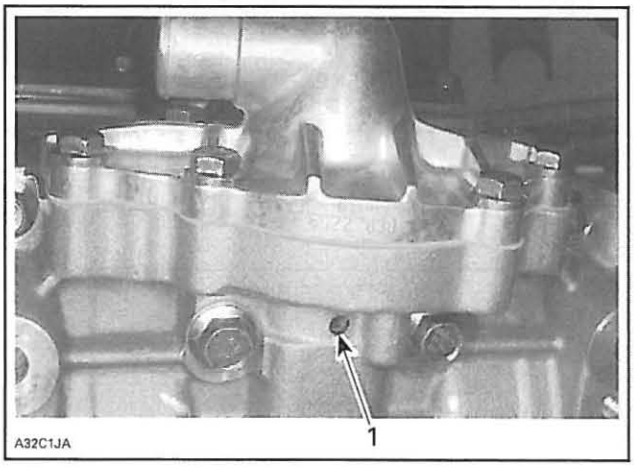
Check the following:

- All jointed surfaces:
  - spark plugs base
  - cylinder head and cylinder-block
  - RAVE valve cover
  - injectors area
  - decompressor area
  - cylinder crankcase halves (joint)
  - counter balancing shaft outer seals and their filling tubes
  - crankshaft seals (PTO and MAG sides)
  - oil injection pump mounting flange (O-ring)
  - coolant pump housing
  - crankcase grease reservoir fitting.
- Small injection oil lines coming from pump. Air bubbles or oil column going toward pump, indicates a defective check valve in injection nipple.



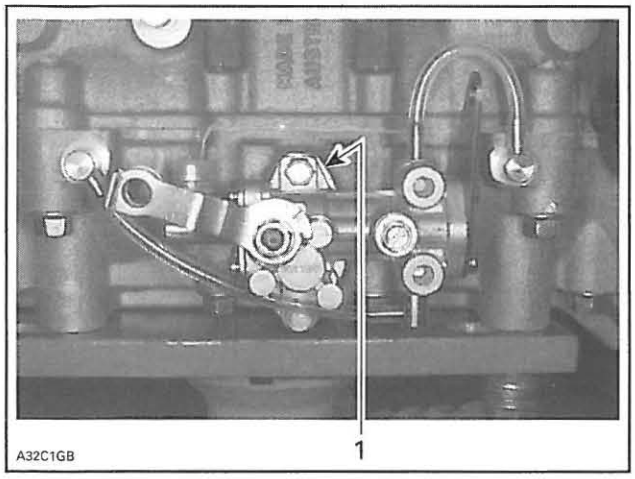
TYPICAL
1. *Injection nipples*
2. *Small injection oil lines*

- Air bubbles in antifreeze. It indicates defective cylinder head O-ring or cylinder base gasket.
- Crankshaft outer seals (behind drive pulley and magneto).
- Pump shaft gear oil reservoir. See *PUMP SHAFT OIL GEAR RESERVOIR* further in this section.
- Leak indicator hole below coolant pump housing. If there is a leak, it indicates that a pump shaft is defective (oil seal behind coolant ceramic seal).



1. *Leak indicator hole*

- Leaks can be also on oil pump side. Check mounting area for leaks.

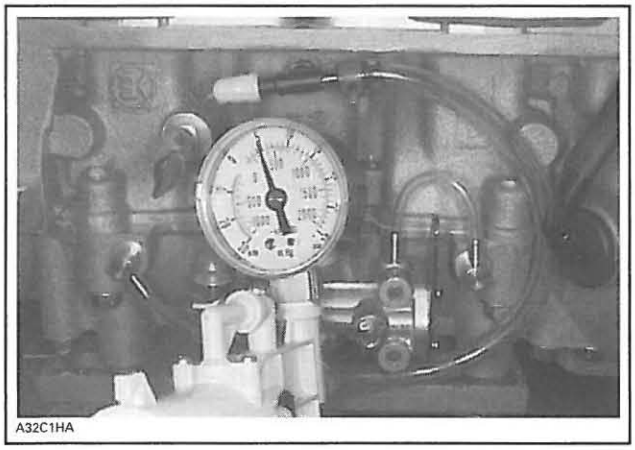


TYPICAL
1. Check mounting area

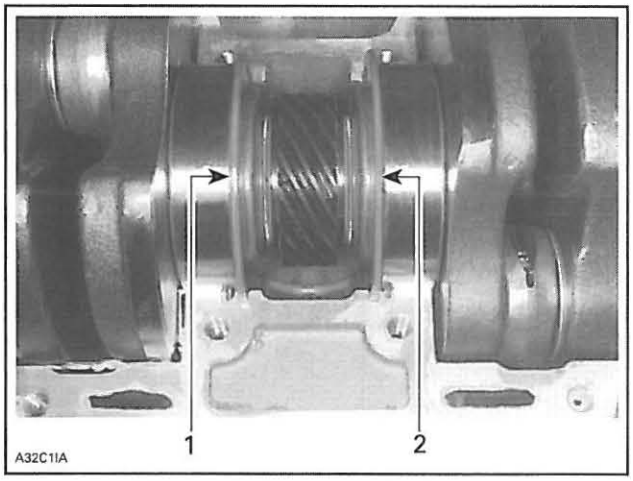
If leak still persists, it indicates a defective casting somewhere in engine. Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

Pump Shaft Oil Gear Reservoir

Install air pump on adapter and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.

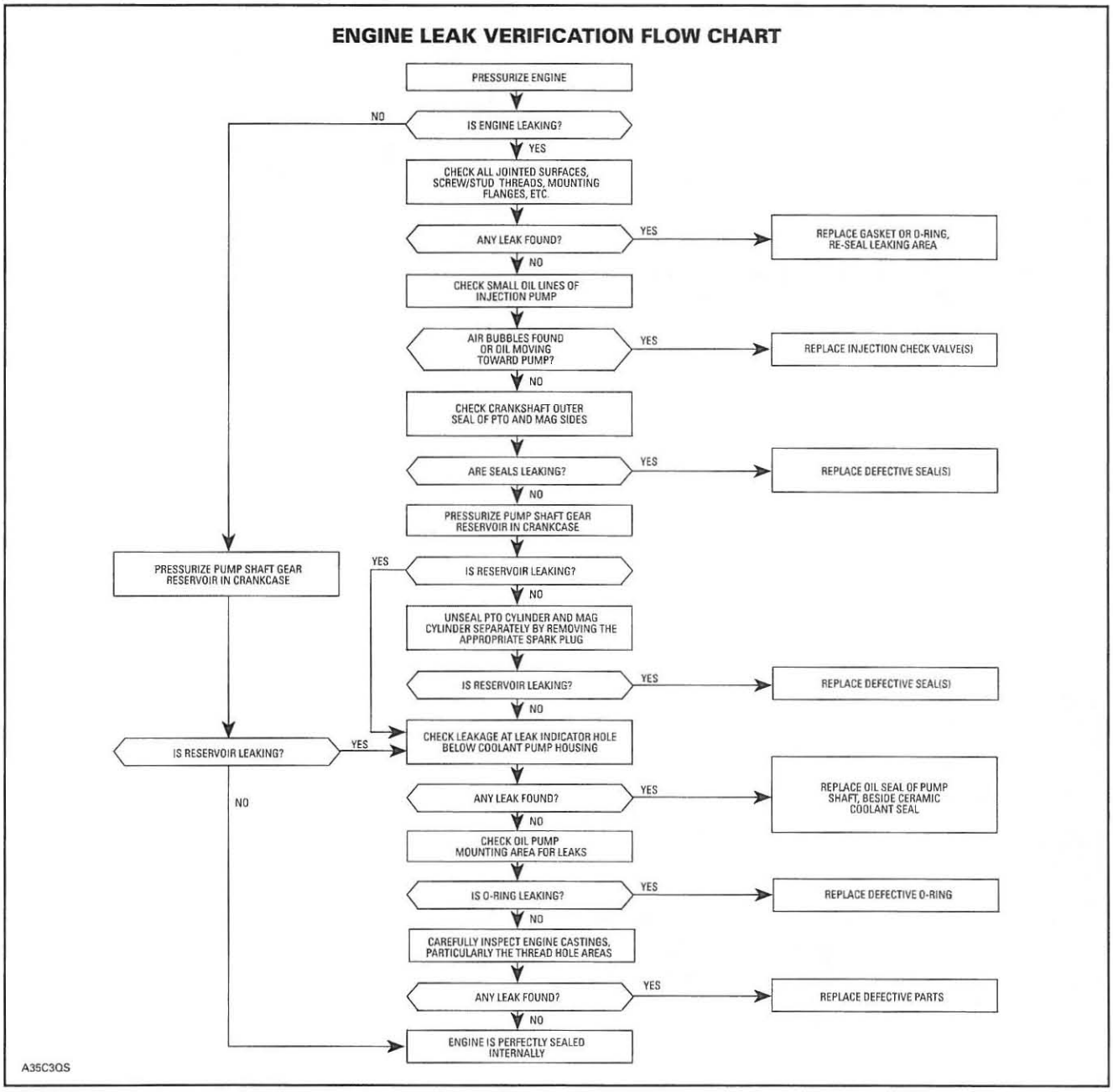


If pressure drops, it indicates a defective crankshaft inner seal.



TYPICAL — CRANKSHAFT INSTALLED IN UPPER HALF CRANKCASE
1. Crankshaft inner seal on PTO side
2. Crankshaft inner seal on MAG side

ENGINE LEAK VERIFICATION FLOW CHART

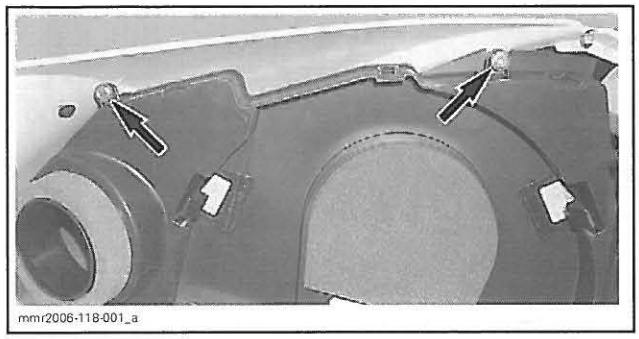


AIR INTAKE SYSTEM

AIR FILTER

Removal

Remove both screws that attach the secondary air intake silencer to LH side panel.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Pull air filter out of secondary air intake silencer.


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Installation

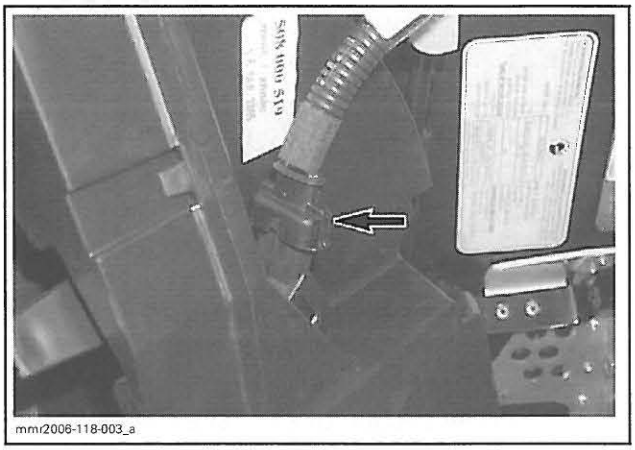
The installation is the reverse of the removal procedure.

SECONDARY AIR INTAKE SILENCER

Removal

Open LH side panel.

Unplug air pressure sensor (APS) connector.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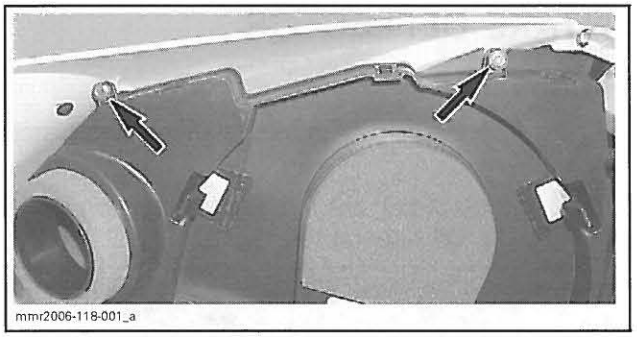
Remove screws retaining secondary air intake silencer to LH side panel.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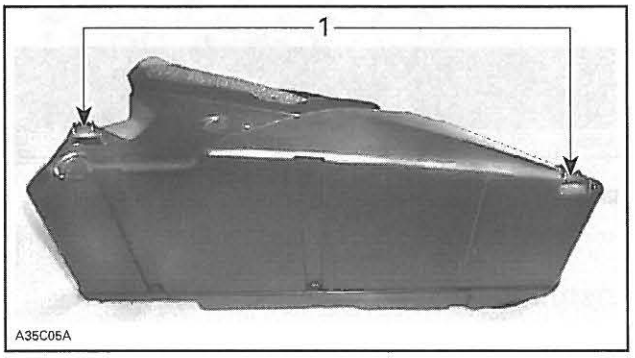
Remove air intake silencer (body side).

Installation

Position lower section of secondary air intake silencer on LH side panel using locating holes.



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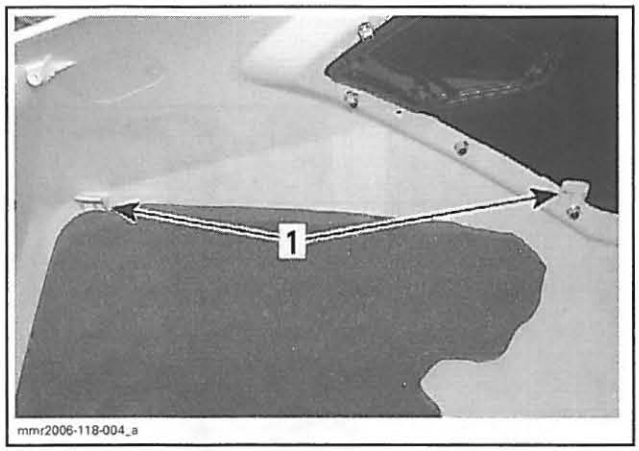
1. Locating holes



1. Side panel tabs

Position upper section of air intake silencer on LH side panel and secure with screws.

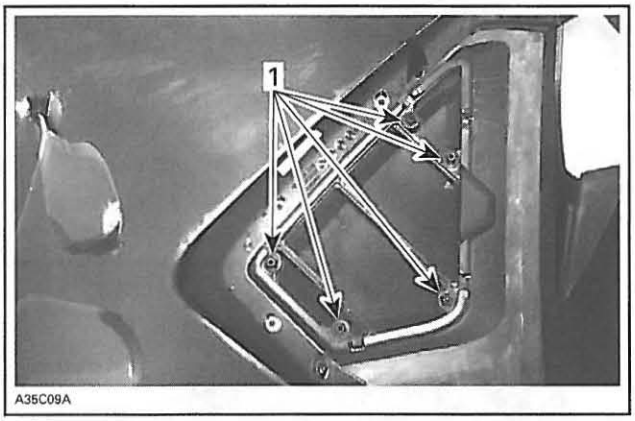
Connect APS connector.

INTAKE DEFLECTOR

Removal

Remove secondary air intake silencer, see procedure above.

Using cutting pliers, cut push nuts retaining intake deflector to LH side panel.



1. Push nuts

Remove intake deflector and its filter.

Installation

For installation, reverse the removal procedure.

PRIMARY AIR INTAKE SILENCER

Removal

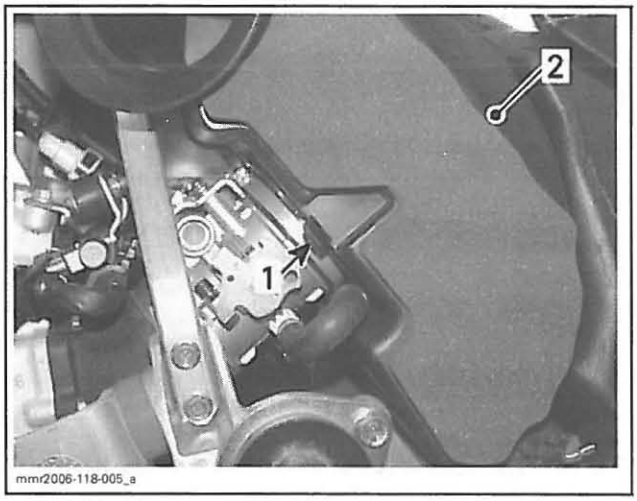
Open LH side panel.

Remove driven pulley. Refer to *DRIVEN PULLEY*.

Unplug air temperature sensor (ATS) connector.

Push and hold the locking tab of adapter plate toward the front of the vehicle.

Pull on primary air intake silencer to remove.



1. Locking tab
2. Primary air intake silencer

Installation

The installation is the reverse of the removal procedure.

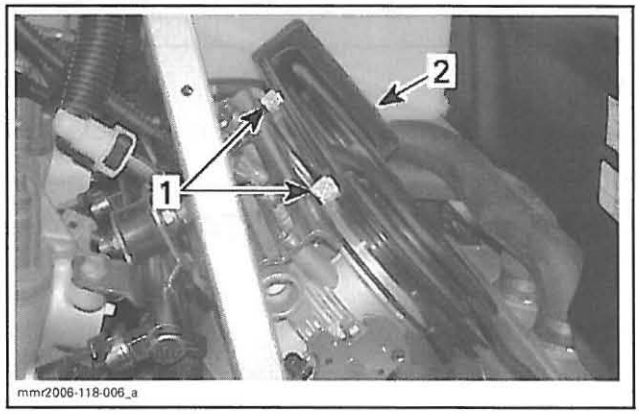
ADAPTOR PLATE

Removal

Remove primary air intake silencer, refer to procedure above.

Unscrew clamps from throttle body.

Remove adaptor plate.



1. Clamps
2. Adaptor plate

Installation

The installation is the reverse of the removal procedure.

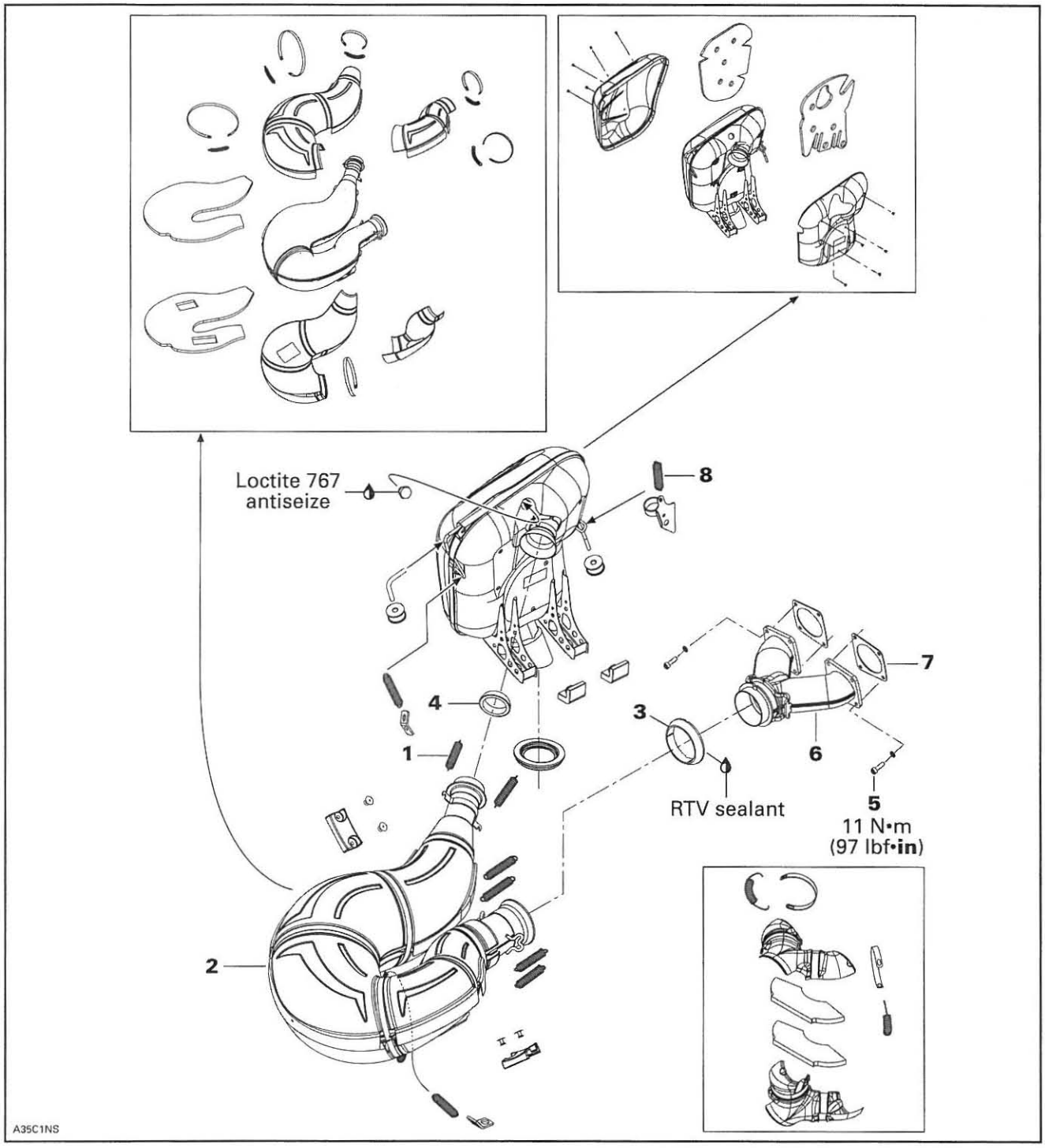
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
exhaust spring installer/remover	529 035 401	27–28
exhaust spring installer/remover	529 035 989	28

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 antiseize	293 800 070	29
RTV sealant	293 800 090	28


Loctite 767
antiseize
8
7
4
3
1
6
RTV sealant
5
11 N•m
(97 lbf•in)
2
A35C1NS

GENERAL

⚠ WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use torque values and service products as shown in exploded view(s).

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

⚠ WARNING

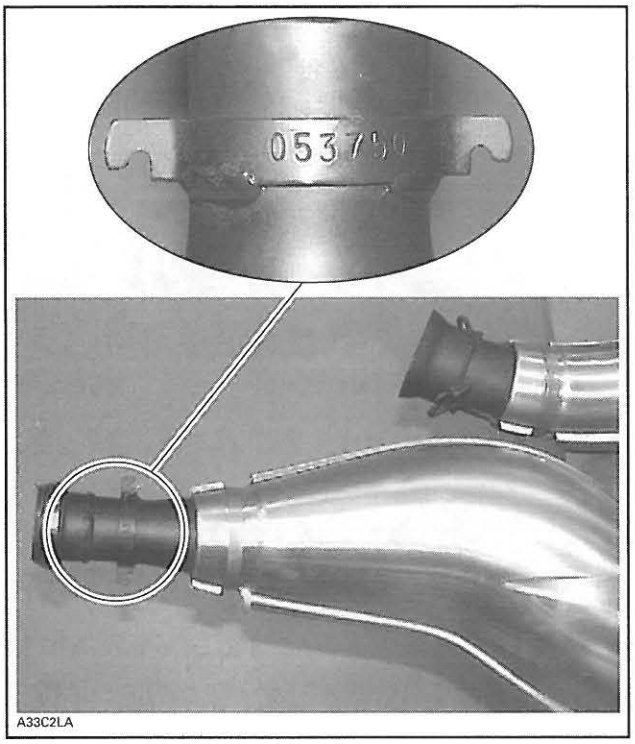
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

TUNED PIPE

Identification

Each tuned pipe is identified by a number. To use the proper tuned pipe with the proper vehicle, check the number on the welded clamp at the end of tuned pipe. This number depicts the 6 last digits of the BRP part number.



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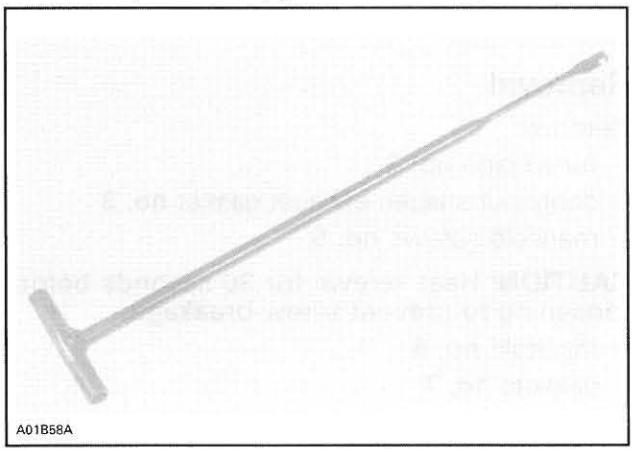
TYPICAL

Removal

Open hood and right side panel.

Remove:

- all exhaust springs **no. 1** using exhaust spring installer/remover (P/N 529 035 401)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- tuned pipe **no. 2**
- exhaust gasket **no. 3** and **no. 4**.

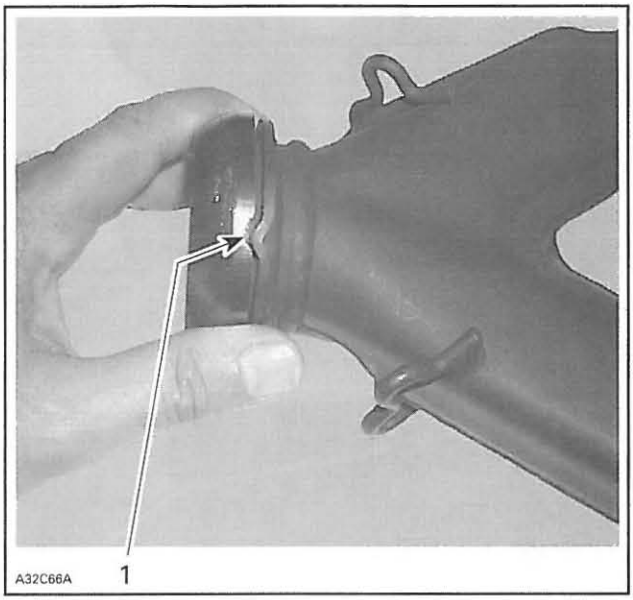
Inspection

Check:

- tuned pipe shield for damages
- tuned pipe ends for cracks or damages.

Installation

Install doughnut shaped exhaust gasket **no. 3** with both of its notches aligned with Y-manifold protrusions.



1. Align notches

If the gaskets are damaged, replace them.

Use RTV sealant (P/N 293 800 090) on doughnut gasket prior to install tuned pipe.

Install all exhaust springs using exhaust spring installer/remover (P/N 529 035 989).

MANIFOLD

Removal

Remove:
- tuned pipe **no. 2**
- doughnut shaped exhaust gasket **no. 3**
- manifold screws **no. 5**

CAUTION: Heat screws for 30 seconds before loosening to prevent screw breakage.
- manifold **no. 6**
- gaskets **no. 7**.

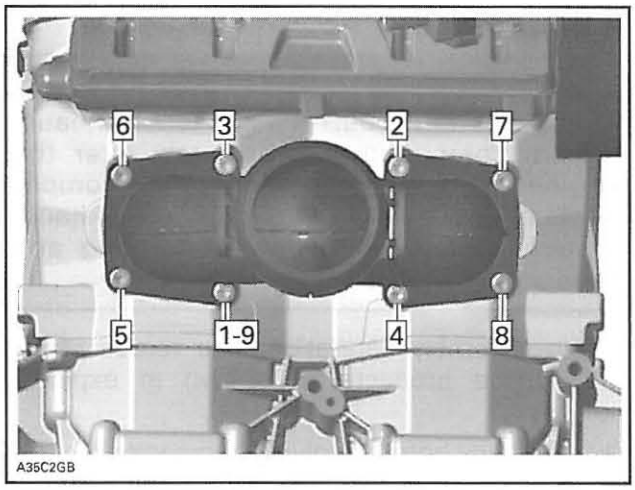
Inspection

Check if the manifold is cracked or damaged. Replace if necessary.

Installation

Install the manifold with new gaskets.

Torque manifold screws **no. 5** following this sequence.



Install tuned pipe.

MUFFLER

Identification

Each muffler is identified by a number. To use the proper muffler with the proper vehicle, check the number on the welded clamp at the end of muffler. This number depicts the 6 last digits of the BRP part number.

TYPICAL

Removal

Remove tuned pipe **no. 2**.

Disconnect the exhaust gas temperature sensor (EGTS).

Remove springs **no. 8** retaining the muffler **no. 9**. Use exhaust spring installer/remover (P/N 529 035 401).

Remove the muffler.

Inspection

Check the muffler for cracks or other damages.

Installation

For installation, reverse the removal procedure.

If the EGTS plug on muffler was removed, use Loctite 767 antiseize (P/N 293 800 070).

EXHAUST GAS TEMPERATURE SENSOR (EGTS)

Refer to the *COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT* section to verify or change the EGTS.

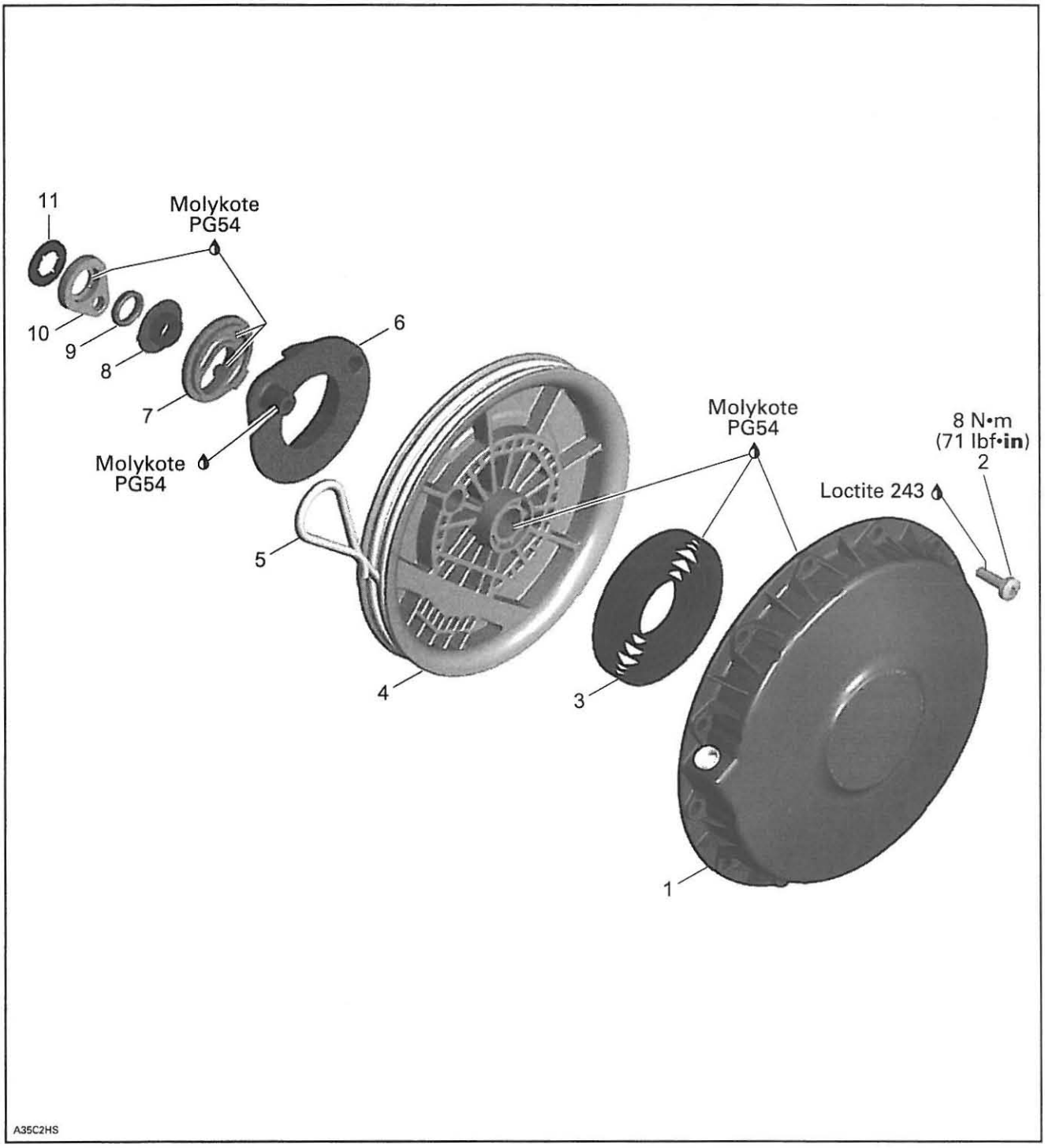
REWIND STARTER

SERVICE TOOLS

Description	Part Number	Page
small hose pincher	295 000 076	33

SERVICE PRODUCTS

Description	Part Number	Page
Molykote PG 54	420 899 763	34–35


11
Molykote
PG54
10
9
8
7
6
Molykote
PG54
5
4
Molykote
PG54
8 N•m
(71 lbf•in)
2
Loctite 243
3
1
A35C2HS

GENERAL

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope **no. 5** is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring **no. 9** every time rewind starter is disassemble.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

During assembly/installation, use torque values and service products as shown in exploded view(s).

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

STARTER HANDLE

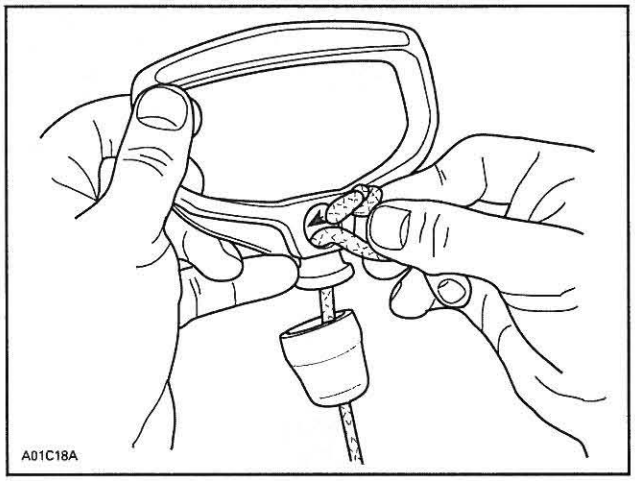
Removal

Pull rope for 50 cm (20 in) approximately. Using a small hose pincher (P/N 295 000 076), lock rope near rewind starter.

Using a small screwdriver, extract rope knot from stater handle. Cut rope close to knot.

Installation

Prior to installing starter handle on rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter handle and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter handle over the knot.



TYPICAL

REWIND STARTER

Removal

Remove starter handle.

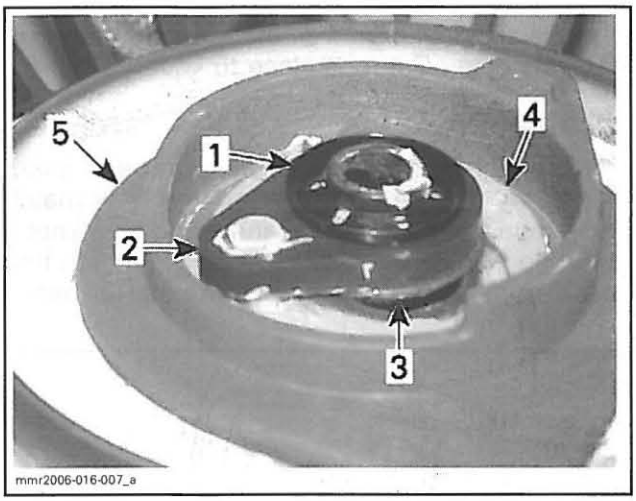
Remove screws **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

Disassembly

Undo knot previously tied at removal. Let sheave get free to release spring preload.

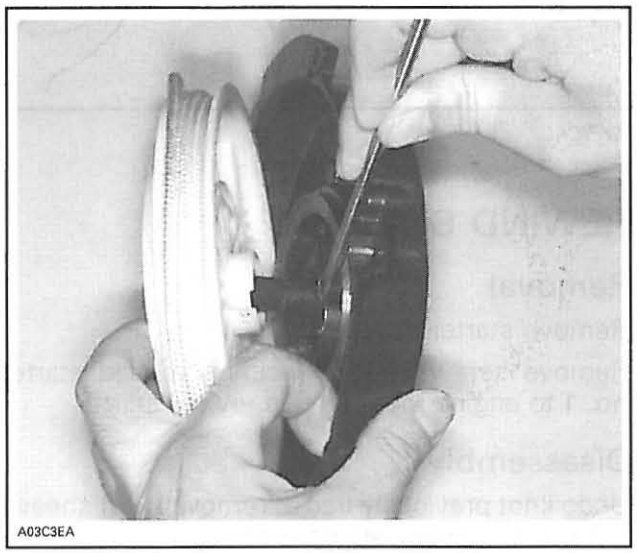
Cut push nut and discard.

Remove lock lever, O-ring **no. 9**, collar sleeve, pawl lock and pawl.



1. *Push nut*
2. *Lock lever*
3. *Collar sleeve*
4. *Pawl lock*
5. *Pawl*

Remove sheave **no. 4** from starter housing **no. 1**. Hold spring with a screwdriver.



Take out the knot and then rope **no. 5**.

Assembly

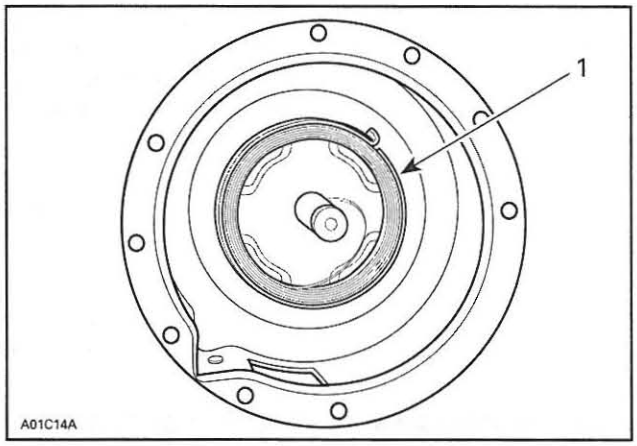
At assembly, position spring **no. 3** outer end into spring guide notch then wind the spring counterclockwise into guide.

⚠ WARNING

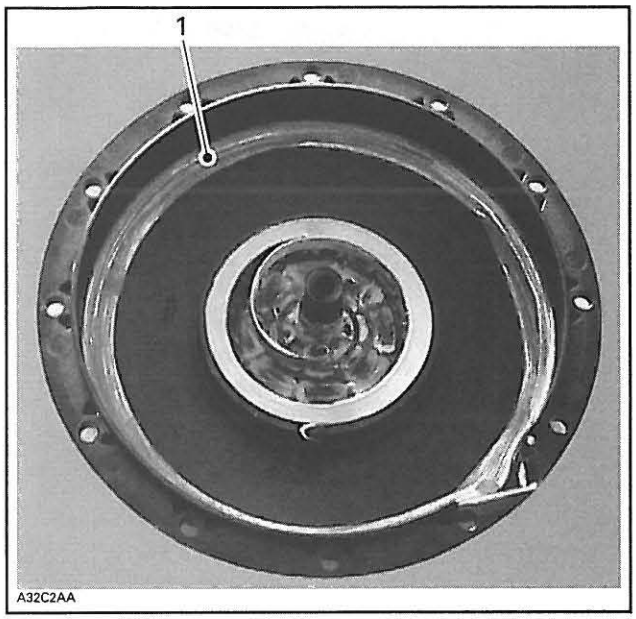
Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

1. *Outer end into guide notch*

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



TYPICAL
1. *Molykote PG 54 inside spring guide*



1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). The use of standard multipurpose grease could result in rewind starter malfunction under very cold temperatures and components life will be shortened.

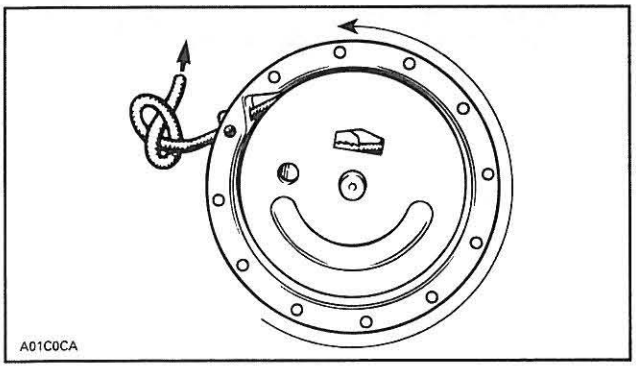
Lubricate housing post with silicone compound grease. Install sheave.

To adjust spring tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

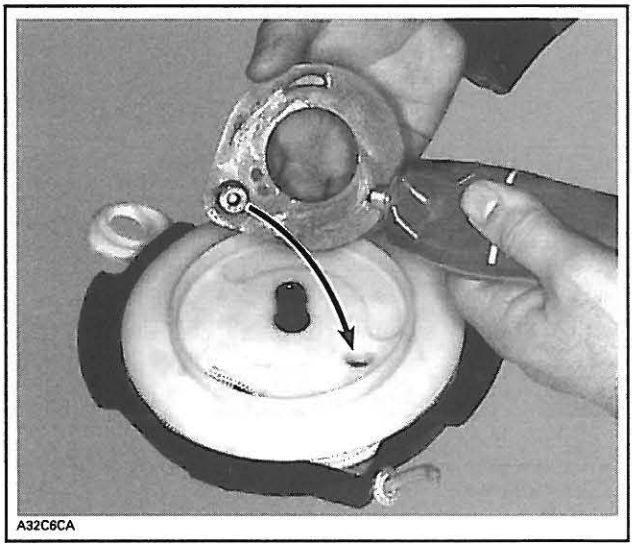
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

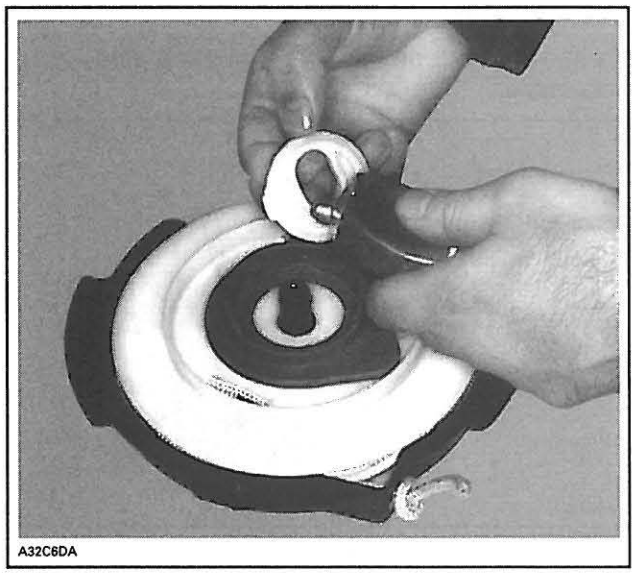


TYPICAL

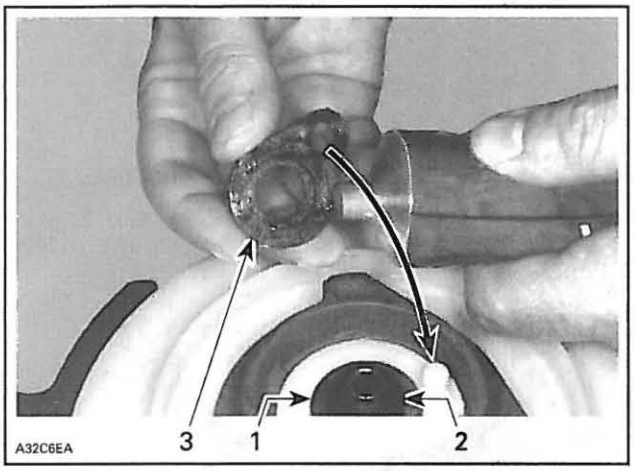
Lubricate pawl **no. 6** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



Lubricate pawl lock **no. 7** with Molykote PG 54 (P/N 420 899 763). Install over pawl.



Install collar sleeve **no. 8** with its collar first. Lubricate a new O-ring **no. 9** and lock lever **no. 10** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.

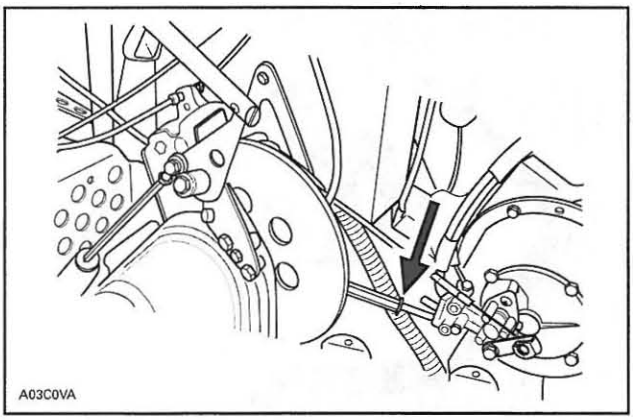


1. *Collar sleeve*
2. *O-ring*
3. *Lock lever*

Position a new push nut **no. 11**.

Installation

Thread starter rope **no. 5** through rope guide when applicable.



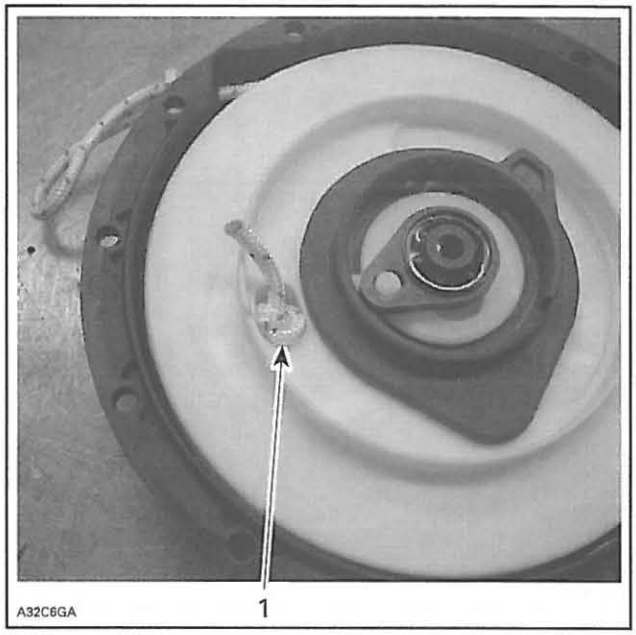
TYPICAL

Reinstall rewind starter assembly on engine.

ROPE

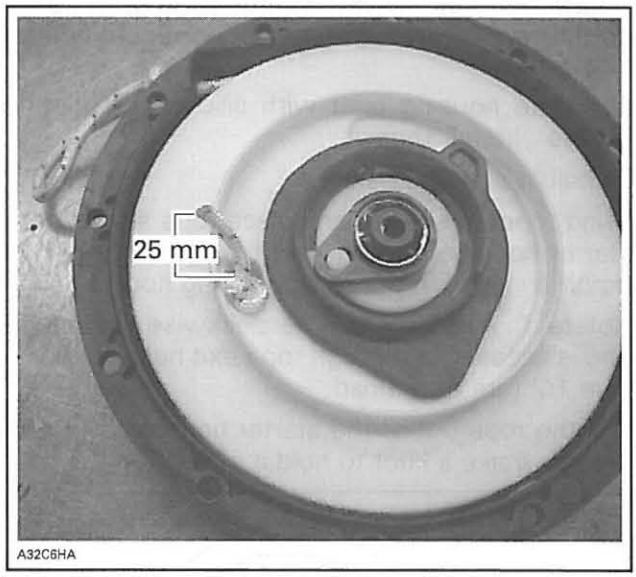
Replacement

Pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Pull out the rope completely.



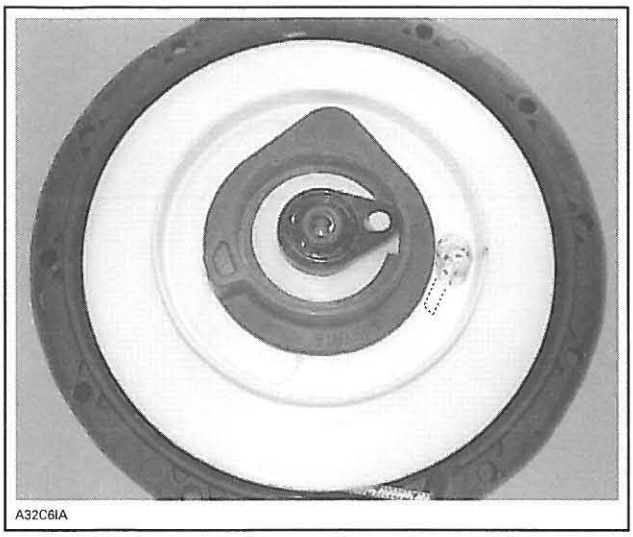
1. *Knot to be untied*

To install rope **no. 5**, insert rope into sheave **no. 4** orifice and lock it by making a knot, leaving behind a free portion of about 25 mm (1 in) in length.



FREE PORTION

Fuse rope end with a lit match and insert it into sheave.



FREE PORTION INSERTED INTO SHEAVE

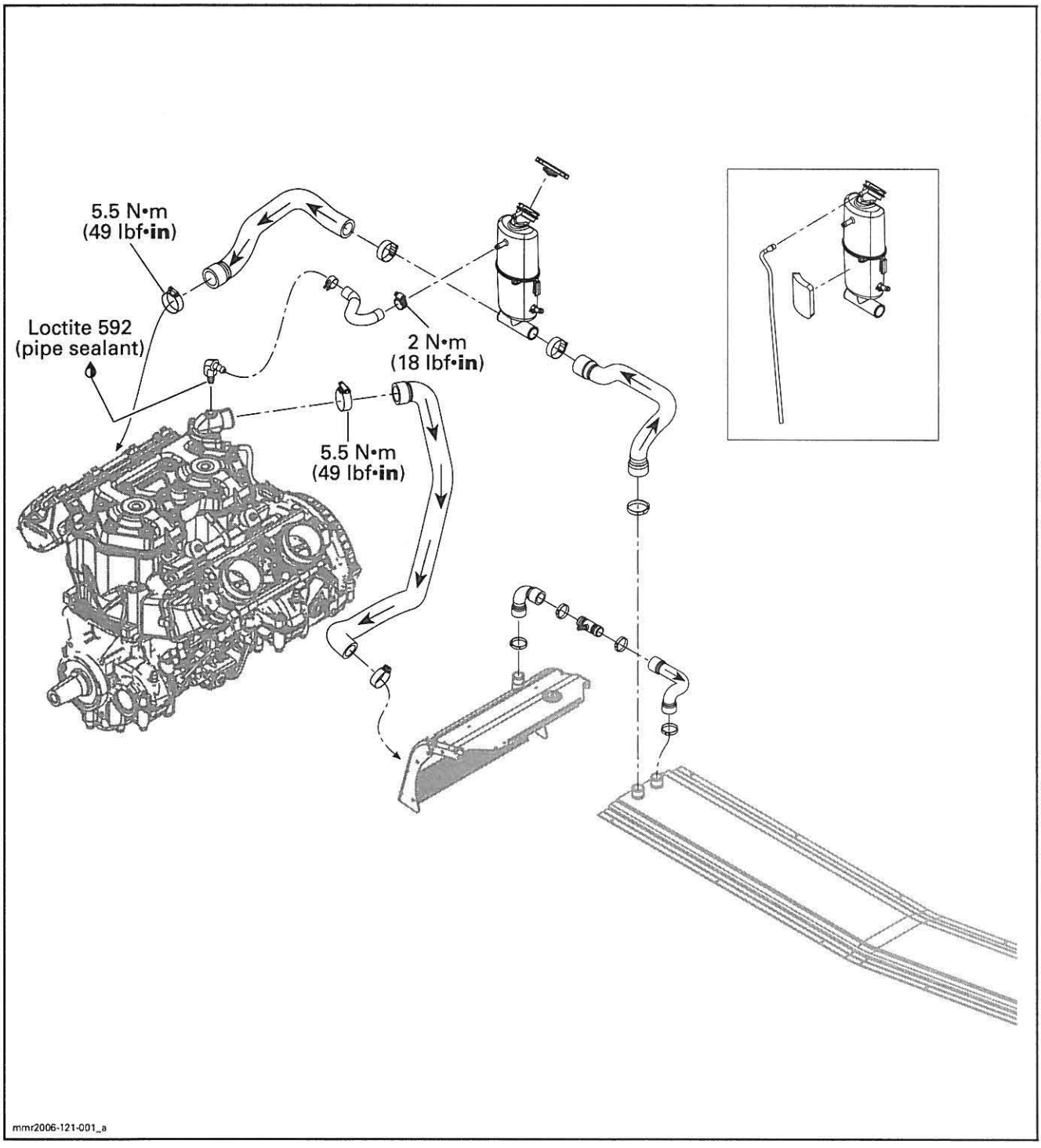
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

COOLING SYSTEM

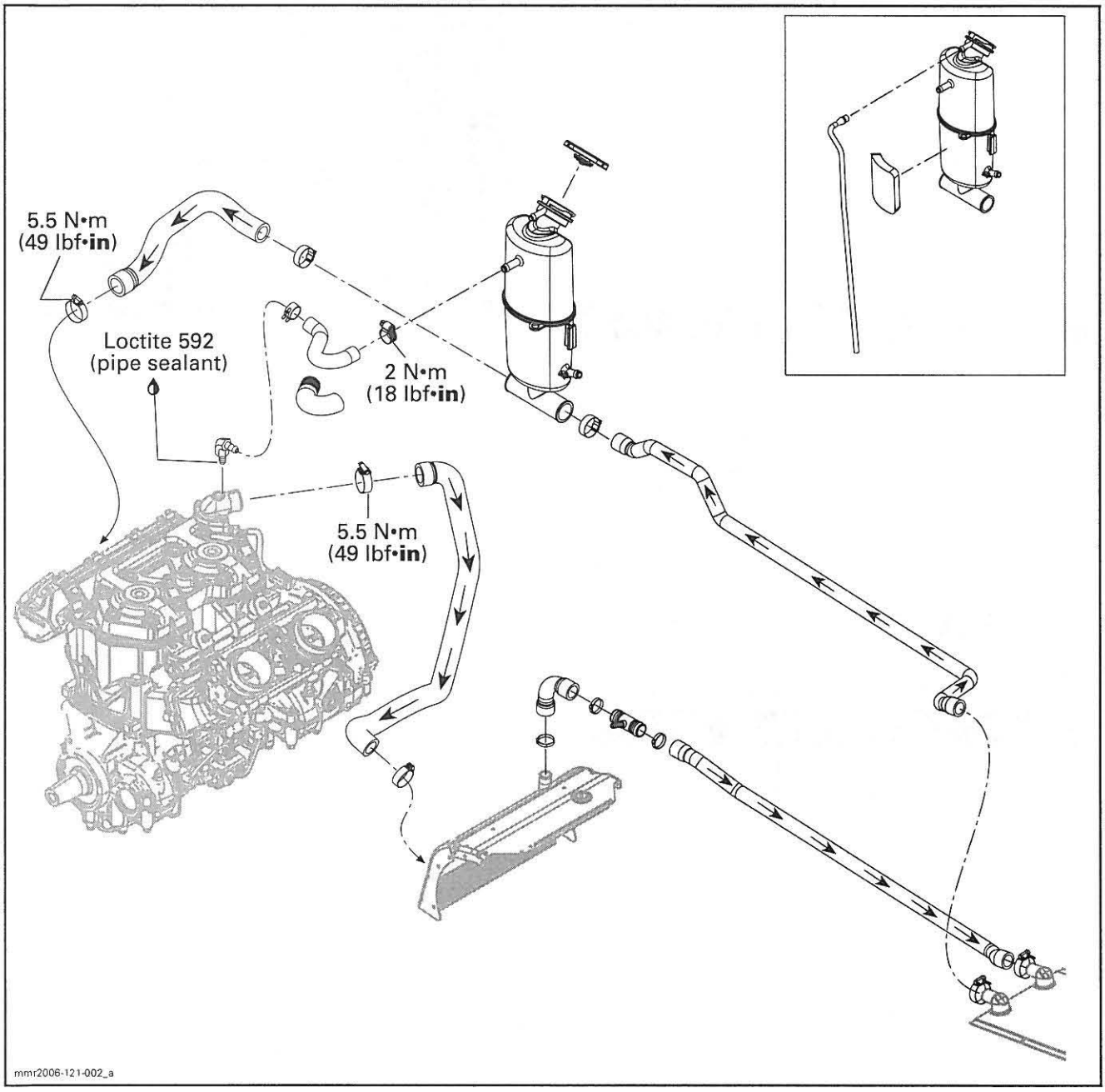
SERVICE TOOLS

SERVICE PRODUCTS

All MACH Z and MX Z Renegade X



All SUMMIT


5.5 N•m
(49 lbf•in)
Loctite 592
(pipe sealant)
2 N•m
(18 lbf•in)
5.5 N•m
(49 lbf•in)
mmr2006-121-002_a

GENERAL

NOTE: On applicable models, it is good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

COOLING SYSTEM LEAK TEST

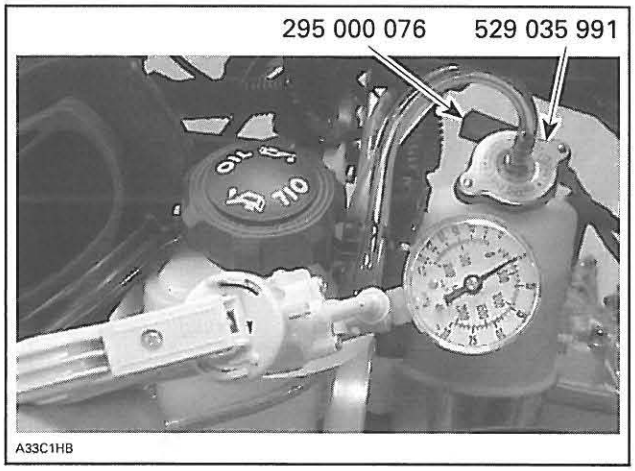
⚠ WARNING

To prevent potential burns, do not remove the coolant tank cap if the engine is hot.

Install the special coolant tank cap (P/N 529 035 991) on coolant tank.

Install a small hose pincher (P/N 295 000 076) on overflow hose.

Using the vacuum/pressure pump (P/N 529 021 800), pressurize all system through coolant tank to 100 kPa (15 PSI).



TYPICAL

Check general condition of hoses and clamp tightness.

Check all hoses and cylinder/base for coolant leaks.

Spray a soap/water solution and look for air bubbles.

Check indicator hole for leaks.

NOTE: Oil leak from indicator hole indicates a pump shaft defective seal, coolant leak indicates a damaged ceramic seal.

COOLANT REPLACEMENT

Recommended Coolant

Use BRP premixed coolant (P/N 219 700 362) or a blend of 50% antifreeze with 50% distilled water.

To prevent antifreeze deterioration, always use same brand. Never mix different brands unless cooling system is completely flushed and refilled.

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens (like slush ice) and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

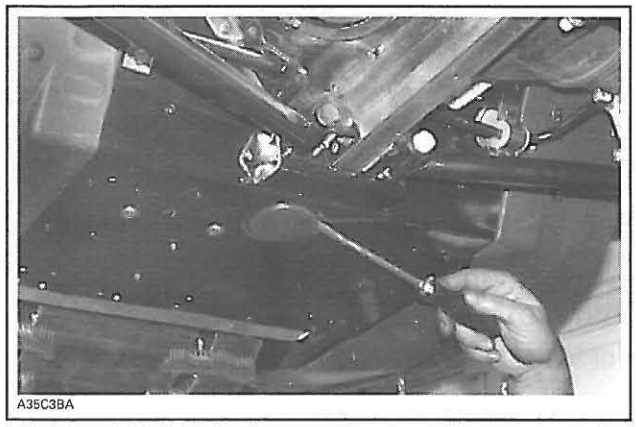
Draining the System

⚠ WARNING

Never drain or refill the cooling system when engine is hot.

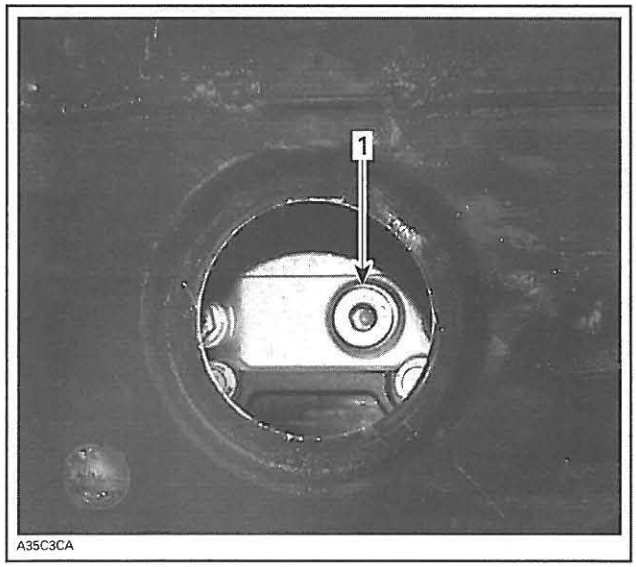
Remove coolant tank cap.

Lift front of the vehicle and remove bottom pan cap.


A35C3BA

Place a drain pan under the drain hole.

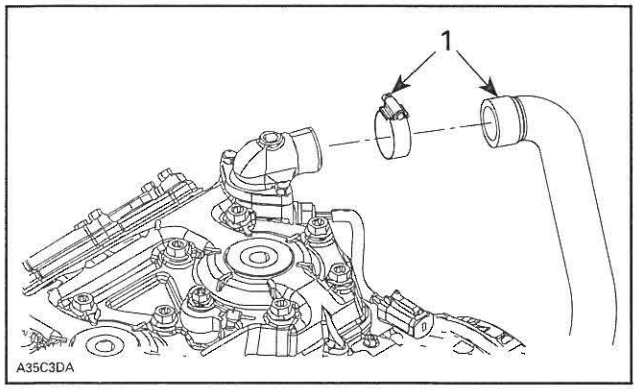
Unscrew drain plug.



A35C3CA

1. Drain plug

Disconnect engine outlet hose and siphon remaining of coolant mixture from radiators using the suction pump (P/N 529 035 880).



A35C3DA

1. Disconnect engine outlet hose

When the coolant level is low enough, lift the rear of vehicle to drain the rear radiator completely.

Install drain plug and torque it to 24 N•m (17 lbf•ft).

Refilling Procedure

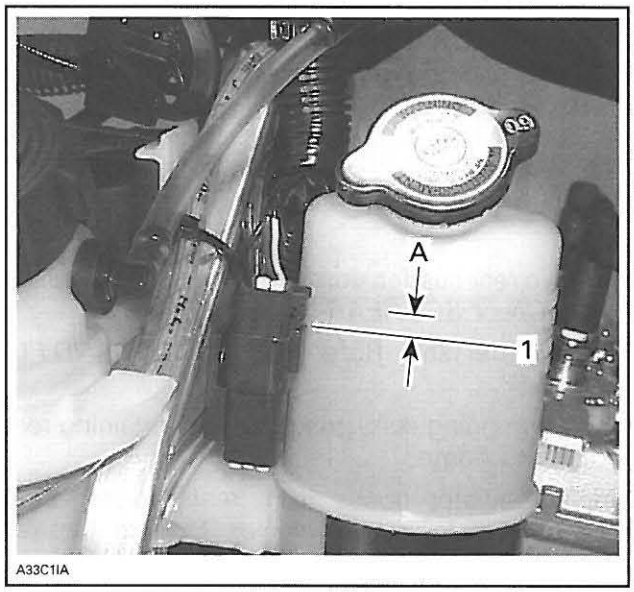
With engine cold, refill coolant tank up to COLD LEVEL line. Start engine. Refill up to line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes). Always monitor coolant level while filling tank to avoid emptying. Install pressure cap.

Lift rear of vehicle and support it safely.

Activate throttle lever 3 - 4 times to bring engine speed to 7000 RPM.

Apply the brake.

Lower vehicle back on ground and add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.



A33C1IA

TYPICAL
1. Cold level line
A. 15 mm (1/2 in)

Lift front of vehicle of 60 cm (24 in) and support it safely. Let the vehicle idle for two minutes.

Put vehicle back on ground and add coolant up to 15 mm (1/2 in) over COLD LEVEL line.

When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.

Check for coolant mixture freezing point. Specification is - 37°C (- 35°F). Adjust as necessary.

THERMOSTAT

There is no thermostat on these models.

COOLANT TANK CAP

Check if coolant tank cap pressurizes the system for 3 minutes. If not, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

FRONT RADIATOR

The front radiator is not available individually. The frame replacement is necessary when a problem occurs with the front radiator.

REAR RADIATOR AND RADIATOR PROTECTOR

Cleaning and Inspection

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if the radiator fins are damaged. Replace the rear radiator if necessary.

NOTE: A radiator with many broken fins does not work properly.

Removal

Drain cooling system, see *DRAINING THE SYSTEM*.

Remove rear suspension. Refer to *SC REAR SUSPENSION* or *SC4 REAR SUSPENSION*.

Remove fuel tank. Refer to *FUEL TANK AND FUEL PUMP*.

Using a grinding disk, grind all rivets retaining rear radiator to frame.

Unplug radiator hoses from rear radiator then remove radiator from vehicle. Discard Oetiker clamps.

Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

When installing hoses, make sure to install new Oetiker clamps.

Insert radiator protector into radiator C-rail and crimp C-rail at rear end.

NOTE: If traction enhancing products (studs) are used on vehicle, install the appropriate radiator protector. Refer to *TRACK* to choose the proper protector kit.

COOLANT TANK

Removal

For removal, drain cooling system before removing coolant tank.

Remove all hoses from coolant tank.

Slide up coolant tank to disengage it from oil tank.

Inspection

Check if the tank is cracked or melted. Replace if necessary.

Installation

For installation, reverse the removal procedure.

COOLANT PUMP

Refer to *BOTTOM END* section.

COOLANT TEMPERATURE SENSOR (CTS)

Refer to *COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT* in *ENGINE MANAGEMENT*.

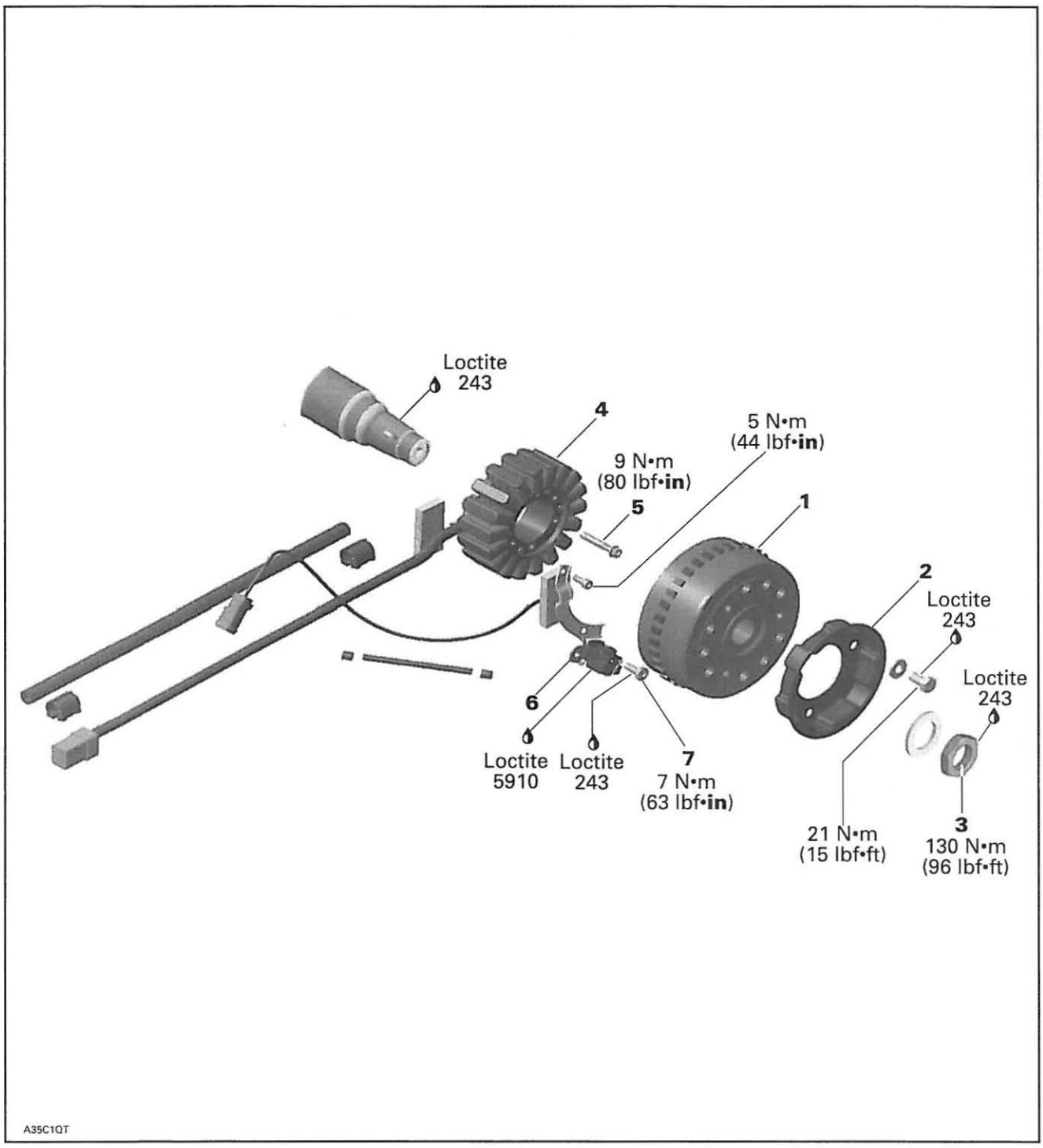
MAGNETO SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	420 876 557	47
magneto puller	529 035 547	47
puller ring	529 036 001	47

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	48
silicone dielectric grease	293 550 004	48


Loctite
243
4
9 N•m
(80 lbf•in)
5
5 N•m
(44 lbf•in)
1
2
Loctite
243
Loctite
243
6
Loctite
5910
Loctite
243
7
7 N•m
(63 lbf•in)
21 N•m
(15 lbf•ft)
3
130 N•m
(96 lbf•ft)
A35C1QT

GENERAL

NOTE: The following procedures can be done without removing the engine. To facilitate magneto removal, hold drive pulley with the appropriate tool. Refer to *DRIVE PULLEY*.

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* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

MAGNETO FLYWHEEL

Cleaning

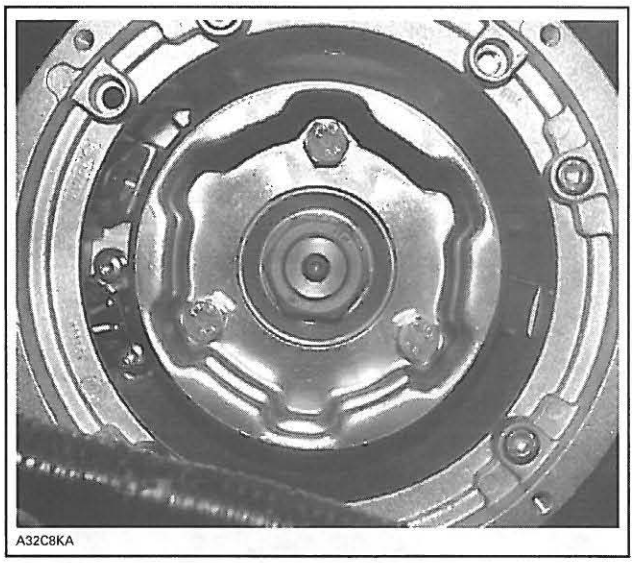
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Removal

To gain access to magneto flywheel **no. 1** assembly, remove the following parts:

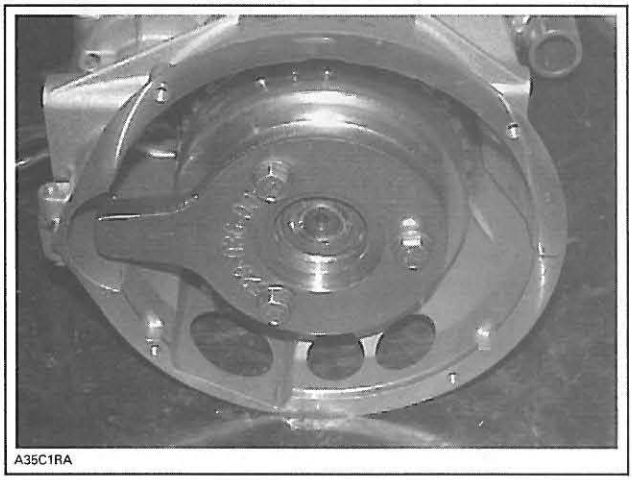
- tuned pipe and muffler
- rewind starter
- starting pulley **no. 2**.


A32C8KA

TYPICAL

- Install the puller ring (P/N 529 036 001) in magneto housing opening.

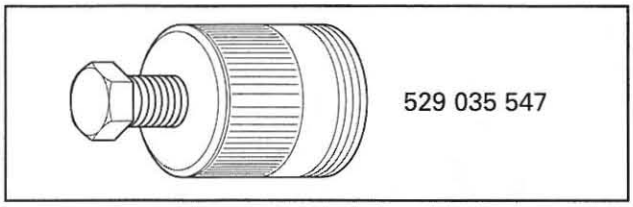
CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto flywheel.

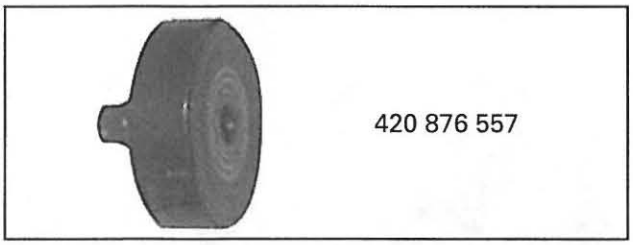

A35C1RA

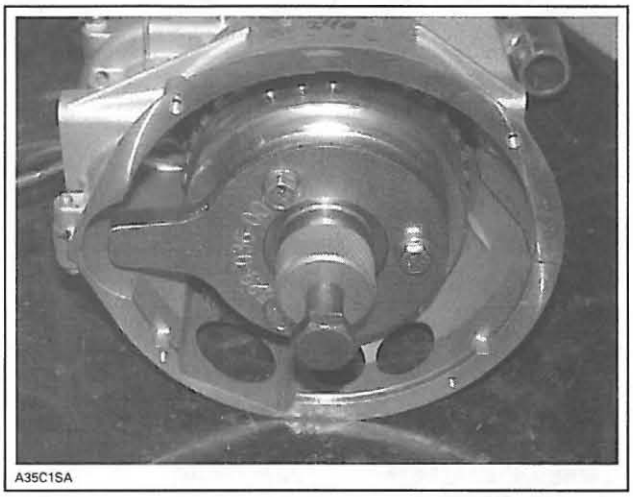
- Remove magneto flywheel nut, using a 30 mm socket machined to 40 mm (1.580 in) outside diameter by 16 mm (5/8 in) long.

NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.

To remove magneto flywheel, install the crankshaft protector (P/N 420 876 557) on crankshaft end. Screw the magneto puller (P/N 529 035 547) into puller ring.







Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.

Installation

Clean crankshaft taper and apply Loctite 243 (blue) (P/N 293 800 060) on it. Install magneto flywheel **no. 1** on crankshaft after positioning the Woodruff key. Install lock washer and torque nut **no. 3**.

When installing starting pulley **no. 2**, apply Loctite 243 (blue) (P/N 293 800 060) on bolt threads before torquing to 21 N•m (15 lbf•ft).

Coat all electric connections except Deutsch housings (waterproof housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone «sealant», this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch waterproof housing otherwise housing seal will be damaged.

Ignition Timing

Check as described in *IGNITION TIMING*.

STATOR

Inspection

Always check stator **no. 4** before changing it. Refer to *CHARGING SYSTEM*.

Cleaning

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

CAUTION: Clean stator using only a clean cloth.

Removal

Remove:

- magneto flywheel **no. 1**
- screws **no. 5** retaining stator to magneto housing
- grommet from crankcase where wires exit magneto housing.

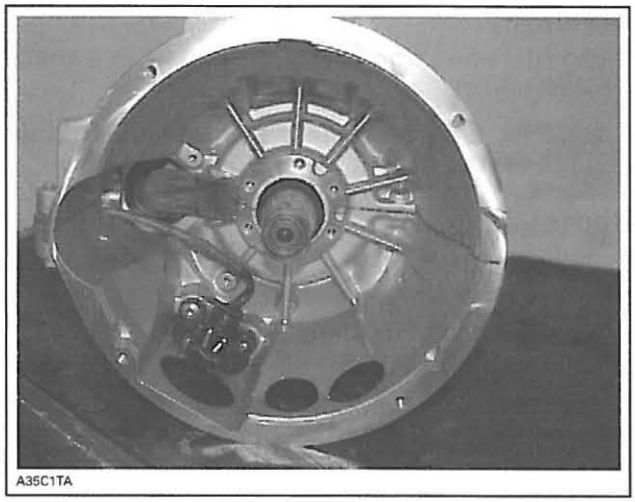
Unplug magneto and CPS connectors then pull the wires through the crankcase hole.

Remove the stator **no. 4**.

Installation

Insert the stator wire into crankcase hole.

Ensure foam is located where stator wires will run to crankcase hole.



Install stator **no. 4** and torque screws **no. 5** in a criss-cross sequence.

Install the grommet on crankcase.

Reinstall all other removed parts.

CRANKSHAFT POSITION SENSOR (CPS)

Inspection

Always check CPS before changing it. Refer to *COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT*.

Removal

To replace the CPS, remove or disconnect the following:

- magneto flywheel no. 1
- grommet from crankcase where CPS wire exits magneto housing
- retaining screws no. 7
- CPS no. 6 and carefully pull wires.

Installation

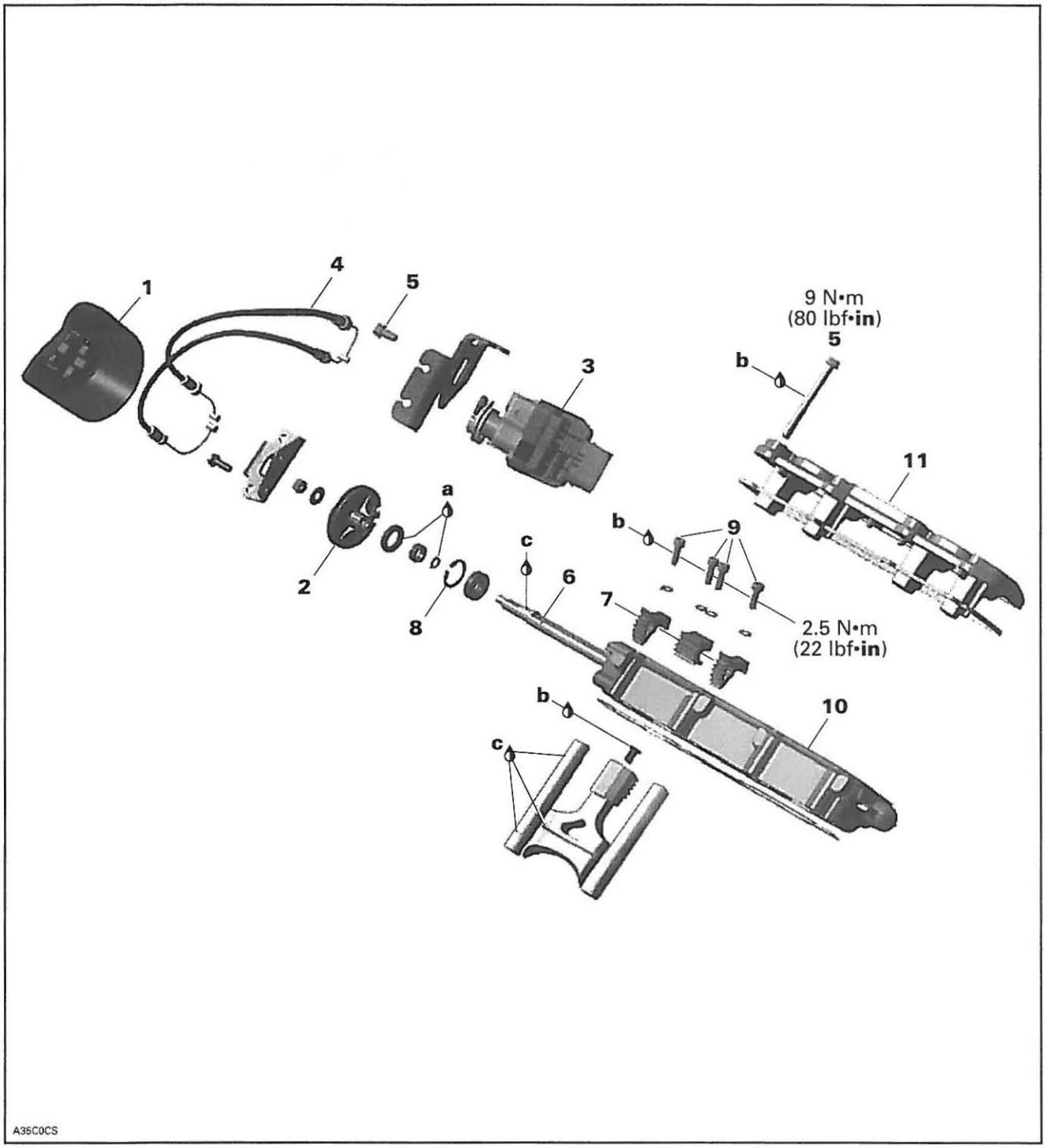
For installation, reverse the removal procedure.

NOTE: Remove the old sealant at CPS location then apply new one. Screw CPS then stick the CPS wires in the sealant.

E-RAVE SYSTEM

SERVICE PRODUCTS

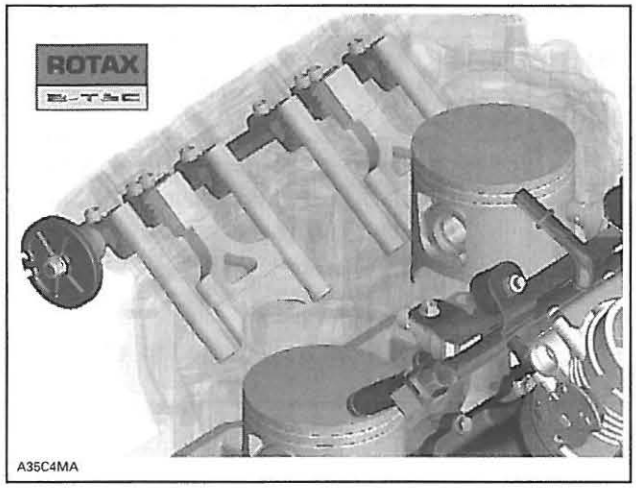
Description	Part Number	Page
Loctite 243	293 800 060	52
Molykote 111	413 707 000	52
XP-S synthetic blend injection oil	293 600 071	52



a. Molykote 111 (P/N 413 707 000)
b. Loctite 243 (P/N 293 800 060)
c. XP-S synthetic blend injection oil (P/N 293 600 071)

GENERAL

An electronically controlled RAVE (E-RAVE) system with side exhaust port control is used. This system offers more torque and less fuel consumption in part load operation, compared to conventional RAVE system.



A35C4MA

The opening of the valve is activated electronically by a rotary electronic actuator (REA). The ECM monitors altitude, engine temperature, throttle position and RPM to operate the actuator for optimum engine operation.

The RAVE valves are all either closed or fully opened.

The E-RAVE system can be serviced with engine on vehicle.

During assembly/installation, use torque values and service products as shown in 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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

E-RAVE Actuator Seek Position Cycles

There are 2 seek position cycles:

Closed position: the first time engine is started.	The actuator moves slowly the RAVE to **closed** position. This sets the actuator **closed position** value.
Opened position: when engine reaches the operating conditions that requires the opening of the RAVE valves.	The actuator moves slowly the RAVE to **open** position. This sets the actuator **open position** value.

The seek position cycles are done at a **slower** speed than normal operation to protect components in case the actuator was not in the proper position or if components were stuck or wrongly adjusted.

NOTE: When the opened position cycle is in progress, there will be a noticeable delay before engine can reach its maximum allowable RPM's. This is a normal condition.

Once the seek position cycles are completed, the actuator works at "full speed" and uses the determined stroke every time RAVE opening or closing is required.

Every time engine is started, the seek position cycles will repeat.

Troubleshooting Tips

Engine RPM not Reaching its Maximum Speed

Assuming there is no other problem causing the lower RPM, this occurs because cable or mechanism are improperly adjusted, damaged or broken.

Fouled Spark Plugs

Assuming there is no other problem causing it, when a malfunction of E-RAVE system is detected by ECM, a fail-safe fuel map is selected. This cause a richer fuel mixture that may cause spark plug fouling.

E-RAVE System Possible Problems

When the EMS light blinks and no fault is reported in B.U.D.S. software, the problem is likely to be related to the E-RAVE system. The following could be suspected.

- Actuator overheating. Caused by the actuator itself or by an overload caused by mechanical components failure.
- Communication problem between ECM and actuator. It could be caused by a not-powered actuator.
- Mechanical problem. Cables/pulleys condition/adjustment, E-RAVE valve gear mechanism.

Chart for Possible Problems

PROBLEM		VEHICLE FEEDBACK		
ACTUATOR STATE	RAVE SYSTEM	FAULT CODE	FAIL-SAFE RICHER MIXTURE	EMS LIGHT
Seek cycle succeeded	RAVE valves, cables or actuator stuck in open or closed position	None	Yes (1)	– Only flashes if throttle is held for a few seconds (where RAVE valve should open) – Turns off a few seconds after throttle is released (RAVE valve closed area) 1. Engine must be restarted to leave this condition
Seek cycle failed	RAVE valves, cables or actuator stuck in open or closed position	None	No	None
—	Cable installed when actuator is on its mechanical stop position (as when engine is started without cables installed)	None	No	– None – RAVE valves will work optimally

PROCEDURES

E-RAVE SYSTEM DYNAMIC TEST

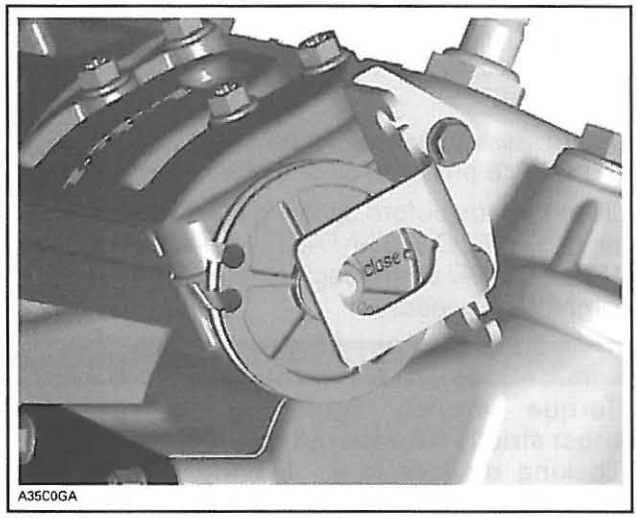
Lift rear of vehicle off the ground and support it with a stand.

⚠ WARNING

To prevent serious injury to individuals near the snowmobile:
- **NEVER stand behind or near a moving track**
- **always use a wide-base snowmobile stand with a rear deflector panel**
- **when the track is raised off the ground, only run it at the lowest possible speed.**

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

Start engine and while at idle speed, check position of the E-RAVE shaft pulley. It should be in the **Close** position.



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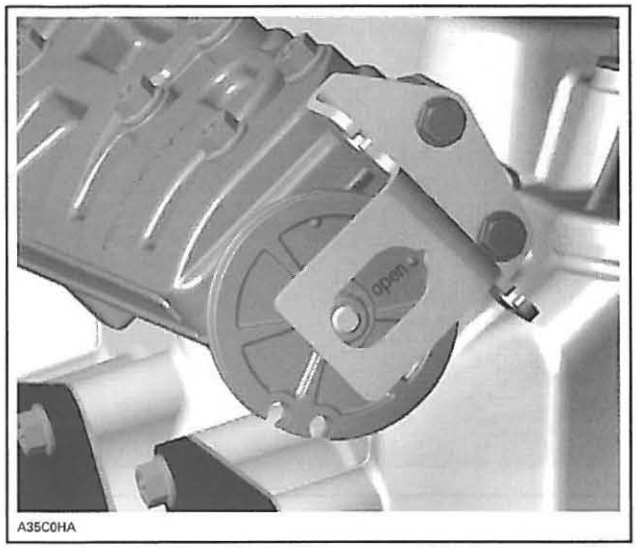
Bring the engine above 6500 RPM while in wide open throttle and check position of the E-RAVE shaft pulley. It should be in the **Open** position.

NOTE: Engine speed may have to be brought to 7200 RPM to have the RAVE system to operate.



If test fails, check cables and pulleys condition and adjustment. If they are correct, check the following.

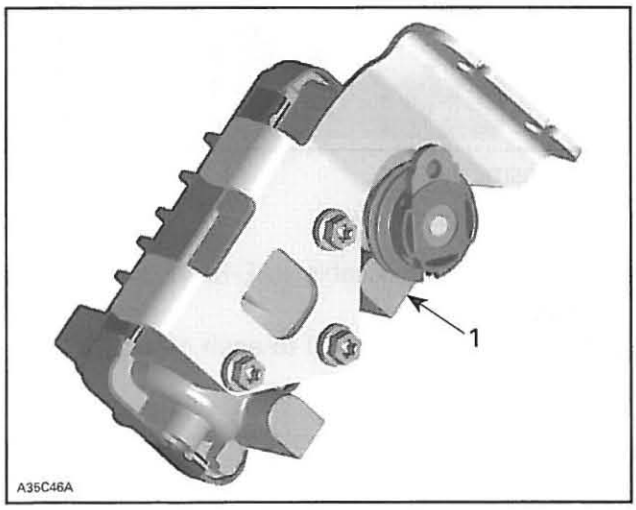
E-RAVE valves Mechanical Operation Test

Disconnect cable from E-RAVE actuator **no. 3** and manually turn E-RAVE shaft pulley to see if E-RAVE valves move properly.

NOTE: Be careful not to mistake normal rack and pinion notched movement for a binding RAVE system.

If RAVE valves move properly, check the actuator.

E-RAVE ACTUATOR



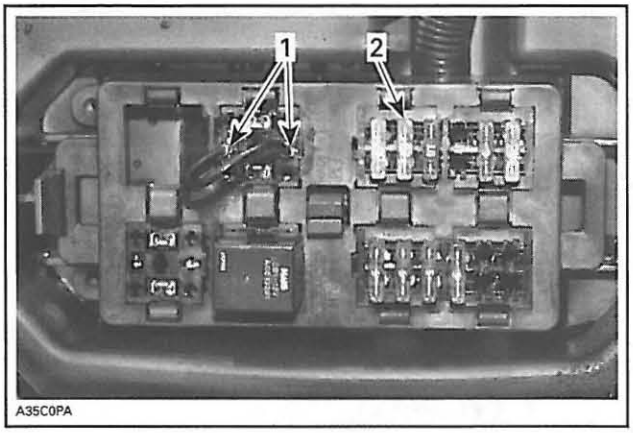
1. E-RAVE actuator

Voltage Test

Remove the headlight relay (R2).

NOTE: To prevent battery discharge, headlight fuse (F8) can be removed.

Bypass relay with a jumper.



1. Jumper
2. Headlight fuse

Disconnect the E-RAVE actuator connector.

Measure voltage between terminal 1 (on harness side) and battery ground.

If battery voltage is read, check continuity between terminal 2 (on harness side) and battery ground. If continuity is faulty, repair/replace wiring/connector.

If battery voltage is not read, check the corresponding fuse(s), relay and continuity of circuit V V-1. If continuity is faulty, repair wiring/connector.

Communication Test

A not-working actuator can be caused by a communication problem between ECM and E-RAVE actuator.

If no power goes to the E-RAVE actuator, no communication can take place.

If B.U.D.S. works, it validates the ECM works and can communicate. Therefore the problem is in the wires going to the E-RAVE actuator.

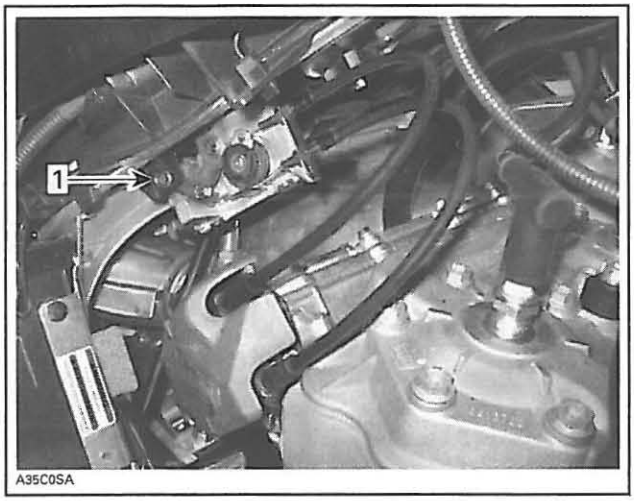
If B.U.D.S. does not work, try a new ECM.

Check continuity of wires V V-3 and V V-5. If continuity is faulty, repair wiring/connector.

If continuity is good, try a new actuator.

Removal

Remove retaining screw **no. 5**.



1. Remove screw

Slide E-RAVE actuator **no. 3** out.

Disconnect electrical connector.

Detach cable **no. 4**.

Installation

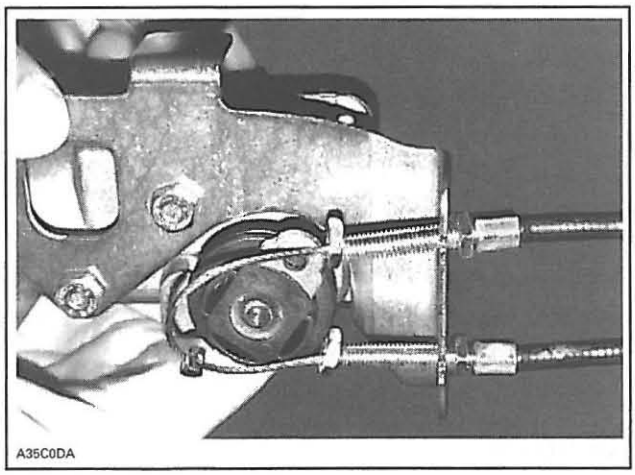
Reverse removal steps.

E-RAVE CABLES

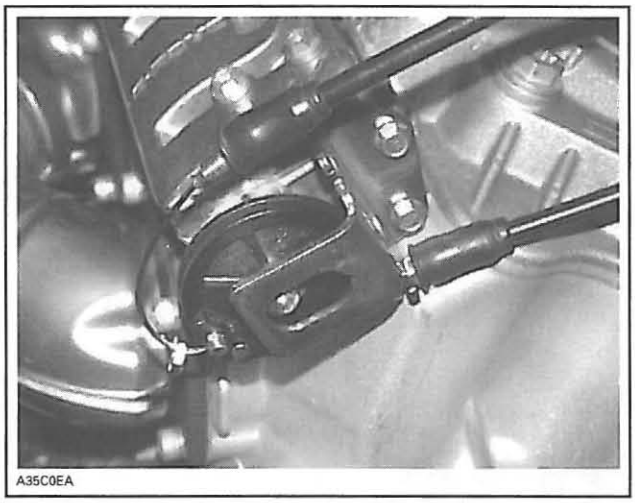
Removal

Completely unscrew adjuster nuts from E-RAVE actuator bracket.

Detach cables from E-RAVE actuator pulley.



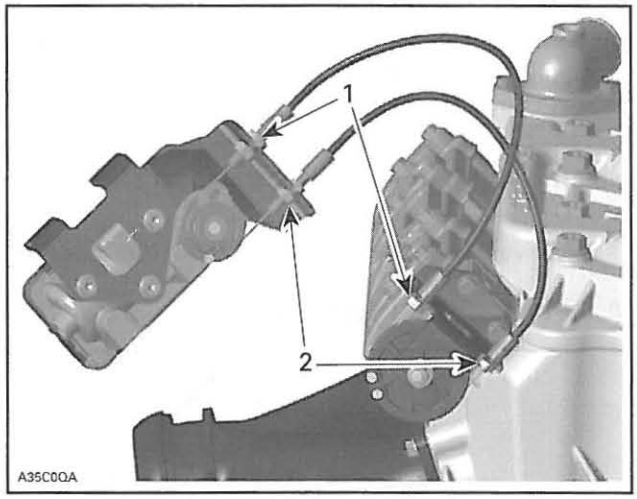
Detach cables from E-RAVE shaft pulley **no. 2**.



Installation

Reverse removal steps. However, pay attention to the following.

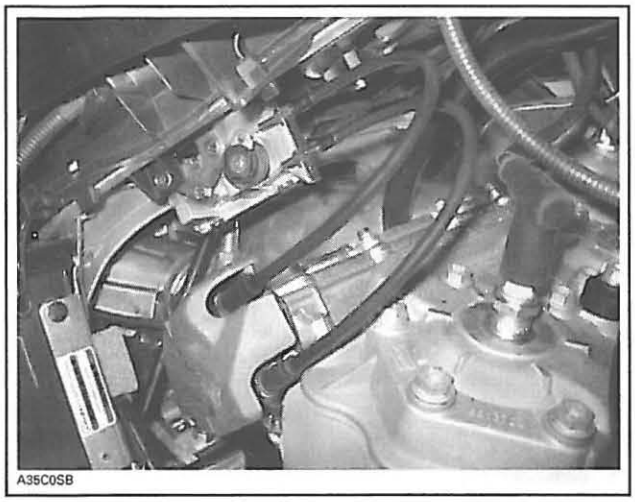
Connect E-RAVE cables as per following photo:



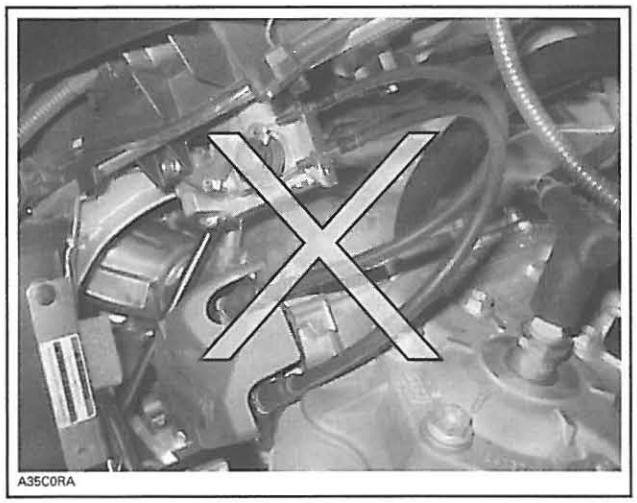
CABLE POSITIONS
1. Cable ends in top holes
2. Cable ends in bottom holes

Tighten nut of each cable to E-RAVE shaft pulley bracket.

Ensure cables are parallel to each other.

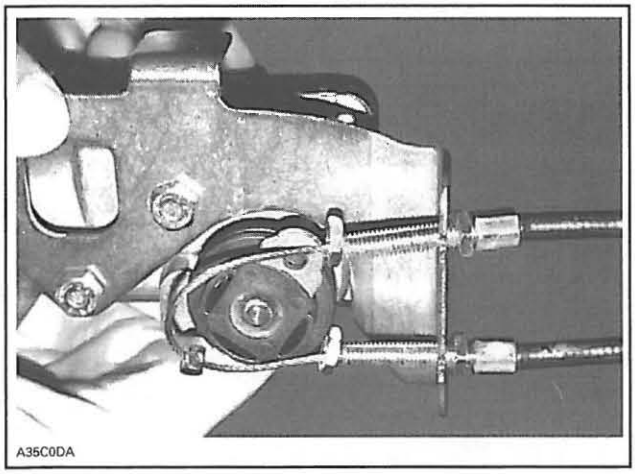


RIGHT



WRONG

Insert cables in E-RAVE actuator pulley.



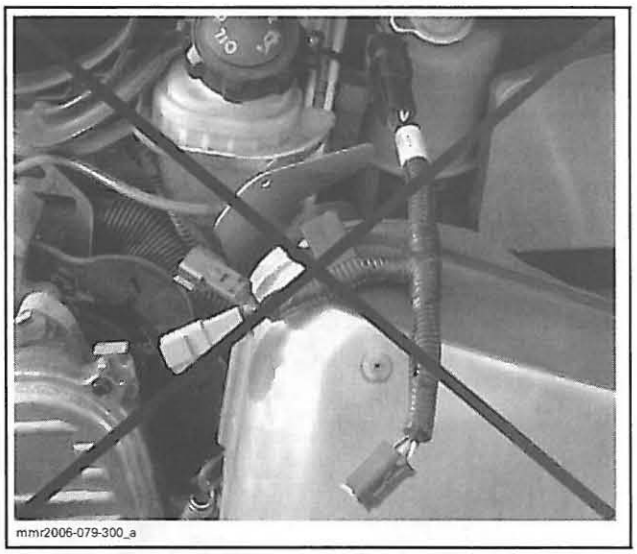
Loosely install adjuster nuts. Do not tighten adjusters yet, proceed with adjustment as described below.

Adjustment

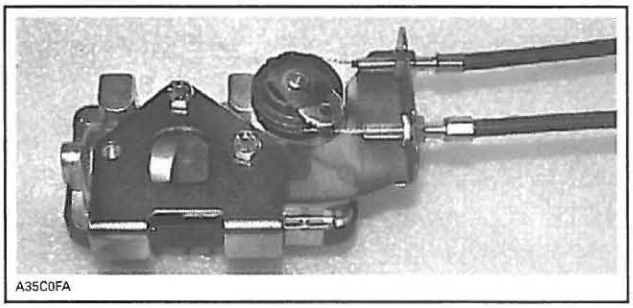
IMPORTANT: Ensure all components are properly installed to their operating position, that proper routing of cable is achieved and that cable adjustment is performed as specified. Otherwise, improper E-RAVE opera,tion will result leading to poor engine performance.

Remove DESS key and wait until lights of speedometer turn off. ECM must be off.

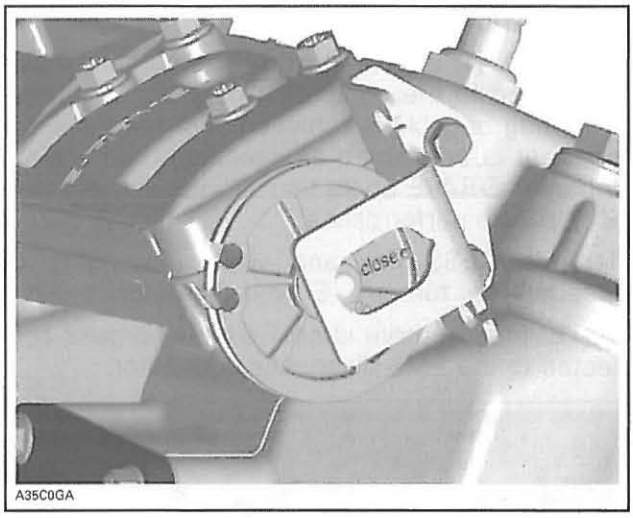
NOTE: Ensure there is no T-supply harness connected to the EMS diagnostic connector.



Ensure cable adjusters and cable ends on E-RAVE actuator pulley are loose.



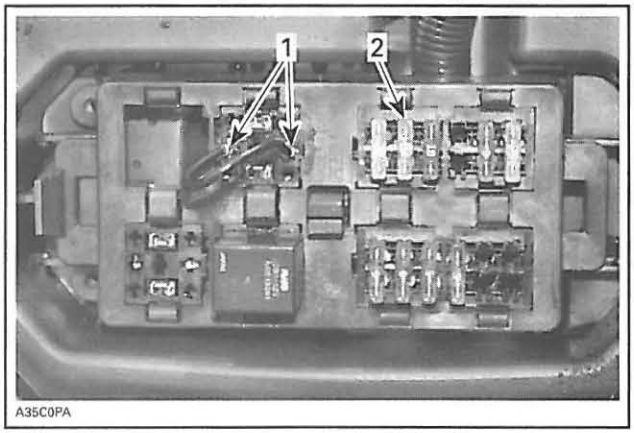
Turn E-RAVE shaft pulley clockwise to the **Close** position.



A35C0GA

Remove the headlight relay (R2).

NOTE: To prevent battery discharge, headlight fuse (F8) can be removed.

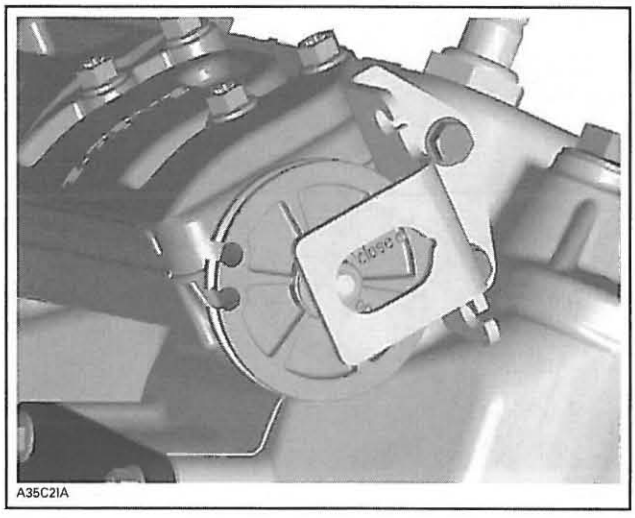


A35C0PA

1. Jumper
2. Headlight fuse

Bypass relay with a jumper. This will turn the E-RAVE shaft pulley to the adjustment position.

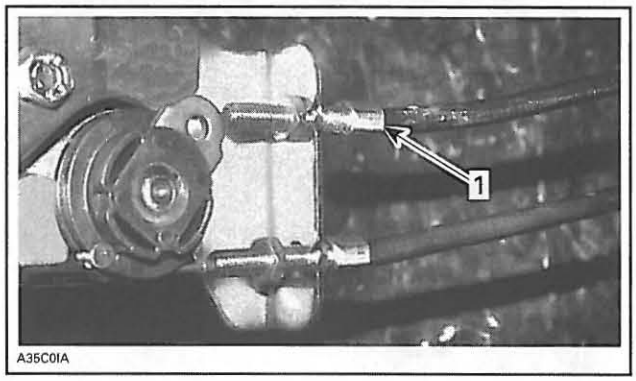
NOTE: If pulley does not turn, E-RAVE actuator was already in right position.



A35C2IA

ADJUSTMENT POSITION

Tighten top cable adjuster (closing cable) with just enough force to remove play in cable.

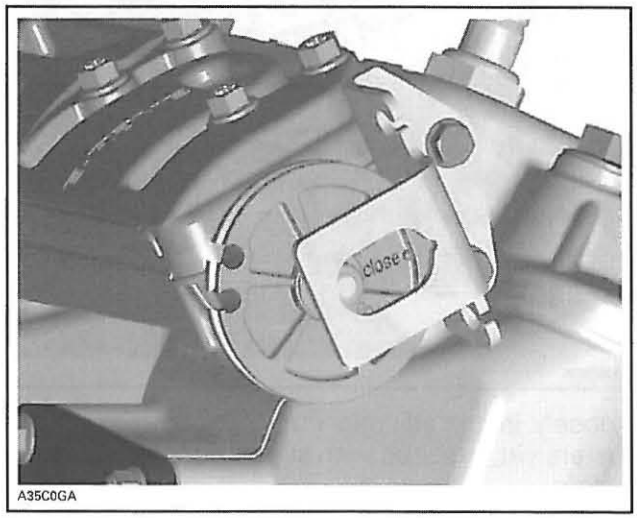


A35C0IA

1. Top (closing) cable adjuster

Install DESS key and set engine cut-out switch to OFF.

Press START/RER button. E-RAVE shaft pulley should turn to the **Close** position.

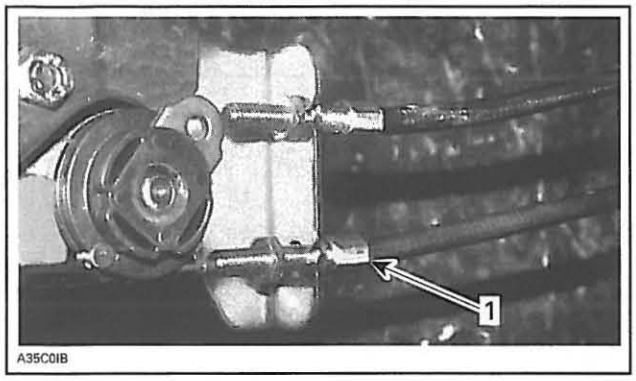


A35C0GA

Readjust top (closing) cable as necessary.

Remove relay jumper.

Tighten bottom cable adjuster (opening cable) to remove play in cable.



1. Bottom (opening) cable adjuster

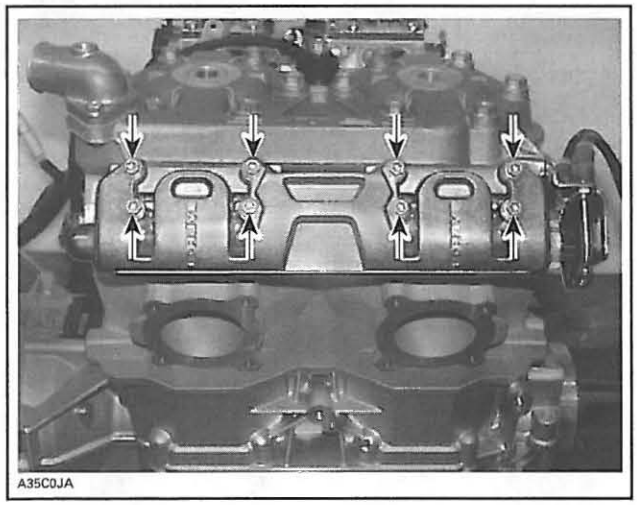
NOTE: A cable that is too tight will make the system too stiff to operate smoothly.

Repeat the *E-RAVE DYNAMIC TEST* above 2 - 3 times then recheck the cables free-play. Readjust as necessary.

E-RAVE COVER

Removal

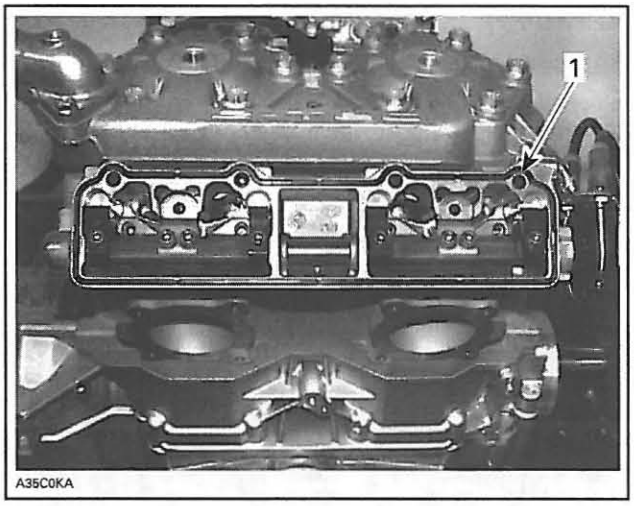
Remove retaining screws **no. 5**.



Remove cover **no. 11**.

Inspection

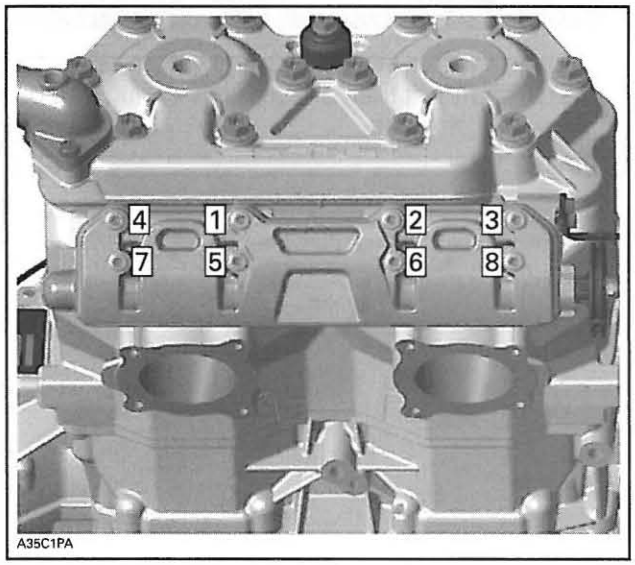
Check seal condition. If it is cracked or hard, replace seal. Check cover condition.



1. Seal

Installation

Follow this tightening sequence.



E-RAVE SHAFT

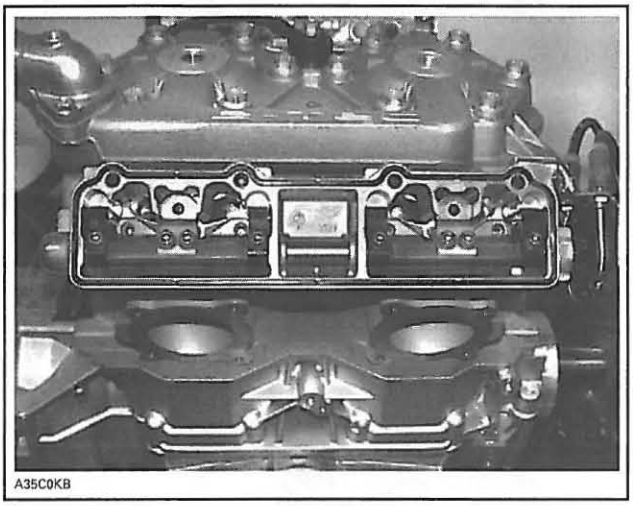
Inspection

Check for smooth mechanical movement of the E-RAVE system. Feel the bearing radial play. If excessive, replace bearing.

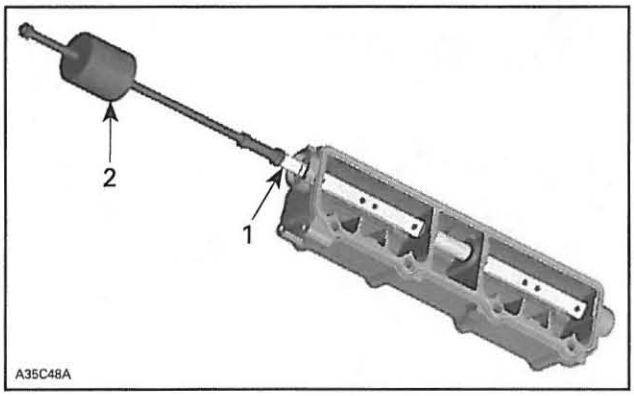
Check seal area for leaks. If so, replace seal.

Removal

Remove the following:
- E-RAVE cables **no. 4**
- pulley **no. 2**
- seal then snap ring **no. 8**
- drive gears **no. 7**.


A35C0KB

Reinstall shaft nut then use a hammer puller to pull shaft out by the nut.



A35C48A

1. E-RAVE shaft
2. Hammer puller

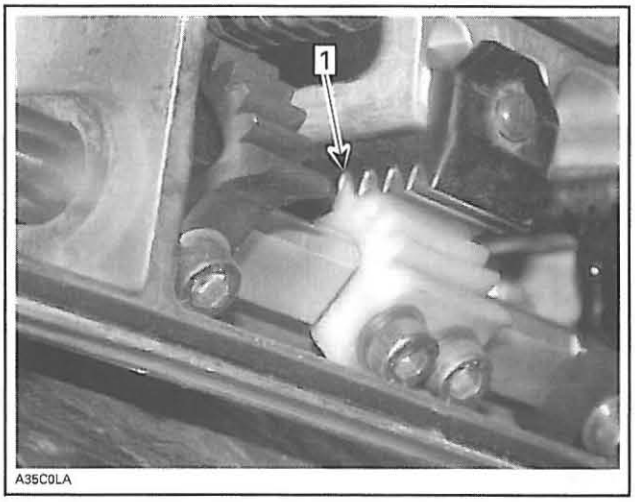
Push bearing out of shaft.

Installation

Reverse removal steps. However, pay attention to the following.

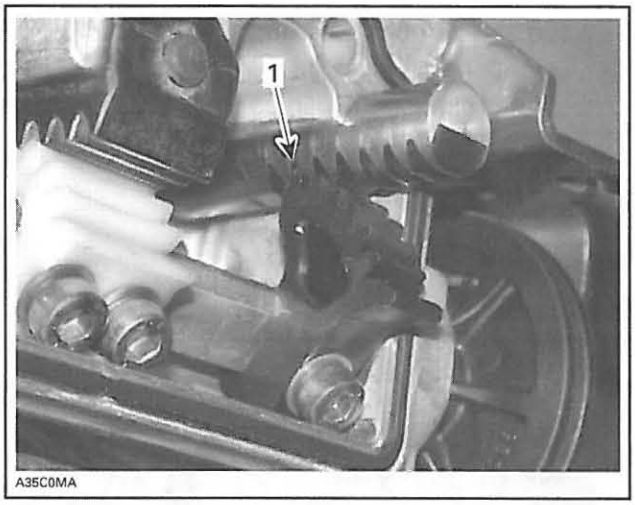
When installing new bearing on shaft, use an appropriate pusher that seats against the inner race of bearing. Drive shaft in housing until it bottoms.

When installing drive gears **no. 7**, ensure to mesh gears as shown.



A35C0LA

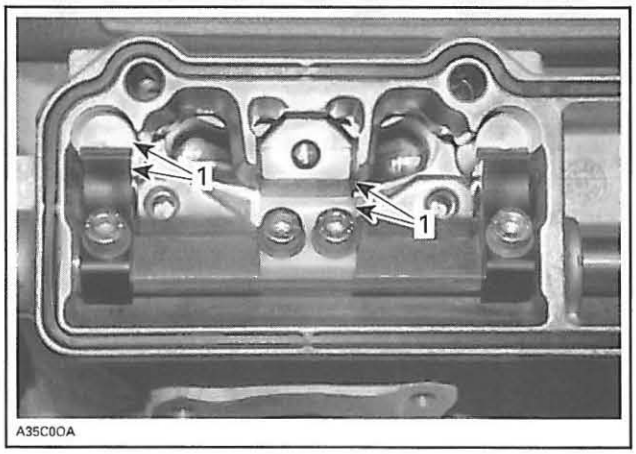
CENTER VALVE
1. Mesh in 1st tooth of center valve gear



A35C0MA

SIDE VALVE
1. Mesh gear in 2nd tooth of side valve gear

Ensure that after torquing screws, the shaft gears are properly aligned with valve gears.



A35C0OA

1. Gears aligned

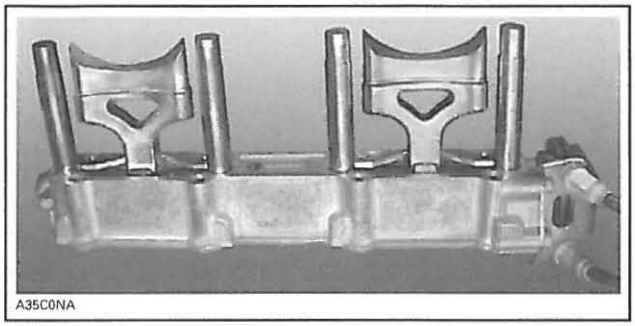
After assembly, check for smooth mechanical movement of the E-RAVE system.

E-RAVE HOUSING

Removal

Remove the following:
- E-RAVE cables **no. 4**
- cover **no. 11**

NOTE: E-RAVE housing with shaft and E-RAVE valves can be removed altogether if desired.


A35C0NA

- drive gears **no. 7**.

Inspection

Check housing condition.

Installation

Reverse removal steps.

E-RAVE VALVES

Removal

Remove the following:
- cover **no. 11**
- drive gears **no. 7**
- housing **no. 10**.

Inspection

Clean carbon deposits on parts. Check gears condition.

The round auxiliary valves may show some distortion on the end closest to the pistons. This is a normal set-in during operation. They are not contacting the pistons and are actually sealing better. Do not replace them unless they do not operate in their bores.

Installation

Reverse removal steps.

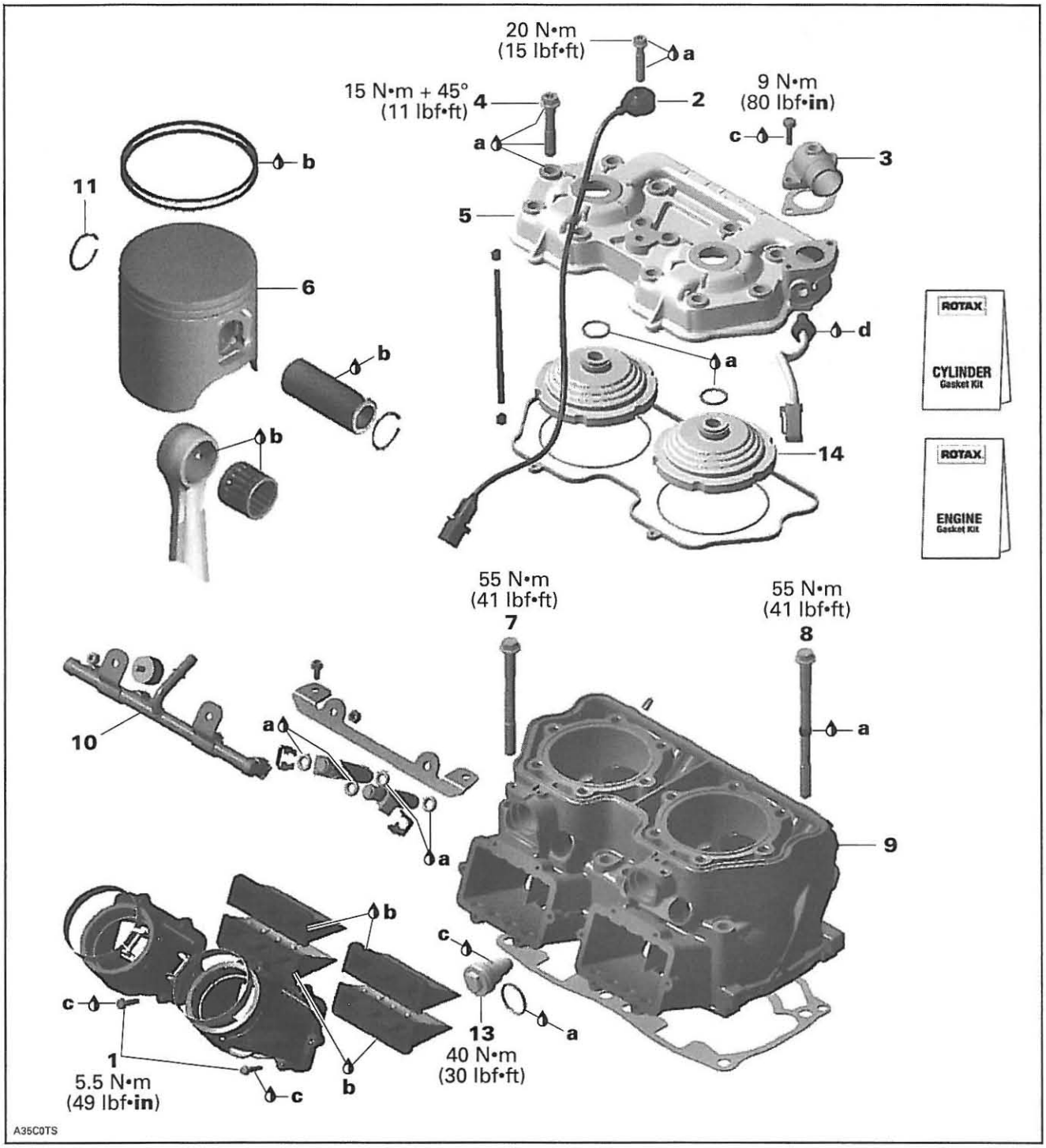
TOP END

SERVICE TOOLS

Description	Part Number	Page
Piston circlip installer	529 035 998	71
piston pin puller/installer	529 036 002	70

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	64
Loctite 5910	293 800 081	64
Loctite Chisel	413 708 500	65
Molykote 111	413 707 000	64
XP-S synthetic blend injection oil	293 600 071	64



a. Molykote 111 (P/N 413 707 000)
b. XP-S synthetic blend injection oil (P/N 293 600 071)
c. Loctite 243 (P/N 293 800 060)
d. Loctite 5910 (P/N 293 800 081)

GENERAL

Before disassembling the engine, proceed with an engine leak test. Refer to *LEAK TEST*.

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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

Component Removal with the Engine Installed

The following engine components can be removed with engine on vehicle such as:
- cylinder head
- cylinder block
- piston(s)
- reed valve(s).

NOTE: Since the cylinder block is heavy and the working space is limited, being assisted by someone will ease the cylinder block removal/installation.

To proceed with engine removal, refer to *REMOVAL AND INSTALLATION*.

Parts Cleaning

Discard all gaskets and O-rings. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

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

Scrape off carbon formation from cylinder block exhaust port, cylinder head and piston dome.

NOTE: The letters "A or B" (beside an arrow on the piston dome) must be visible after cleaning.

Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

INSPECTION

Refer to table below to find top end engine dimension specifications. For measurement procedures, refer to *ENGINE MEASUREMENT* section.

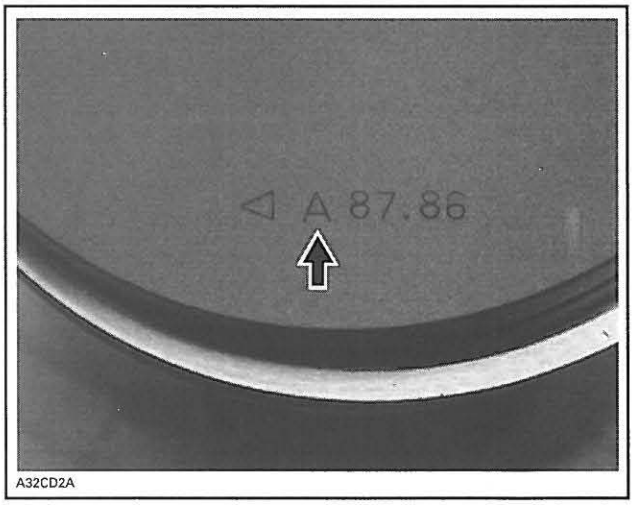
ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder head volume	42.59 cc	46.72 cc	N.A.
Cylinder taper	.02 mm (.0008 in)	0.04 mm (.0016 in)	0.10 mm (.004 in)
Cylinder out of round	0.008 mm (.0003 in)	0.015 mm (.0006 in)	0.015 mm (.0006 in)
Piston/cylinder wall clearance	0.112 mm (.0044 in)	0.152 mm (.0060) in)	0.20 mm (.008 in)
Ring/piston groove clearance	0.045 mm (.002 in)	0.090 mm (.004 in)	0.20 mm (.008 in)
Ring end gap	0.550 mm (.022 in)	0.70 mm (.027 in)	1.0 mm (.039 in)

Piston and Cylinder Block Replacement

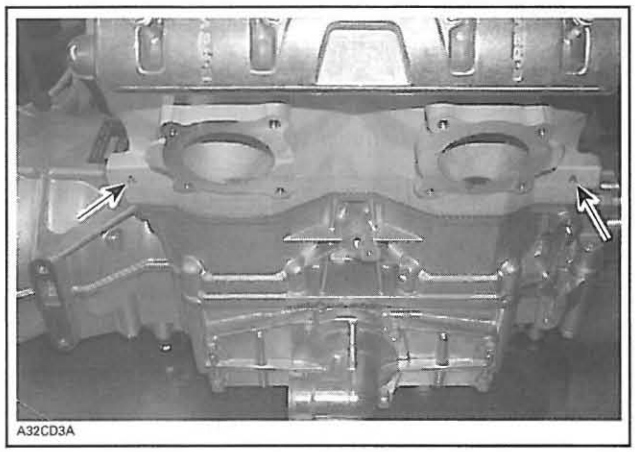
NOTE: There is no oversize piston available.

This engine uses pistons with 2 tolerance groups; therefore, when a piston needs to be replaced, it is important to correctly identify its tolerance group before proceeding with its replacement.

The pistons and cylinders are identified by the letters "A" or "B".



A32CD2A


A32CD3A

NOTE: A cylinder block may use pistons of 2 different tolerance groups. **Always match piston "A" with cylinder "A" and piston "B" with cylinder "B".**

When a cylinder block needs to be replaced, the replacement part is provided with 2 matching pistons.

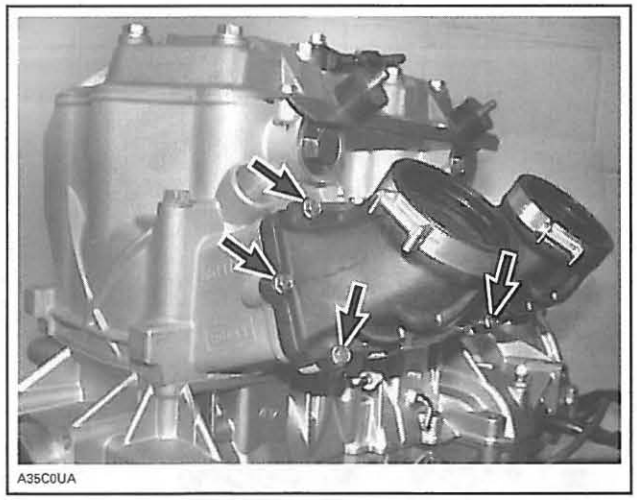
PROCEDURES

REED VALVE

Removal

Remove throttle body. Refer to *ENGINE MANAGEMENT*.

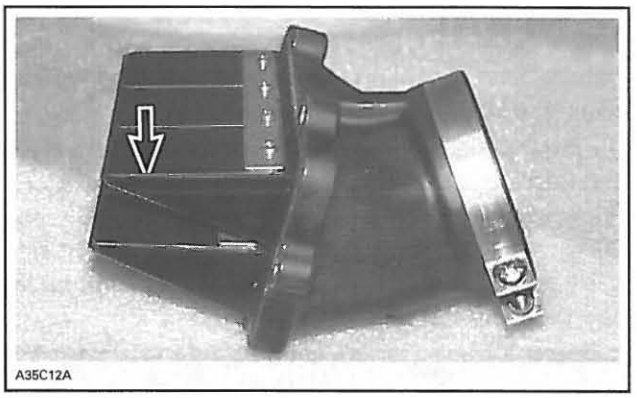
Unscrew intake adapter screws **no. 1**.


A35C0UA

Remove intake adapter and reed valves.

Inspection

There must not be any play between any blade and valve body when exerting a finger pressure on blade.


A35C12A

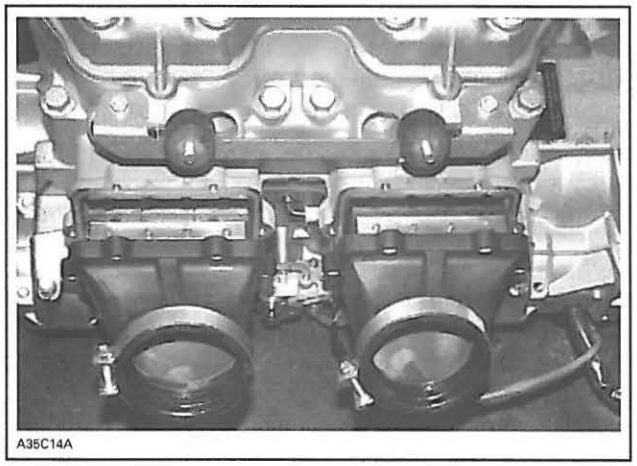
If a play is felt, replace reed valve.

Check the rubber flange for cracks and/or damage.

Installation

The installation is the reverse of the removal procedure, however pay particular attention to the following.

LH and RH side intake adapters are different. Install as shown.


A35C14A

Properly seat adapters against engine flanges and torque screws **no. 1** in a criss-cross sequence.

CYLINDER HEAD

Removal

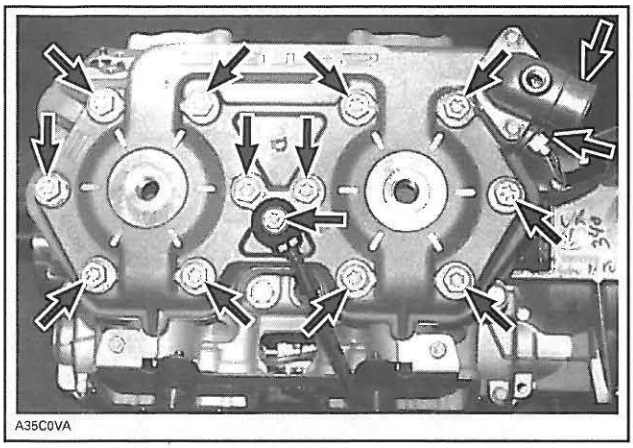
Remove the knock sensor **no. 2**.

Disconnect the temperature sensor connector.

Unplug coolant hose from upper thermostat housing **no. 3**.

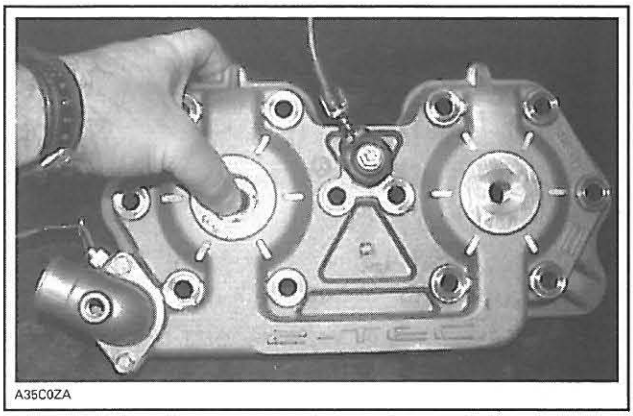
Unscrew cylinder block head screws **no. 4**.

Remove the cylinder head **no. 5**.

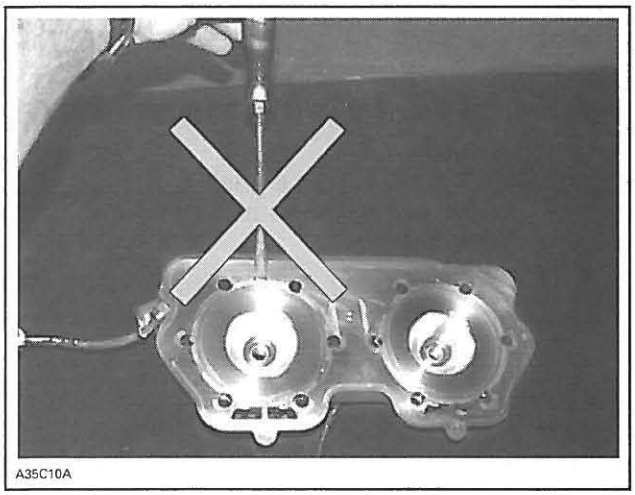

A35C0VA

Disassembly

If it is necessary to withdraw the removable combustion chamber **no. 14**, push out by spark plug hole area.

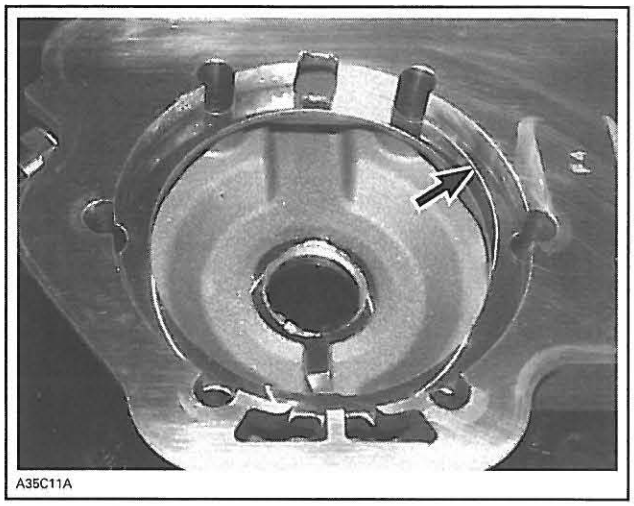

A35C0ZA

CAUTION: Do not pry out combustion chamber. It could damage the surface contact of cylinder head.


A35C10A

Assembly

If combustion chamber **no. 14** was removed, ensure its contact surface is clean before installing it.


A35C11A

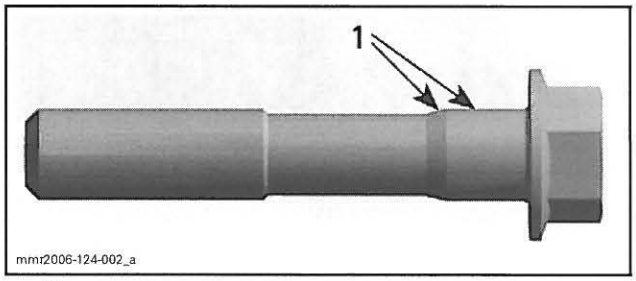
Ensure to properly align mounting holes.

Installation

The installation is the reverse of the removal procedure, however pay particular attention to the following.

CAUTION: Proper installation procedure of cylinder head screws is critical so that cylinder head aligns correctly. Otherwise, combustion chamber leak may occur through O-ring. Strictly follow procedure below.

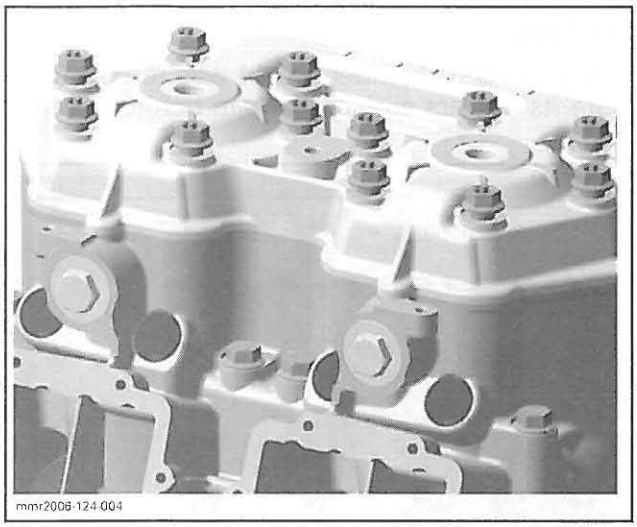
NOTE: The taper shape and area close to screw head are used for cylinder head alignment.



mmr2006-124-002_a

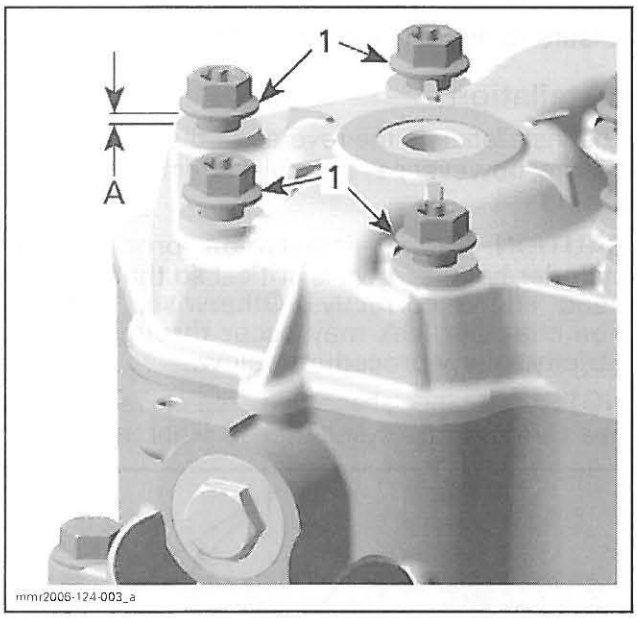
1. Alignment area

1. Manually install **every** screw in cylinder head. Just insert in the holes without screwing them.



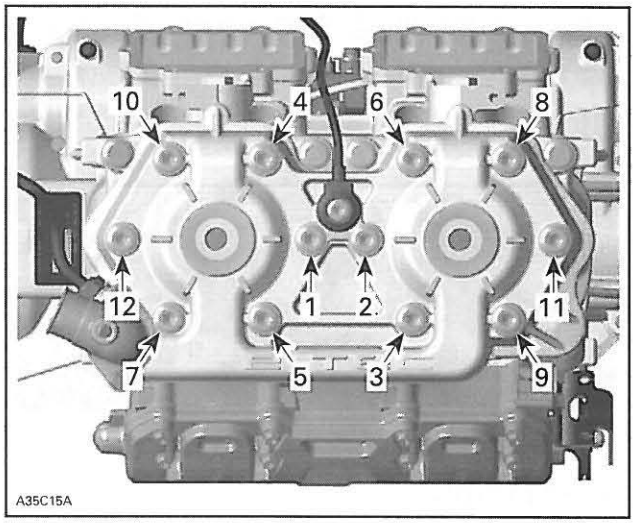
ALL SCREWS DROPPED IN THEIR HOLES

2. Then, **screw in each screw** in a criss-cross sequence to the specified distance.



PARTIAL VIEW OF SCREWS AND CYLINDER HEAD
1. All screws in this position
A. Screw in approx. 5 mm (.200 in)

3. After **every** screw height was set, torque screws following this sequence. Refer to the exploded view at the beginning of this section of for the torque value.



CYLINDER BLOCK

Removal

Remove throttle body and fuel rail **no. 10**. Refer to *ENGINE MANAGEMENT*.

Remove intake adapters.

Remove RAVE system. Refer to *RAVE SYSTEM*.

Remove cylinder head.

Unscrew cylinder block screws **no. 7** and **no. 8** then remove the cylinder block **no. 9**.

NOTE: If engine is in vehicle, lean cylinder block toward rear to withdraw.

Installation

The installation is the reverse of the removal procedure, however pay particular attention to the following.

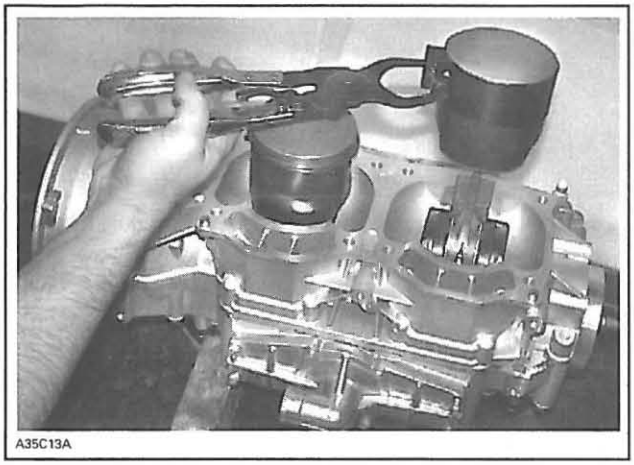
Choose the right gasket thickness according to combustion chamber volume. Refer to *ENGINE MEASUREMENT*. Install selected gasket on crankcase.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may lead engine to poor performance.

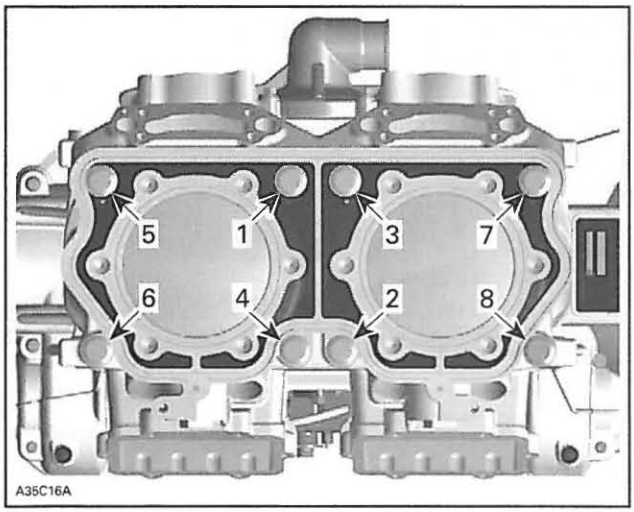
Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

To ease cylinder block installation, it is recommended to use a piston ring compressor pliers such as Snap-ON RC-980 or equivalent.

Bring one piston close to TDC then carefully slide piston into cylinder.


A35C13A

Torque cylinder block screws following this sequence. Torque screws in 2 steps, half torque first, then to final torque.



A35C16A

DECOMPRESSOR

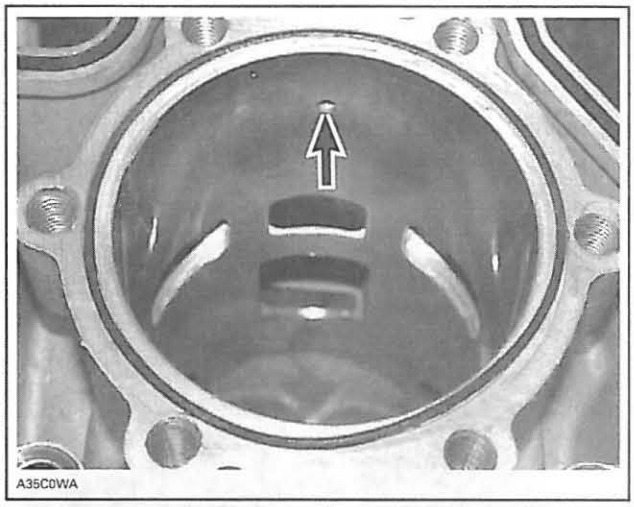
Mach Z

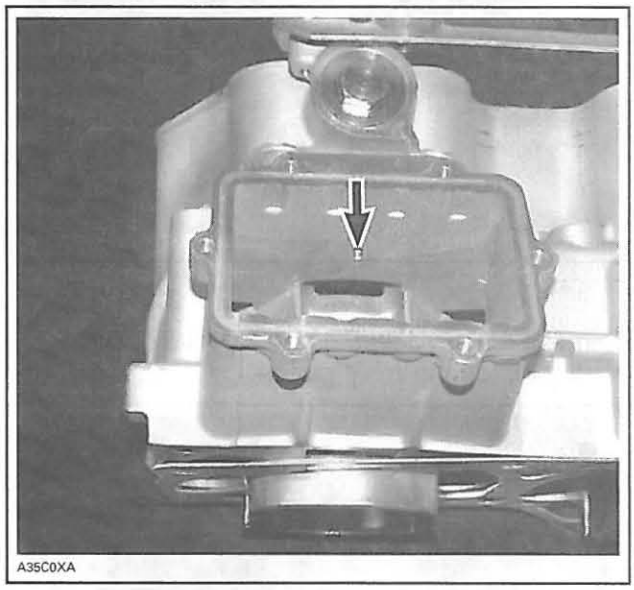
Removal

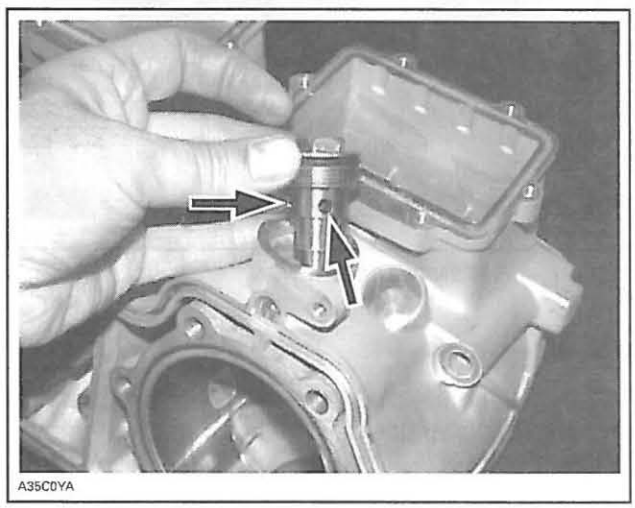
Do not remove decompressor plug **no. 23** needlessly.

Inspection

Inspect holes in cylinder-block for carbon deposits and if clogged, remove decompressor plug to allow proper cleaning.


A35C0WA


A35C0XA


A35C0YA

Installation

The installation is the reverse of the removal procedure.

PISTON

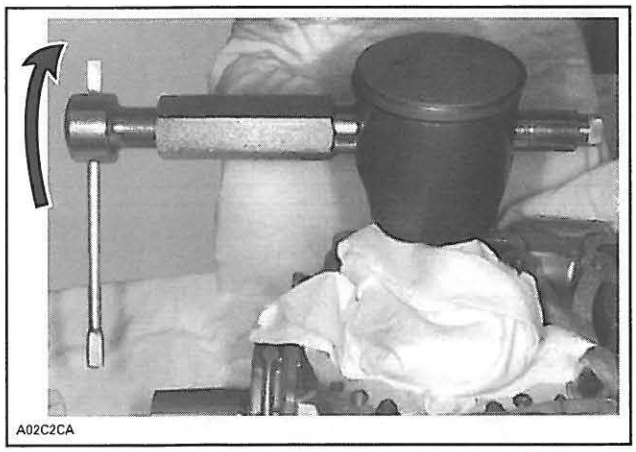
Removal

Remove cylinder block.

With a pointed tool inserted in piston notch, remove circlips **no. 11** from piston **no. 6**.

TYPICAL

Using piston pin puller/installer (P/N 529 036 002), extract piston pin from piston.



TYPICAL — PISTON PIN EXTRACTION

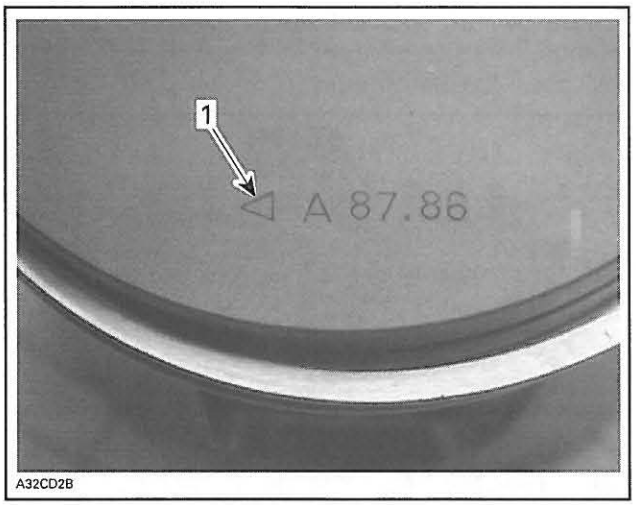
Installation

The installation is the reverse of the removal procedure, however pay particular attention to the following.

Lubricate needle bearings and insert into connecting rod.

TYPICAL

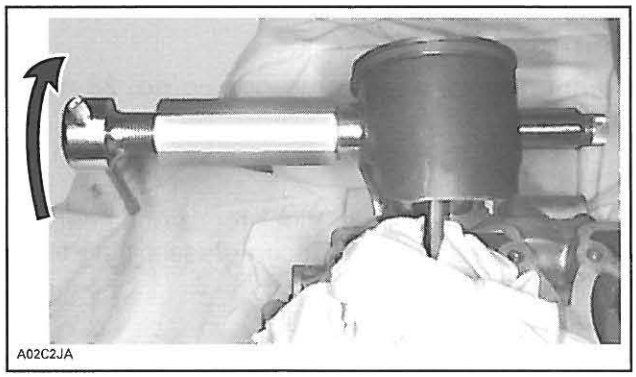
At assembly, place the pistons over the connecting rods with the arrow pointing toward the exhaust port.



1. Arrow pointing toward exhaust port

NOTE: If a new piston is installed, refer to *INSPECTION* in this section to ensure the proper piston is used.

Install piston pin puller/installer and turn handle until piston pin is correctly positioned in piston.



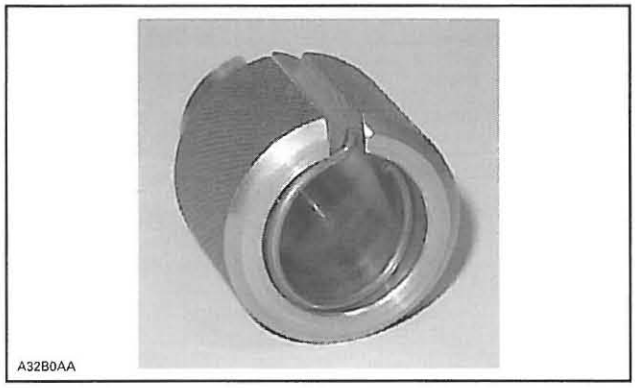
TYPICAL

Use a piston circlip installer to install mono-hook circlips **no. 11**.

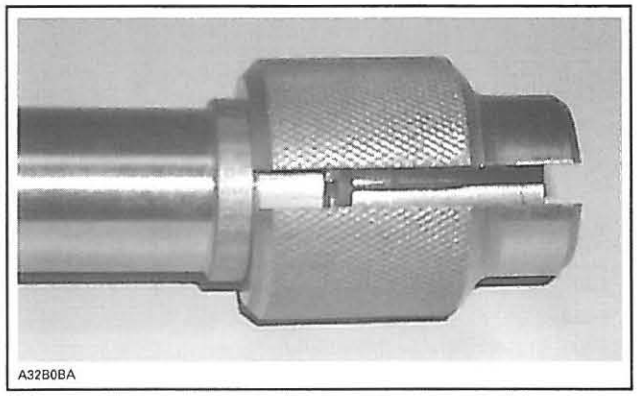
ENGINE	TOOL
995	Piston circlip installer (P/N 529 035 998)

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one because, on a second attempt, the circlip will lose its normal retaining capabilities.

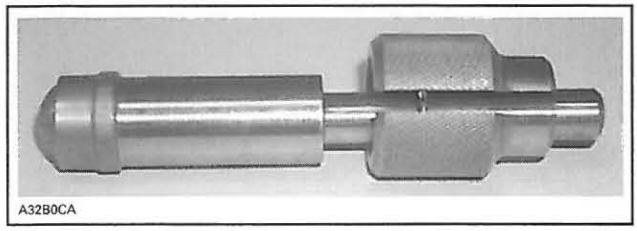
Insert circlip into support so that, when installed in piston groove, the tab faces upward.

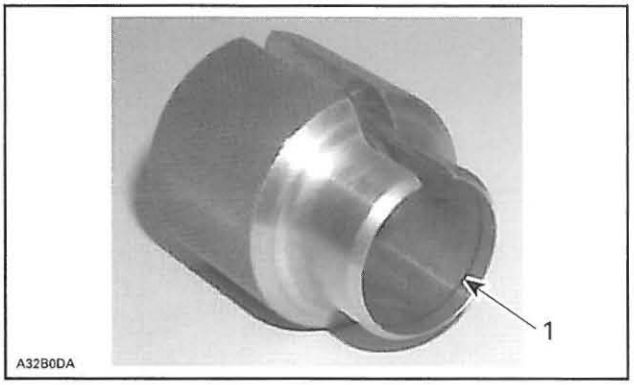

A32B0AA

With round end of pusher, position circlip perpendicularly to the support axis.


A32B0BA

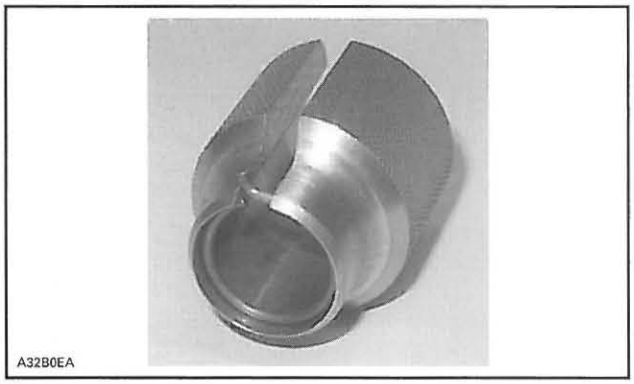
With the other end of the pusher, push circlip into the support groove.


A32B0CA



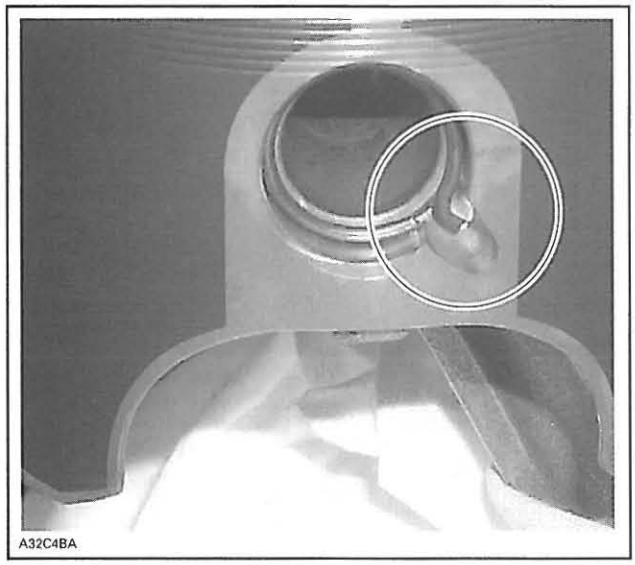
A32B0DA

1. Groove


A32B0EA

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to put circlip in place. Make sure to install new circlips with tab toward top as per following photo.


A32C4BA

TAB TOWARD TOP

CAUTION: Circlips must not move freely after installation; if so, replace them.

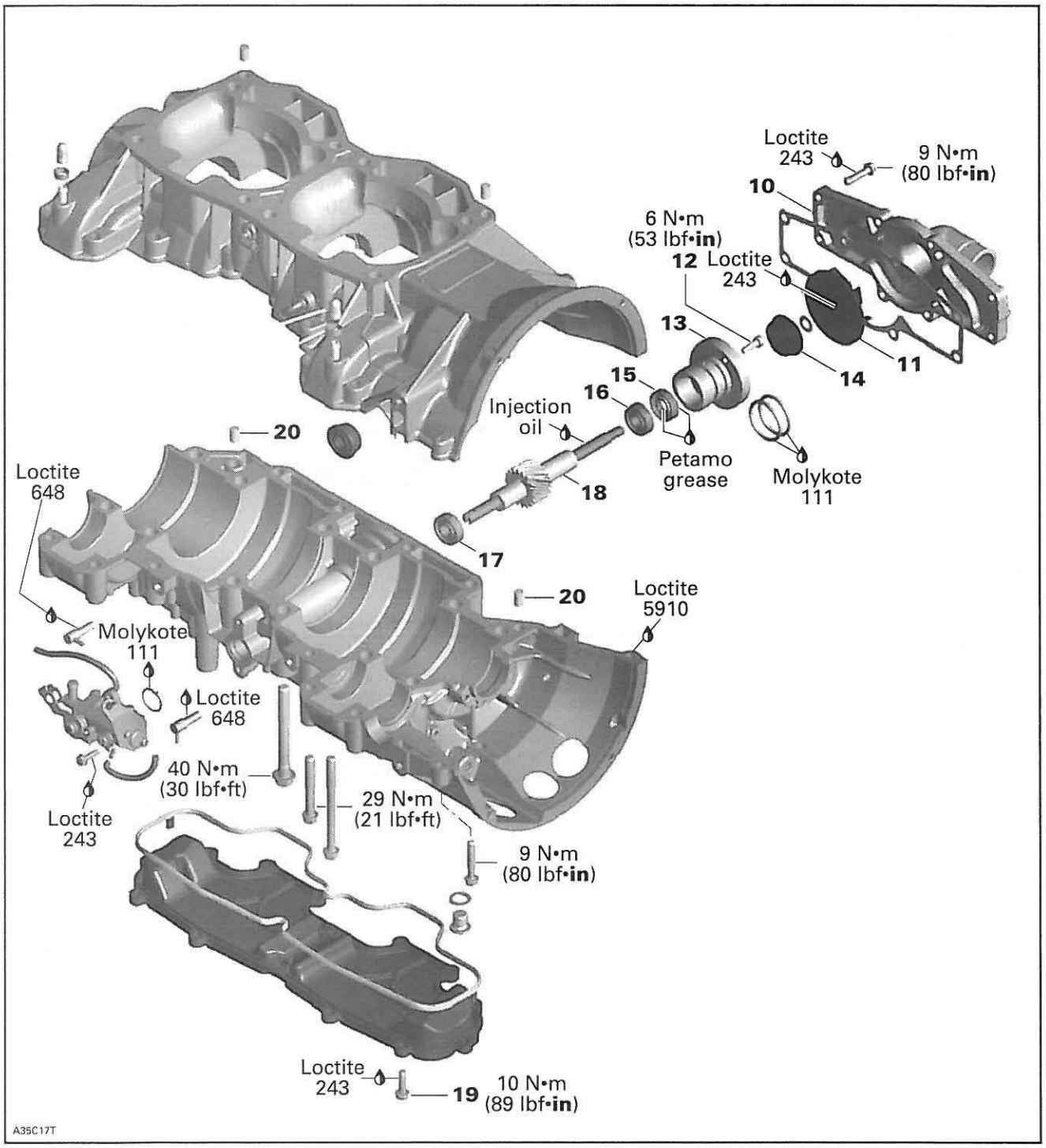
BOTTOM END

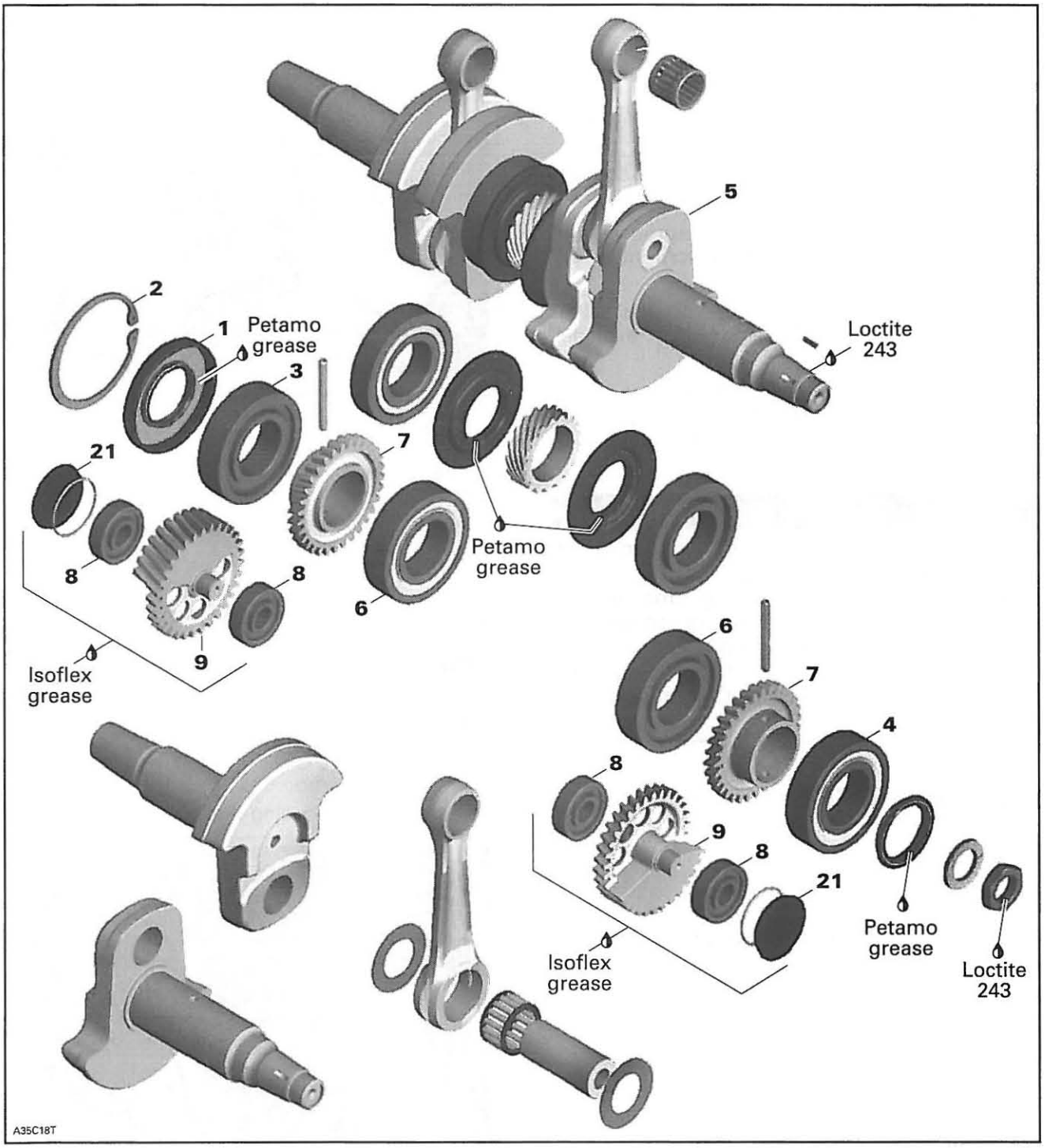
SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	84
bearing puller	529 036 004	83
ceramic seal installer	529 036 014	79
crankshaft protector	420 876 552	83
crankshaft protector	420 876 557	83
engine removal hook	529 035 829	86
half rings	420 977 479	82
oil seal protector	529 035 822	79
oil seal pusher	529 035 757	78
puller ring	420 977 494	82
screws	420 840 681	83
spark plug lift ring	529 035 830	86
temperature indicator stick	529 035 970	84

SERVICE PRODUCTS

Description	Part Number	Page
Isoflex grease	293 550 021	82
Loctite 5910	293 800 081	80
Loctite 767 (antiseize lubricant)	293 800 070	83
Loctite chisel	413 708 500	80
Petamo grease	420 899 271	76
pulley flange cleaner	413 711 809	83
XP-S Lube	293 600 016	83


Loctite 243
9 N•m (80 lbf•in)
10
6 N•m (53 lbf•in)
12
Loctite 243
13
11
14
15
16
Injection oil
Petamo grease
Molykote 111
20
18
Loctite 648
17
20
Loctite 5910
Molykote 111
Loctite 648
40 N•m (30 lbf•ft)
29 N•m (21 lbf•ft)
Loctite 243
9 N•m (80 lbf•in)
Loctite 243
19
10 N•m (89 lbf•in)
A35C17T


2
1
Petamo grease
3
21
7
8
8
9
6
Petamo grease
5
Loctite 243
Isoflex grease
6
7
4
8
9
8
21
Petamo grease
Isoflex grease
Loctite 243
A35C18T

GENERAL

Before disassembling the engine, proceed with an engine leak test. Refer to *LEAK TEST*.

To verify internal parts, refer to *ENGINE MEASUREMENT* section.

All oil seals and gaskets must be discarded and replaced with new ones when crankcase is split.

CAUTION: After rebuilding an engine always observe a break-in period as described in *OPERATOR'S GUIDE*.

During assembly/installation, use torque values and service products as shown in exploded view(s).

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

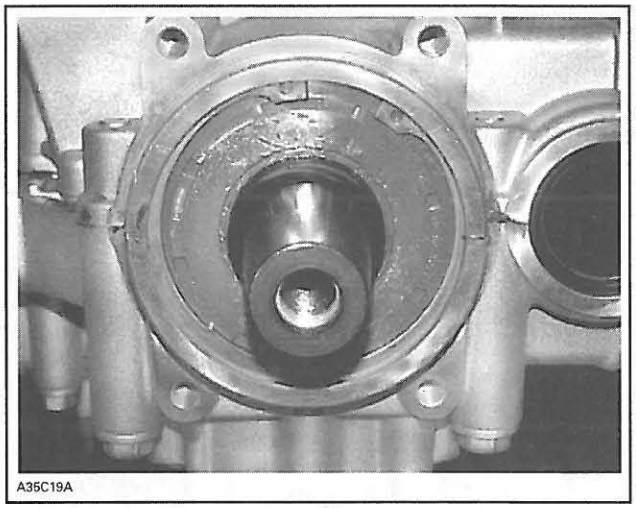
PTO SEAL

Removal

PTO seal **no. 1** may be removed without removing engine from vehicle.

Remove drive pulley, refer to *DRIVE PULLEY*.

Remove snap ring **no. 2** then extract seal.


A35C19A

Installation

Fill the inner side of seal with Petamo grease (P/N 420 899 271).

Push seal in place using a suitable tool.

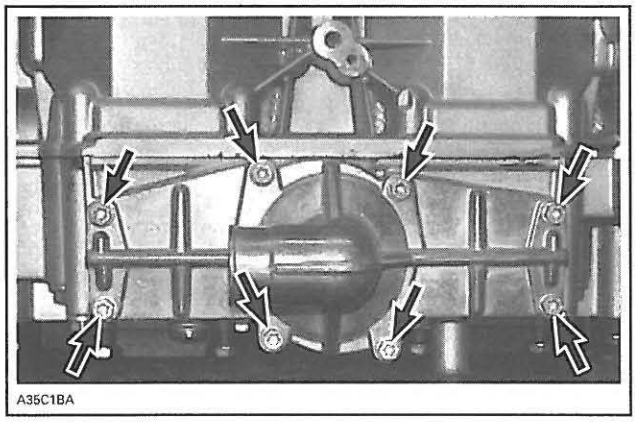
Reinstall snap ring.

COOLANT/OIL PUMP SHAFT

Removal

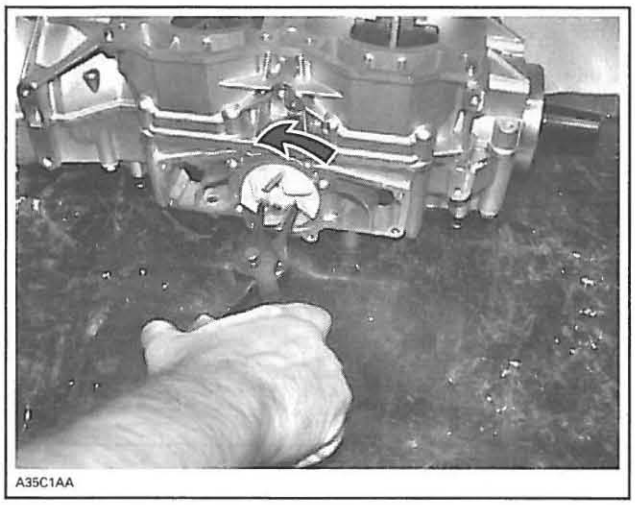
NOTE: It is not necessary to split up crankcase halves to pull out shaft.

Remove:
- injection oil pump
- coolant pump housing **no. 10**

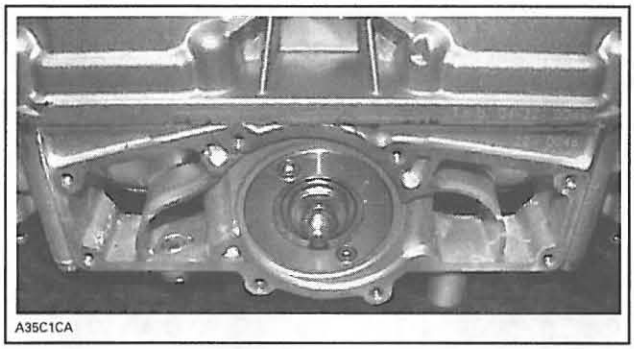

A35C1BA

- impeller **no. 11**

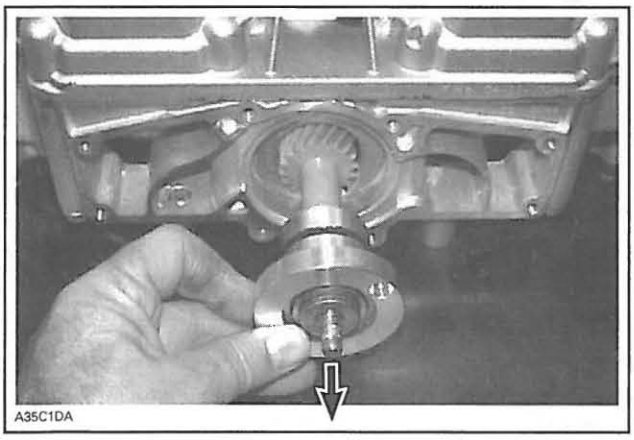
CAUTION: Be careful not to damage impeller fins.


A35C1AA

– bearing housing screws **no. 12**


A35C1CA

From injection oil pump side, push shaft out while turning shaft to release it from worm gear.

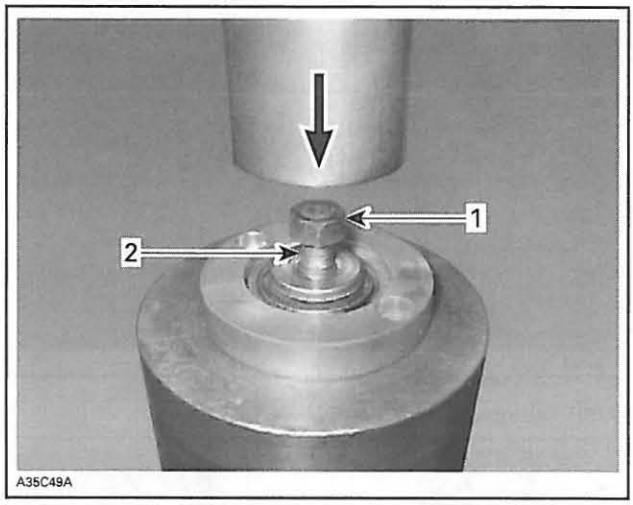

A35C1DA

Disassembly

CAUTION: Pay attention not to damage the bearing housing no. **13** during disassembly. Marks or other damages will lead to coolant and/or oil leaking.

NOTE: For disassembly/assembly procedure a press is required.

Protect the threads of shaft with a suitable M8 nut. Properly support bearing housing and push shaft out.

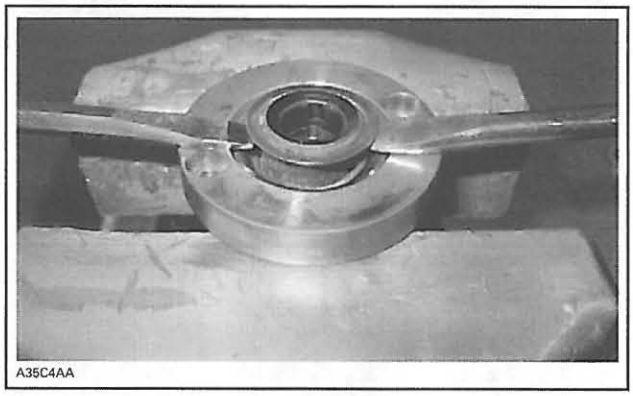


A35C49A

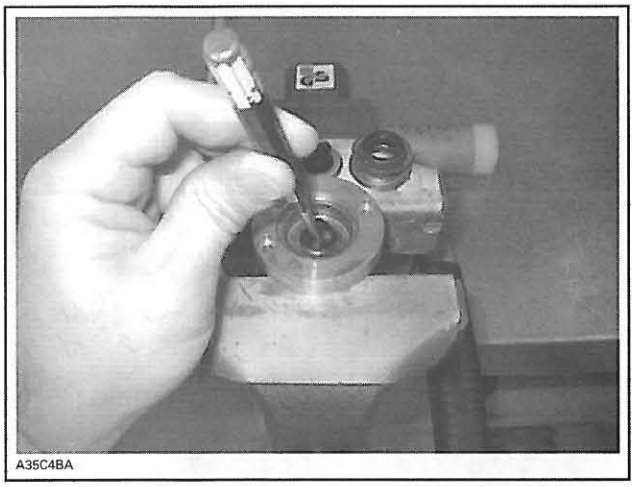
1. M8 nut
2. Shaft

CAUTION: When removing coolant/oil pump shaft, always replace ceramic seal no. **14** and oil seal no. **15**. Ceramic seal cannot be removed without damage.

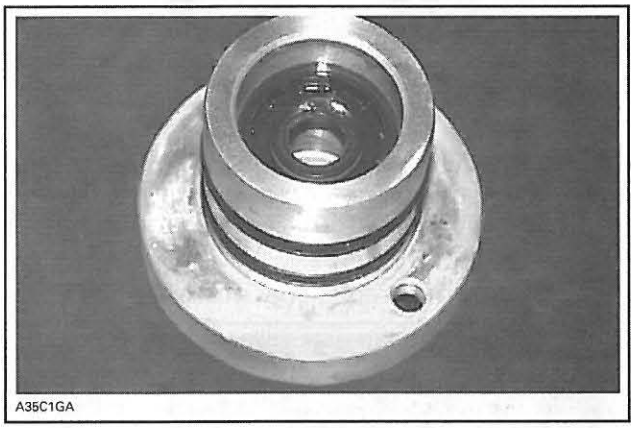
Pry inner part of ceramic seal **no. 14** out.


A35C4AA

Extract bearing **no. 16** from the bearing housing using an appropriate pusher.

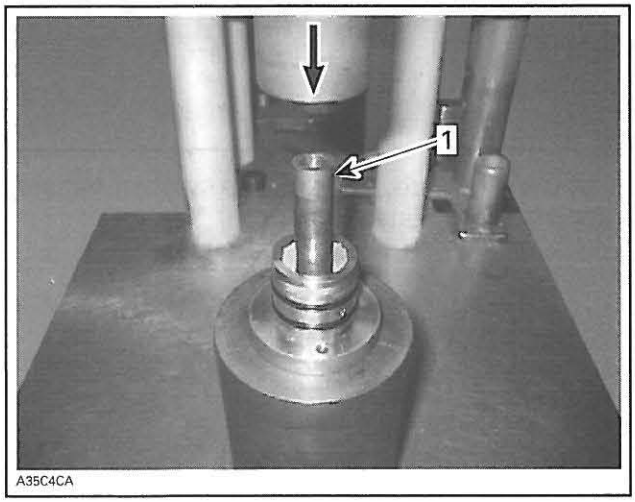

A35C4BA

Push oil seal **no. 15** out.


A35C1GA

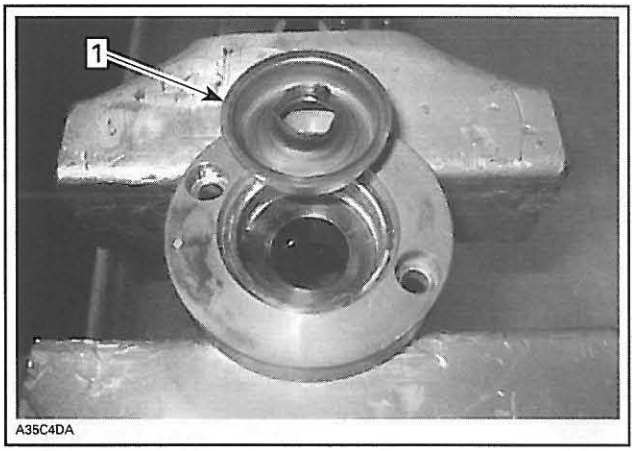
Carefully press the outer part of ceramic seal out.

NOTE: Use a mandrel with diameter of approximately 16 mm (.63 in).



A35C4CA

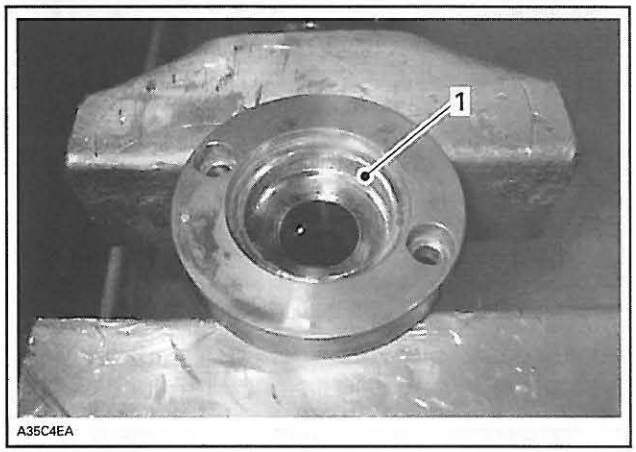
1. 16 mm (.63 in) mandrel



A35C4DA

1. Outer part of ceramic seal

Remove sealant from bearing housing with sand paper no. 180.



A35C4EA

1. Remove sealant

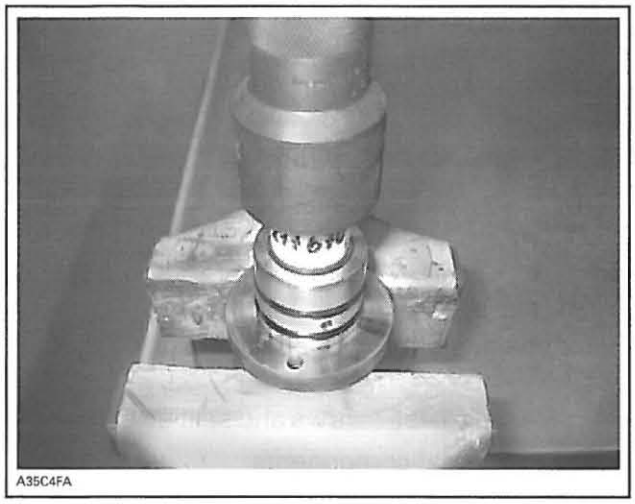
To extract bearing **no. 17** either use a hammer puller or an appropriate pusher.

Assembly

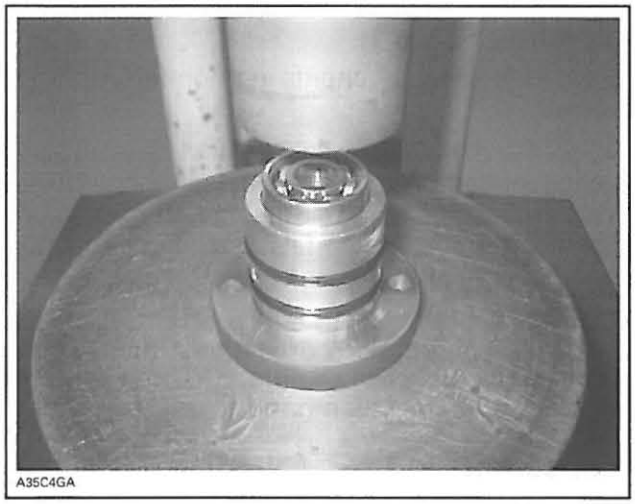
Reverse disassembly procedure and pay attention to the following.

NOTE: Never put oil in the press fit area of the oil seal and ceramic seal.

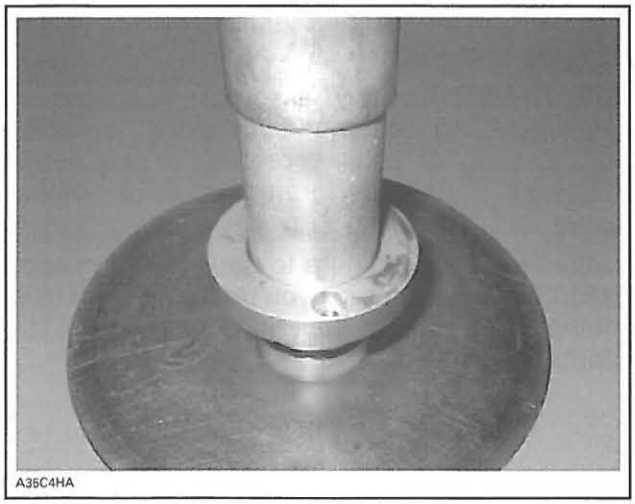
Push the new oil seal **no. 15** in bearing housing using the oil seal pusher (P/N 529 035 757).


A35C4FA

Press bearing **no. 16** into bearing housing **no. 13**.

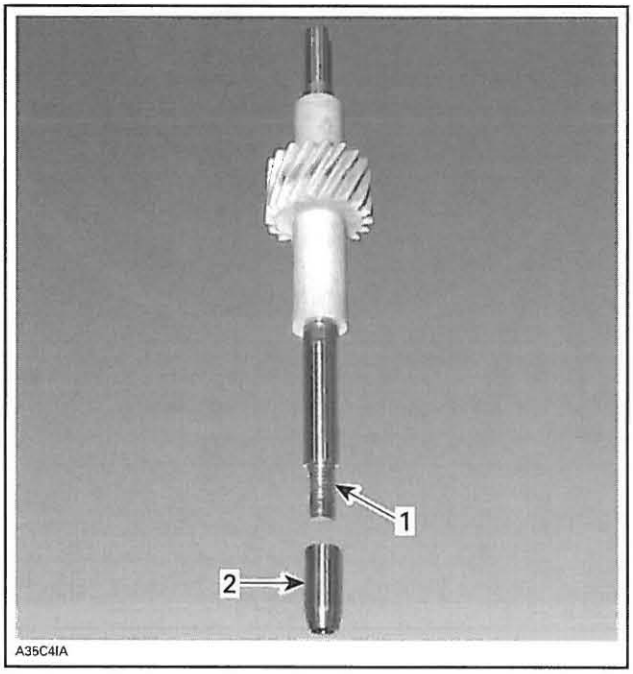

A35C4GA

Push the new ceramic seal **no. 14** in bearing housing **no. 13** using the ceramic seal installer (P/N 529 036 014).


A35C4HA

CAUTION: Never use a hammer for the ceramic seal installation. Only use a press to avoid damaging the ceramic component.

Put oil seal protector (P/N 529 035 822) on coolant/oil pump shaft **no. 18**.



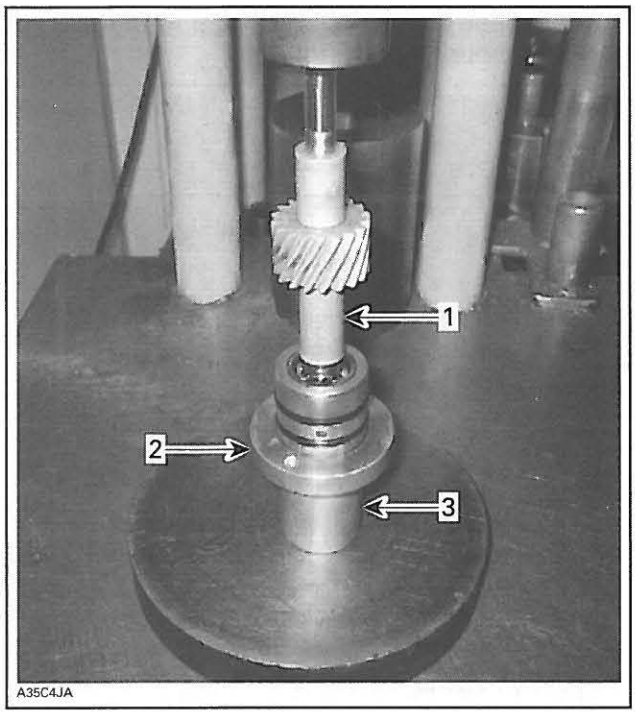
A35C4IA

1. Coolant/oil pump shaft
2. Oil seal protector

Press coolant/oil pump shaft **no. 18** into the bearing housing **no. 13** with appropriate force.

CAUTION: Inadequate force will damage the oil seal no. 15 and bearing no. 16.

NOTE: During installation support the ceramic seal using the ceramic seal installer (P/N 529 036 014) as shown on the following illustration.



1. *Coolant/oil pump shaft*
2. *Bearing housing*
3. *Ceramic seal installer*

Remove oil seal protector from coolant/oil pump shaft.

Installation

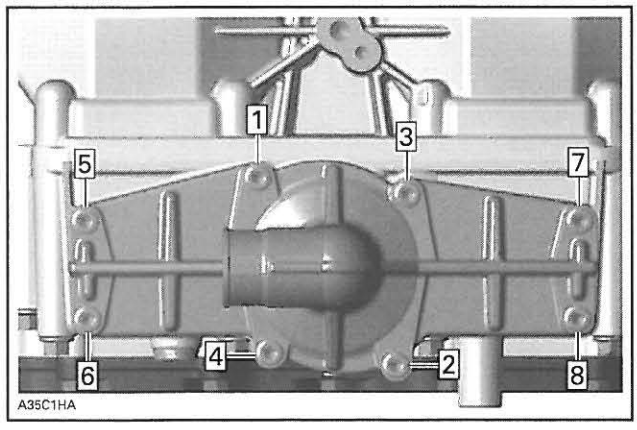
Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.

Install coolant/oil pump shaft assembly in crankcase half while turning shaft to mesh gears.

Torque housing screws **no. 12**.

After impeller installation, ensure shaft turns properly.

Torque impeller housing screws in the following sequence.



Reinstall oil injection pump.

CRANKCASE

Disassembly

Remove engine from chassis. Refer to *ENGINE REMOVAL AND INSTALLATION*.

Remove cylinder head and cylinder block. Refer to *TOP END*.

Remove rewind starter. Refer to *REWIND STARTER*.

Remove magneto flywheel, stator and CPS. Refer to *MAGNETO SYSTEM*.

Remove crankcase screws and split up crankcase.

Remove internal components.

Discard all oil seals, gaskets, O-rings and sealing rings.

Cleaning

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

Crankcase mating surfaces are best cleaned using a combination of the Loctite chisel (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: Never use a sharp object to scrape away old sealant as score marks incurred are harmful to crankcase sealing. Do not wipe with rags. Use a new clean hand towel only.

Inspection

Check crankcase for cracks or other damages. Replace if necessary.

Assembly

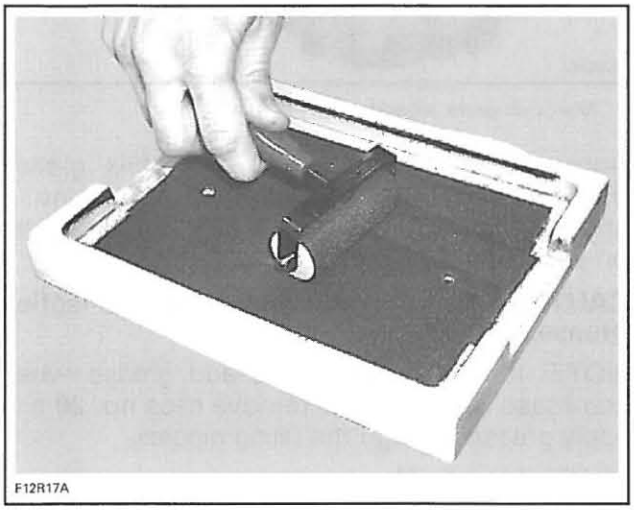
Use the Loctite 5910 (P/N 293 800 081) on mating surfaces of crankcase.

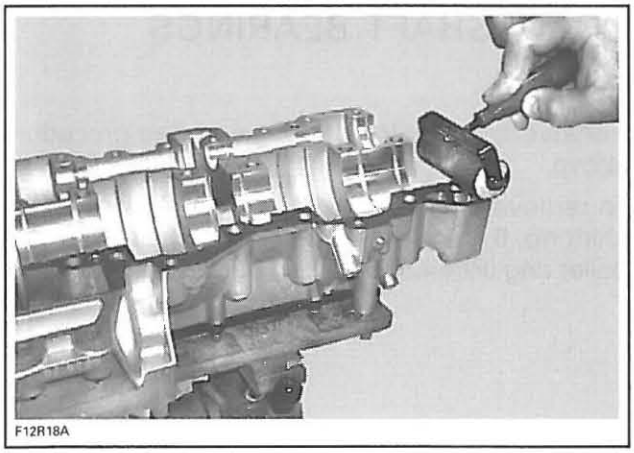
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence, must be performed within 10 minutes.

NOTE: It is recommended to apply the 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 the sealant.

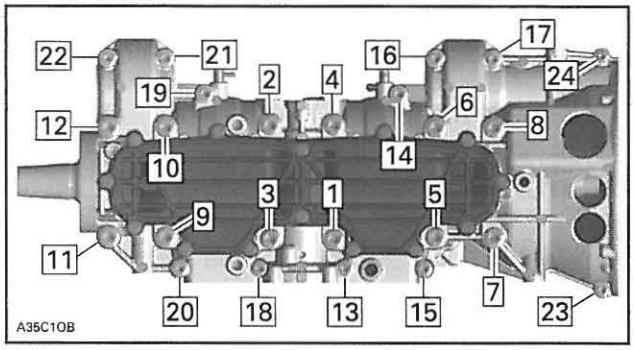
CAUTION: Do not use an activator with the Loctite 5910. Do not use other products to seal crankcase. Using other products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. Even after cleaning, the Loctite 5910 would leave incompatible microscopic particles.

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.


F12R17A


F12R18A

Torque crankcase screws in the following sequence. Initially torque M10 screws half the final torque then, tighten all screws to the required torque.



Ensure snap ring **no. 2** is properly installed in crankcase.

Install all other removed parts. Refer to proper sections for detailed procedures.

CAUTION: After rebuilding an engine always observe a break-in period as described in *OPERATOR'S GUIDE*.

CRANKSHAFT/ COUNTERBALANCE GEARS

Removal

To remove crankshaft, use crankcase disassembly procedure.

Remove counterbalance gears then the crankshaft.

Inspection

Refer to table below to find bottom end engine dimension specifications. For measurement procedures, refer to *ENGINE MEASUREMENT* section.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.03 mm (.0012 in)	0.06 mm (.0025 in)
Crankshaft deflection on MAG side	N.A.	0.05 mm (.002 in)	N.A.
Crankshaft deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	0.23 mm (.009 in)	0.62 mm (.024 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

Inspect crankshaft ends for damage.

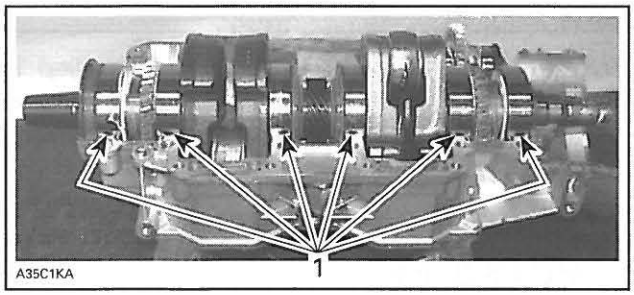
Inspect counterbalance gear teeth for damage or excessive wear. Replace as required.

NOTE: Always replace counterbalance gear and drive gear together.

Installation

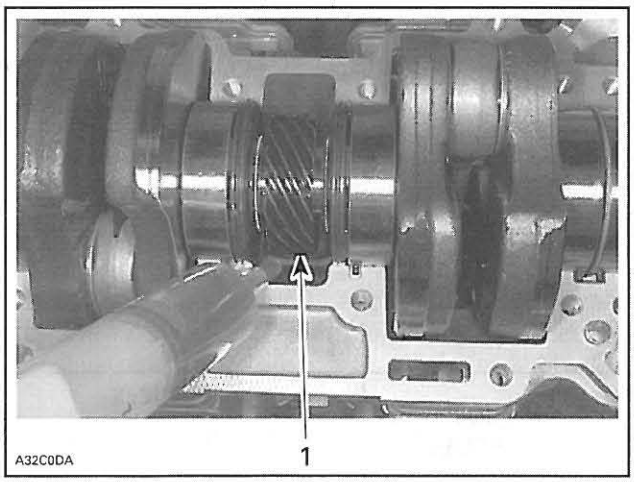
NOTE: Although not mandatory, it is recommended to have the coolant/oil pump shaft installed prior to installing crankshaft.

At crankshaft installation, position locating pins as illustrated.



1. Locating pins

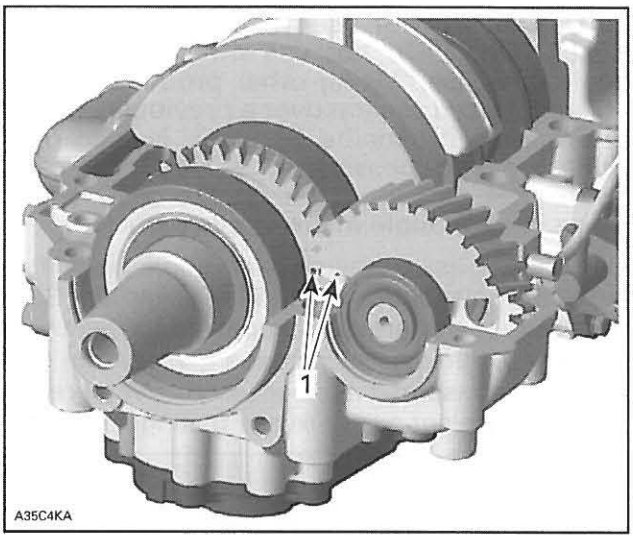
Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.



TYPICAL
1. Oil bath

Install counterbalance gears and make sure to properly index aligning marks with crankshaft drive gears.

CAUTION: Marks on the gears must be aligned, otherwise engine will vibrate and premature wear will occur.



1. Marks on gears aligned

Apply 40 mL (1.4 U.S. oz) of Isoflex grease (P/N 293 550 021) on counterbalance gear **no. 9** and 5 mL (0.2 U.S. oz) on drive gear **no. 7**. Repeat on each side (PTO/MAG).

CAUTION: Use only the recommended Isoflex grease.

NOTE: If it is necessary to add grease when crankcase is assembled, remove caps **no. 20** and apply grease through the filling nipples.

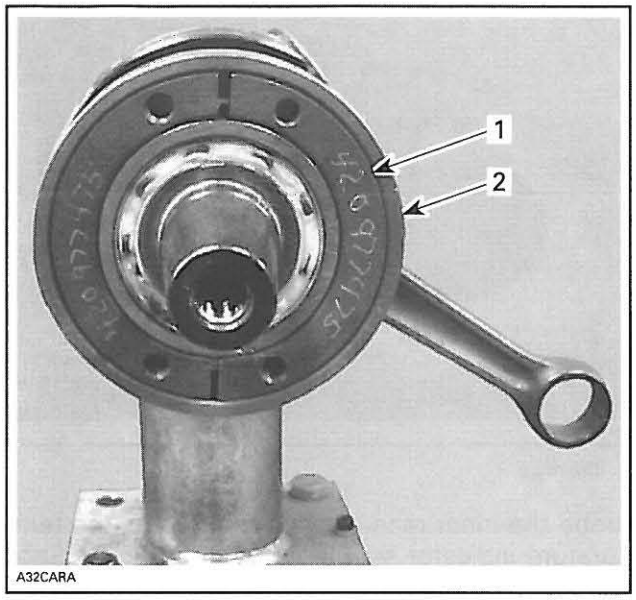
Install caps **no. 21**.

CRANKSHAFT BEARINGS

Removal

Remove crankshaft from engine. See procedure above.

To remove bearings **no. 3** and **no. 4** from crankshaft **no. 5**, install half rings (P/N 420 977 479) and puller ring (P/N 420 977 494) on the outer bearing.

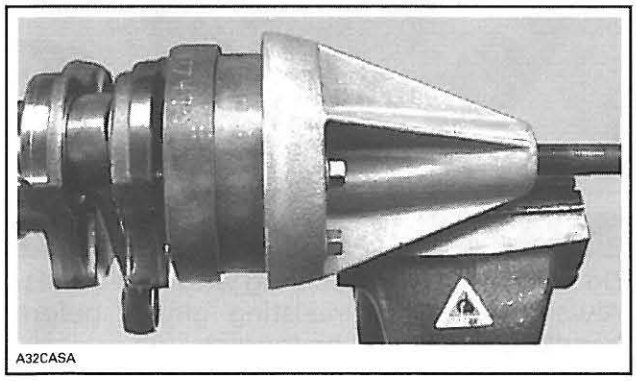


TYPICAL
1. *Half ring*
2. *Puller ring*

NOTE: Apply grease on crankshaft end in order to hold in place the crankshaft protector (P/N 420 876 552) on PTO side and crankshaft protector (P/N 420 876 557) on MAG side.

Using screws (P/N 420 840 681), install bearing puller (P/N 529 036 004) on the half rings.

Secure the bearing puller in a vise by one of its rib.



BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with XP-S Lube (P/N 293 600 016) to avoid damaging the threads.

Screw in the puller bolt until the bearing comes out.

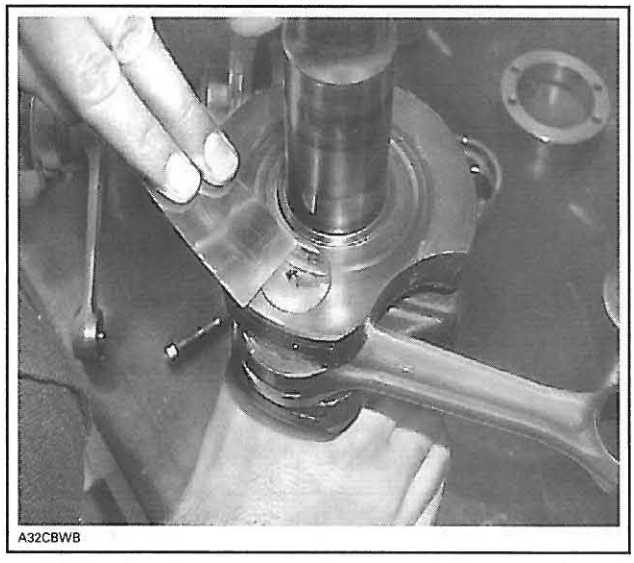
NOTE: To remove/install bearing no. 6 and gear no. 7 from crankshaft, refer to a specialized shop. Special tools and accurate procedures are required.

CAUTION: Do not attempt to remove inner bearing or gear. Gear could be damaged.

Installation

Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.

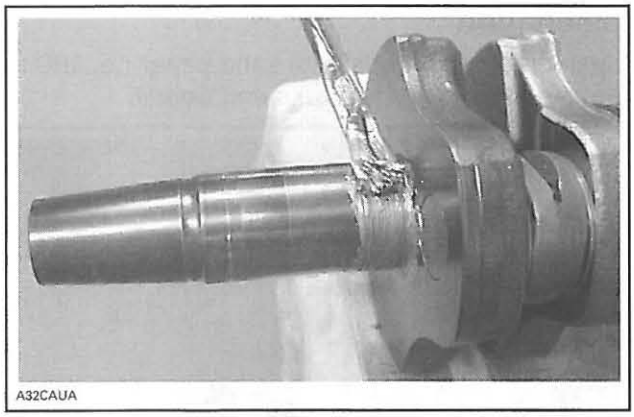
TYPICAL



TYPICAL

Remove all residue using pulley flange cleaner (P/N 413 711 809).

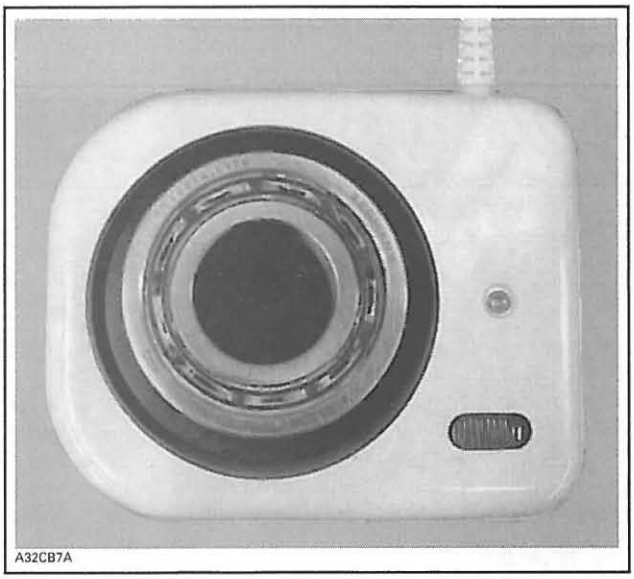
Smear Loctite 767 (antiseize lubricant) (P/N 293 800 070) on part of crankshaft where bearing fits.


A32CAUA

TYPICAL

CAUTION: Never reinstall a bearing that has been removed.

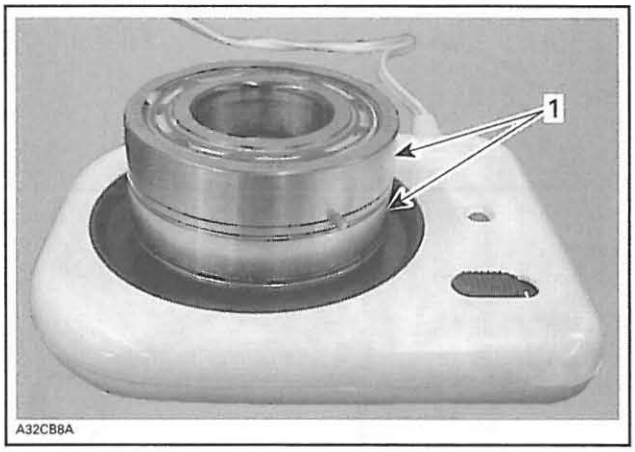
Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal with the heating surface.


A32CB7A

CAUTION: Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) on direct flame, or with a heat gun or in an oil bath. Inappropriate bearing(s) heating may result in inner seals or cage failure.

Turn bearing several times to obtain an even heating process.

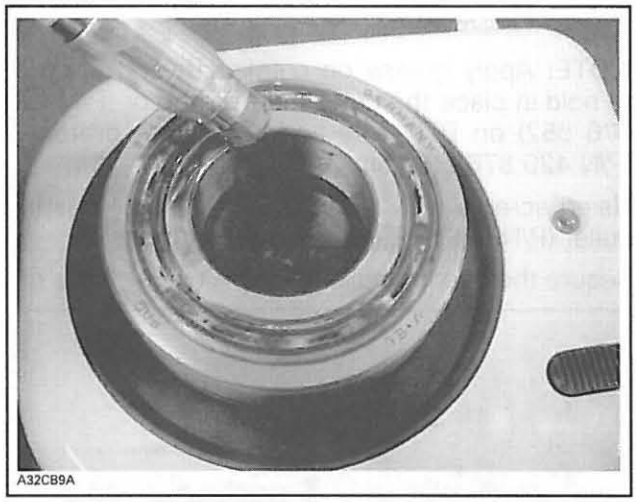
NOTE: Normally it takes approximately 10 minutes to heat up a bearing so in the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. Two bearings can be heated at the same time on one bearing heater.



A32CB8A

1. Bearings

Probe the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.


A32CB9A

⚠ WARNING

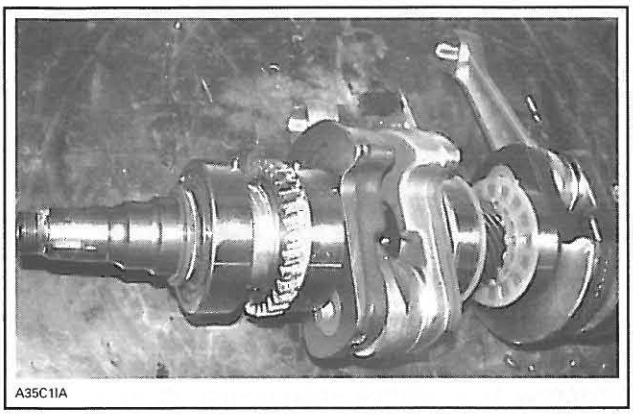
Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

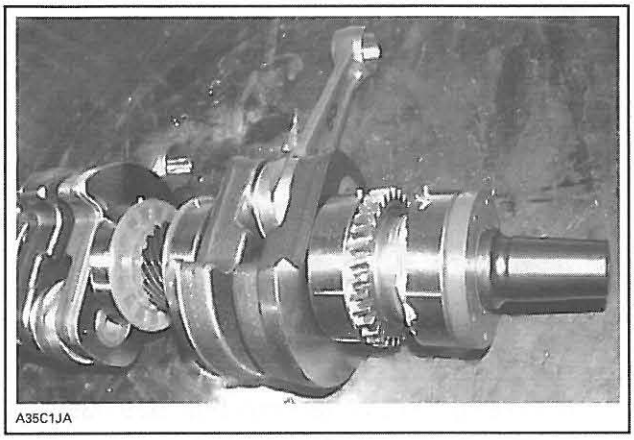
NOTE: To install bearings **no. 6** and gears **no. 7** onto the crankshaft, refer to a specialized shop. Special tools and accurate procedures are required.

Slide bearings **no. 3** and **no. 4** with the integrated seal facing crankshaft. Push bearing to end position.

NOTE: Heated bearings will slide onto the crankshaft. If required, push with a steel tube on the inner ring of the bearing. **Pay special attention to correct positioning of the locating pins.**

Install seals on crankshaft.


A35C1IA


A35C1JA

Install crankshaft into crankcase.

Install all other removed parts.

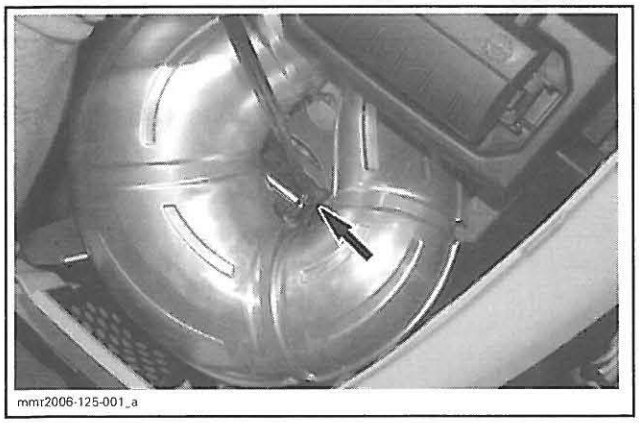
HEAT EXCHANGER COVER

Removal

NOTE: To remove the heat exchanger cover, the engine removal is not necessary.

Drain coolant. Refer to *COOLING SYSTEM*.

Open hood and remove the front tuned pipe spring.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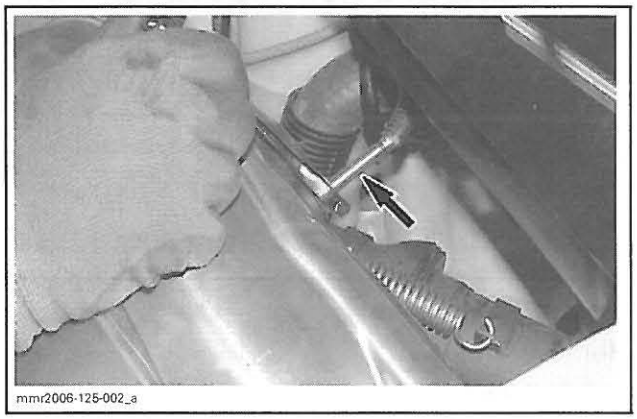
RH Side of Vehicle

Remove side panel.

Unscrew the exhaust gas temperature sensor (EGTS) from muffler.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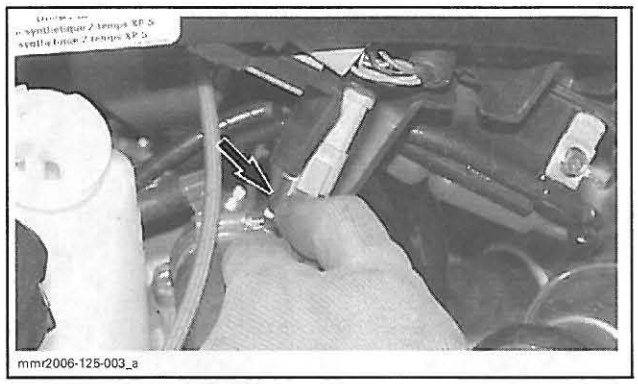
Remove muffler from vehicle.

Unplug the coolant temperature sensor (CTS) connector.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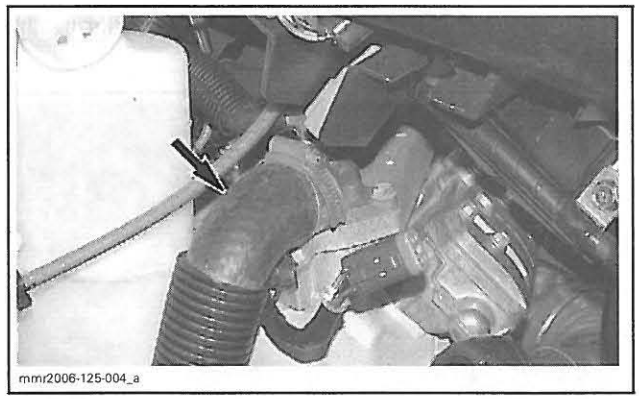
Disconnect the engine cooling outlet hose from cylinder head.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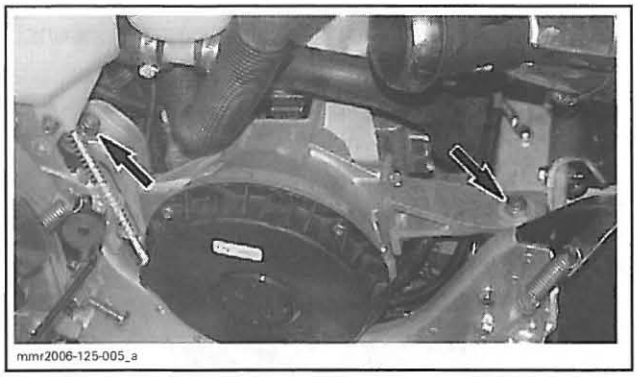
Unscrew and remove both engine support nuts.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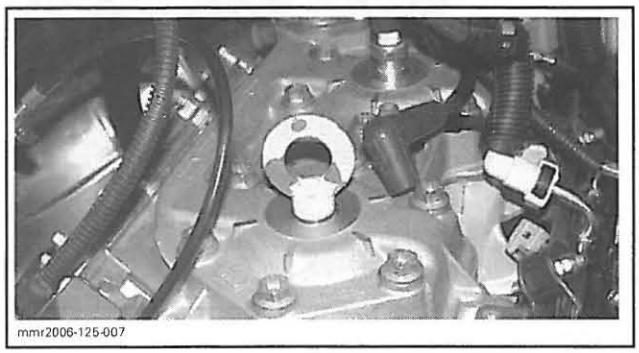
LH Side of Vehicle

Remove:
- side panel
- drive and driven pulleys (refer to *DRIVE SYSTEM*)
- primary air intake silencer (refer to *AIR INTAKE SYSTEM*)
- left frame member.


mmr2006-125-006_a

Replace the PTO spark plug with the spark plug lift ring (P/N 529 035 830).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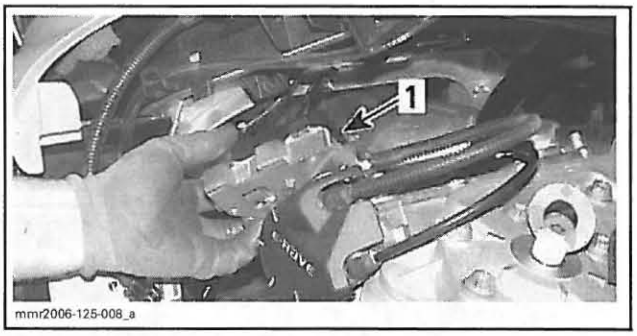
Remove E-RAVE actuator by unscrewing the bolt that attach the actuator to frame.



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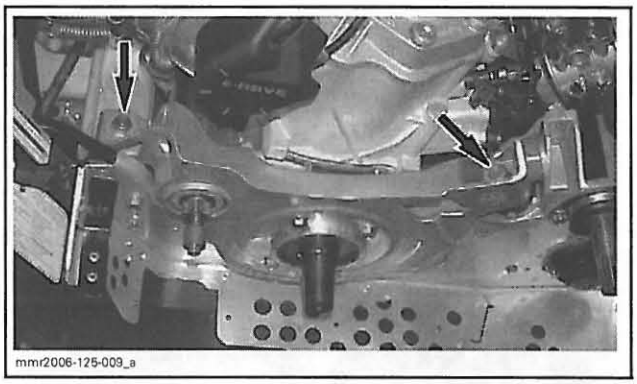
1. E-RAVE actuator

Unscrew and remove engine support nuts.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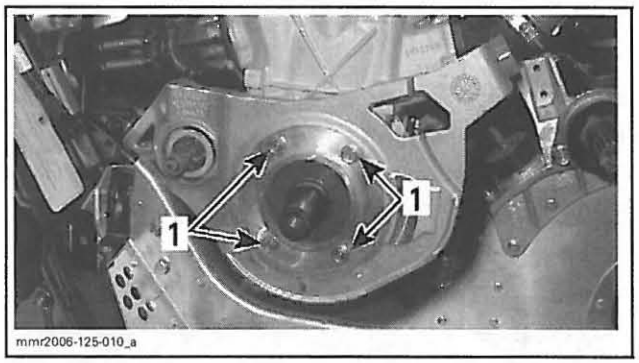
Install the engine removal hook (P/N 529 035 829) and lift engine until support is free.

Remove the PTO engine support from engine by unscrewing support bolts.



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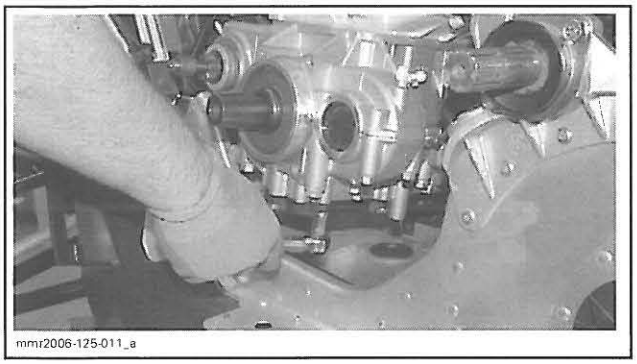
1. Support bolts

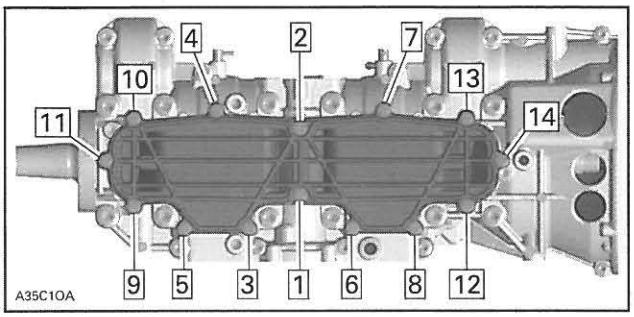
Remove all heat exchanger bolts (14) then the heat exchanger.



Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

When torquing heat exchanger bolts **no. 19**, use the following sequence.



Reinstall all removed parts in accordance with the procedures in specific sections.

NOTE: Make sure to bleed cooling system.

ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	93
dial indicator	414 104 700	92–93

NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to *INSPECTION* in the appropriate *ENGINE* subsection.

CYLINDER HEAD WARPAGE

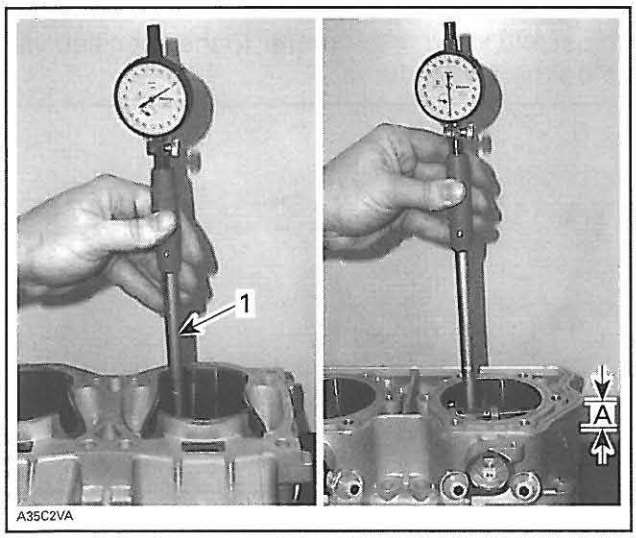
Check gasketed surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification. If cylinder head is out of specification, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

CYLINDER TAPER

Compare cylinder diameter 33 mm (1.3 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

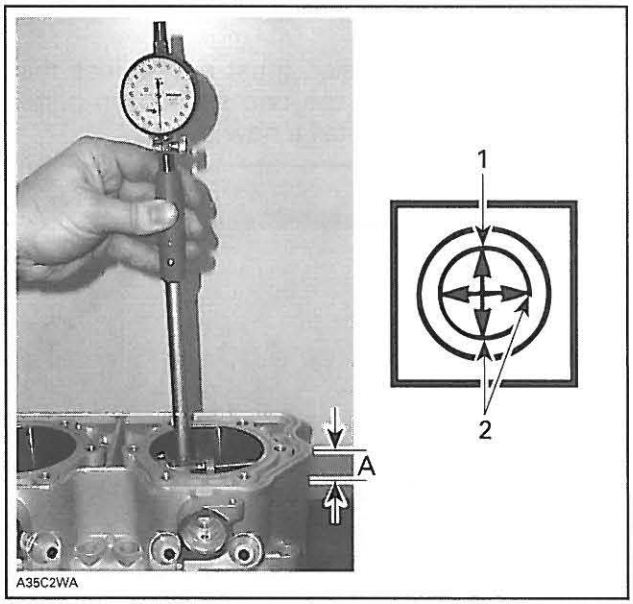


1. Below the intake port
A. 33 mm (1.3 in) from top

CYLINDER OUT OF ROUND

Measuring 33 mm (1.3 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but cannot be rebored.

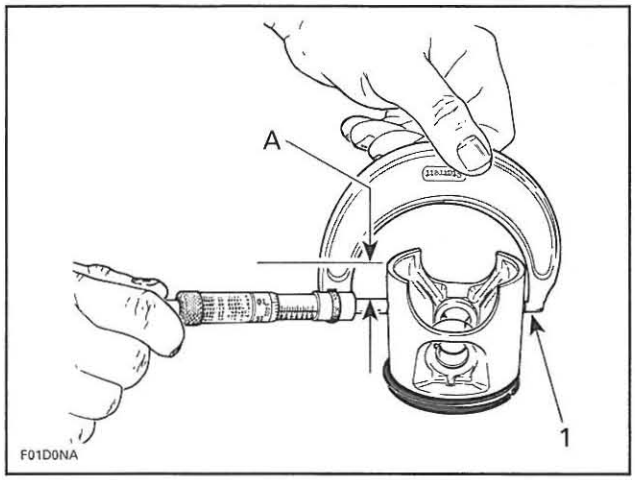
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. 33 mm (1.3 in)

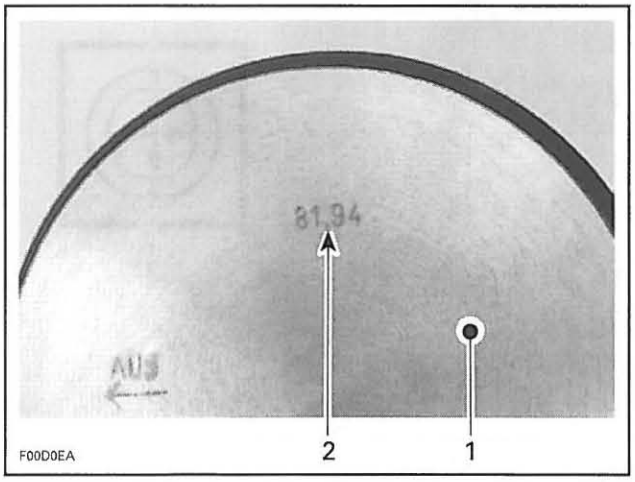
USED PISTON MEASUREMENT

Using a micrometer, measure piston at A perpendicularly (90°) to piston pin.



TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 15 mm (.590 in)

The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.



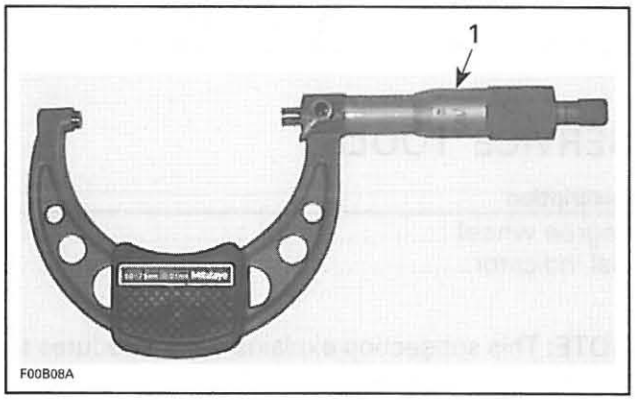
1. Piston dome
2. Piston measurement

CYLINDER/PISTON CLEARANCE

Procedure with a Used Piston

Measure piston as explained in *USED PISTON MEASUREMENT* above. Make sure piston is within specifications.

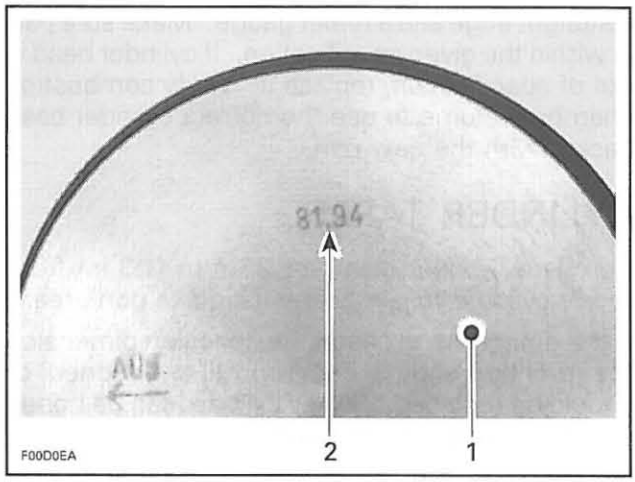
Adjust and lock the micrometer to the piston dimension.



1. Micrometer set to the piston dimension

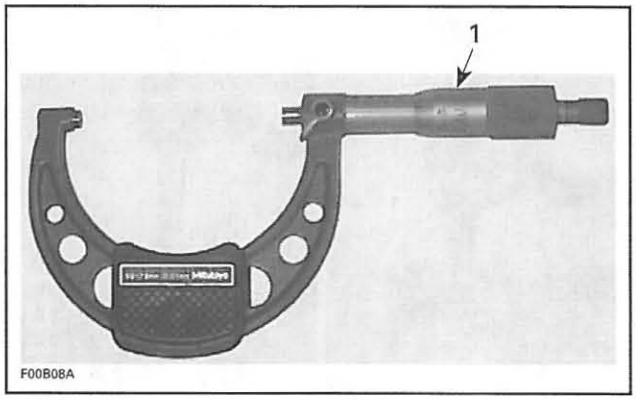
Procedure with a New Piston

Take the measurement on the piston dome.



1. Piston dome
2. Piston measurement

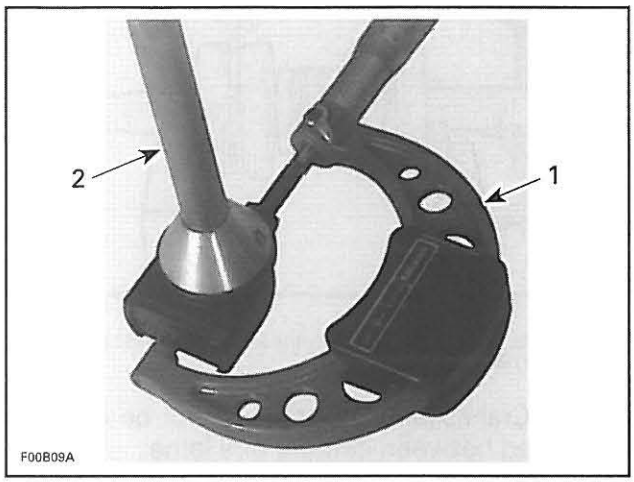
Adjust and lock a micrometer to the specified value on the piston dome.



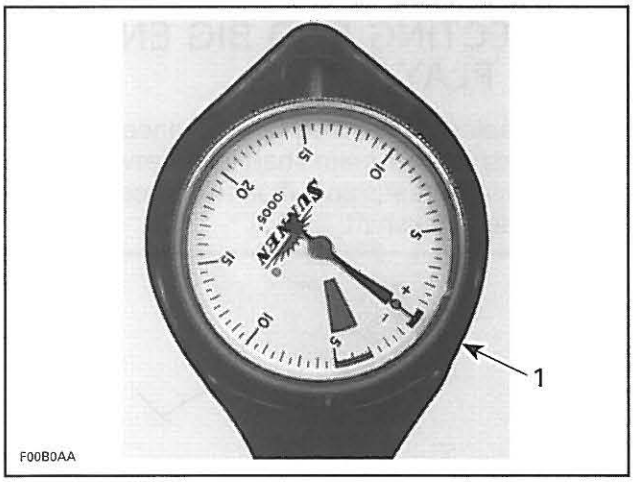
1. Micrometer set to the piston dimension

Procedure Continuation with a New or Used Piston

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge

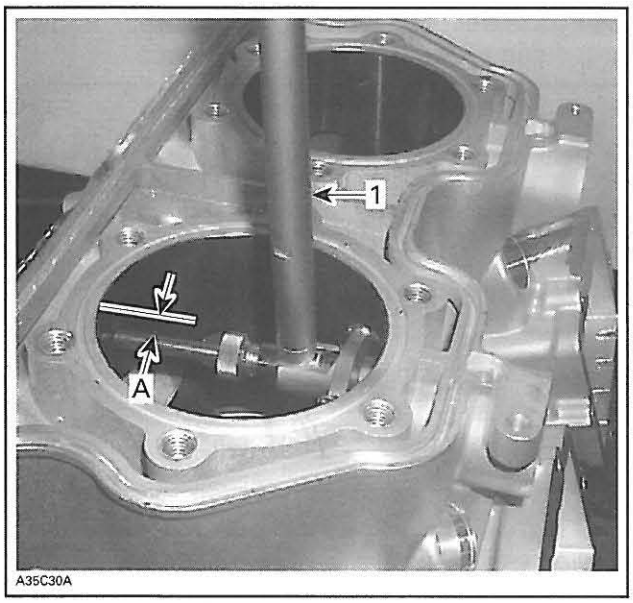


1. Indicator set to 0 (zero)

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 at 33 mm (1.3 in) below cylinder top edge.

IMPORTANT: Always remove cylinder-block from crankcase before measuring.

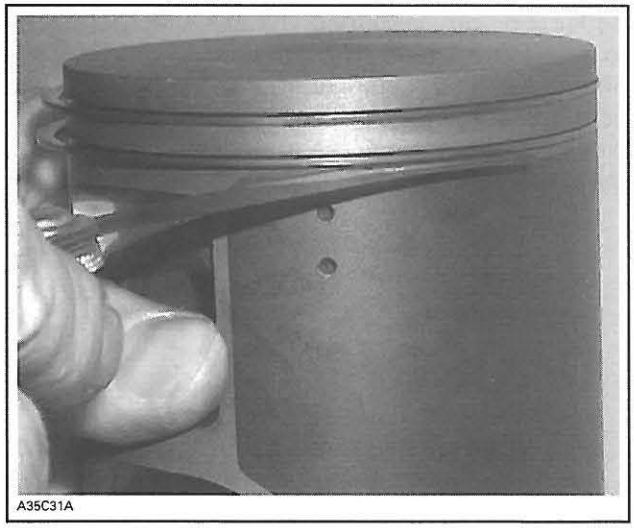


1. Measuring perpendicularly (90°) to piston pin axis
A. 33 mm (1.3 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder-block and pistons.

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

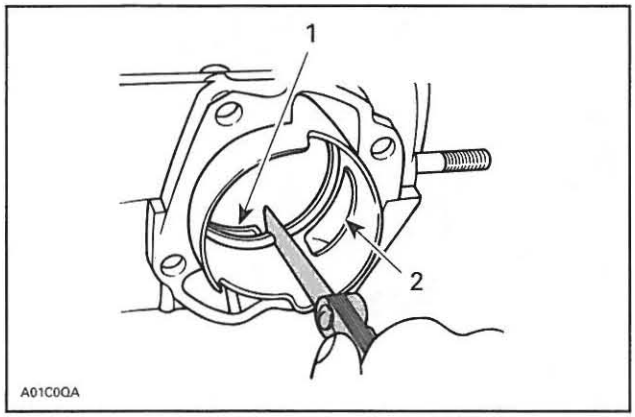


RING END GAP

Position ring halfway between transfer ports and intake port.

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 specified tolerance.



TYPICAL
1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

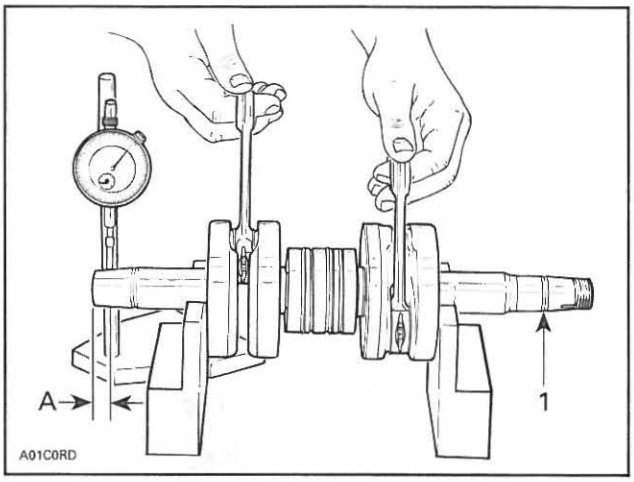
Crankshaft deflection is measured with the dial indicator (P/N 414 104 700).

Measuring in Crankcase

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring on Bench

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement "A" in following illustration.



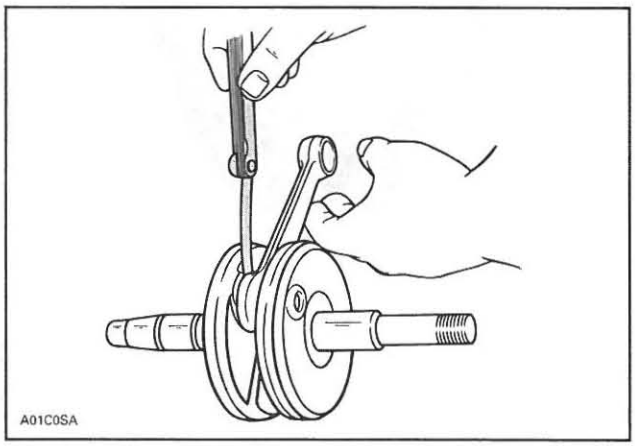
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.

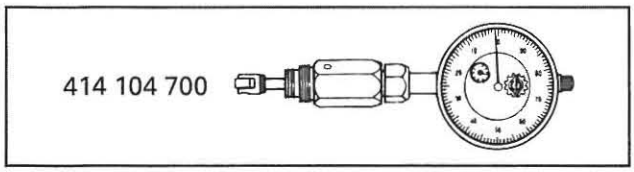


TYPICAL

CRANKSHAFT ALIGNMENT

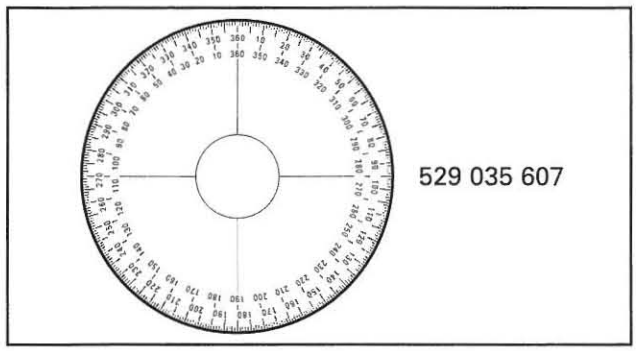
Remove both spark plugs.

Install the dial indicator (P/N 414 104 700) in spark plug hole on MAG side.



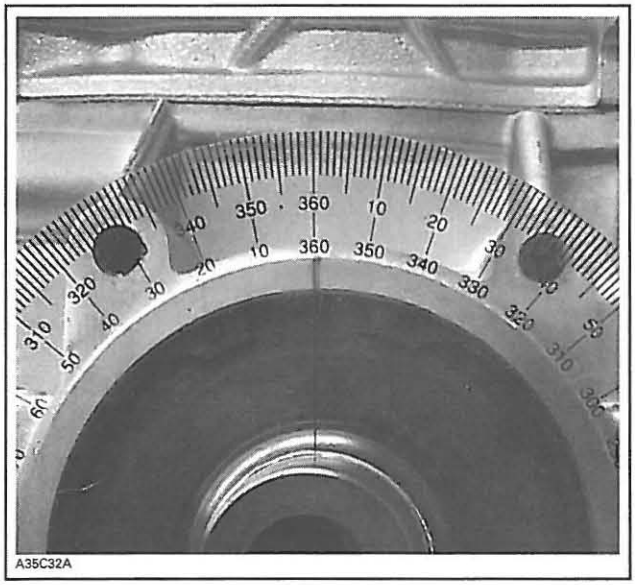
Bring MAG piston at top dead center.

Install the degree wheel (P/N 529 035 607) on crankshaft end.



Scribe a mark on crankcase.

Install degree wheel so that 360° mark aligns with the mark on crankcase. Do not rotate crankshaft.



Remove dial indicator and install it in spark plug hole on PTO side.

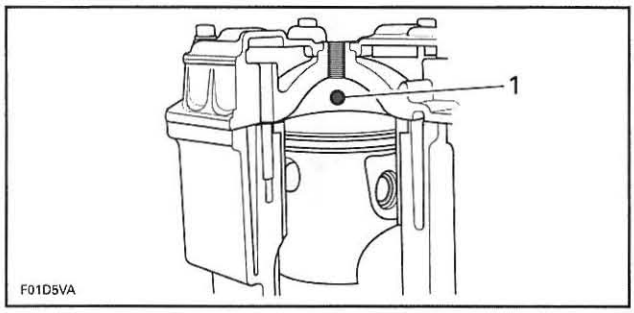
Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

COMBUSTION CHAMBER VOLUME MEASUREMENT

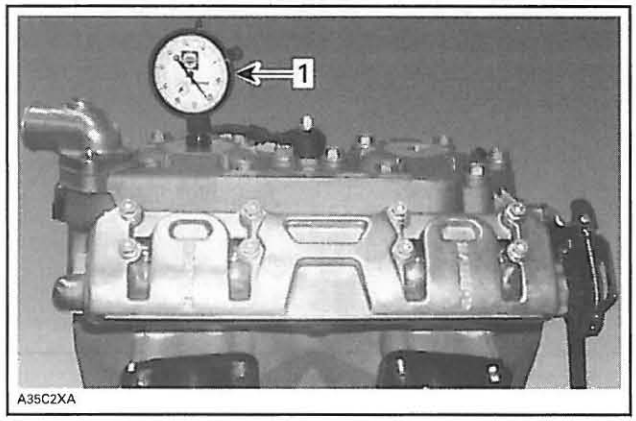
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center (TDC). It is measured with the cylinder head installed on the engine.



TYPICAL
1. Combustion chamber

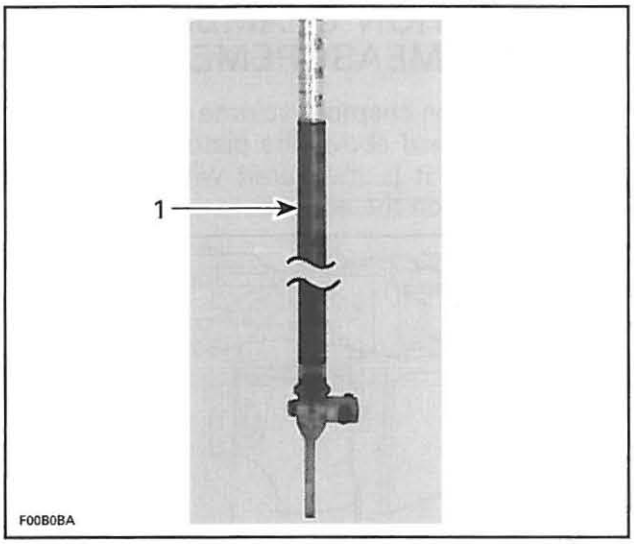
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using the dial indicator (P/N 414 104 700).



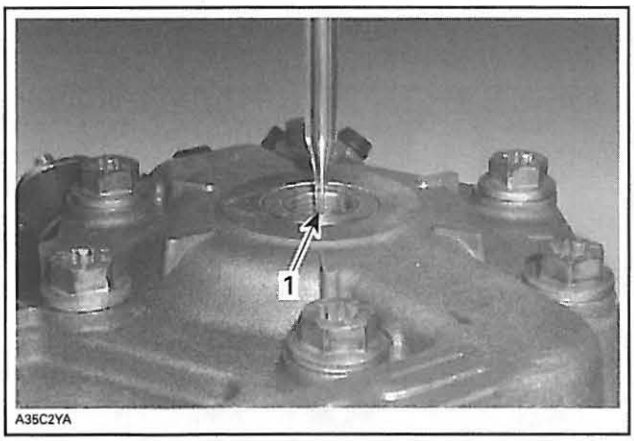
1. Bring piston to TDC

– Obtain a graduated burette (capacity 0 - 50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0 - 50 cc)

- Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
- Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

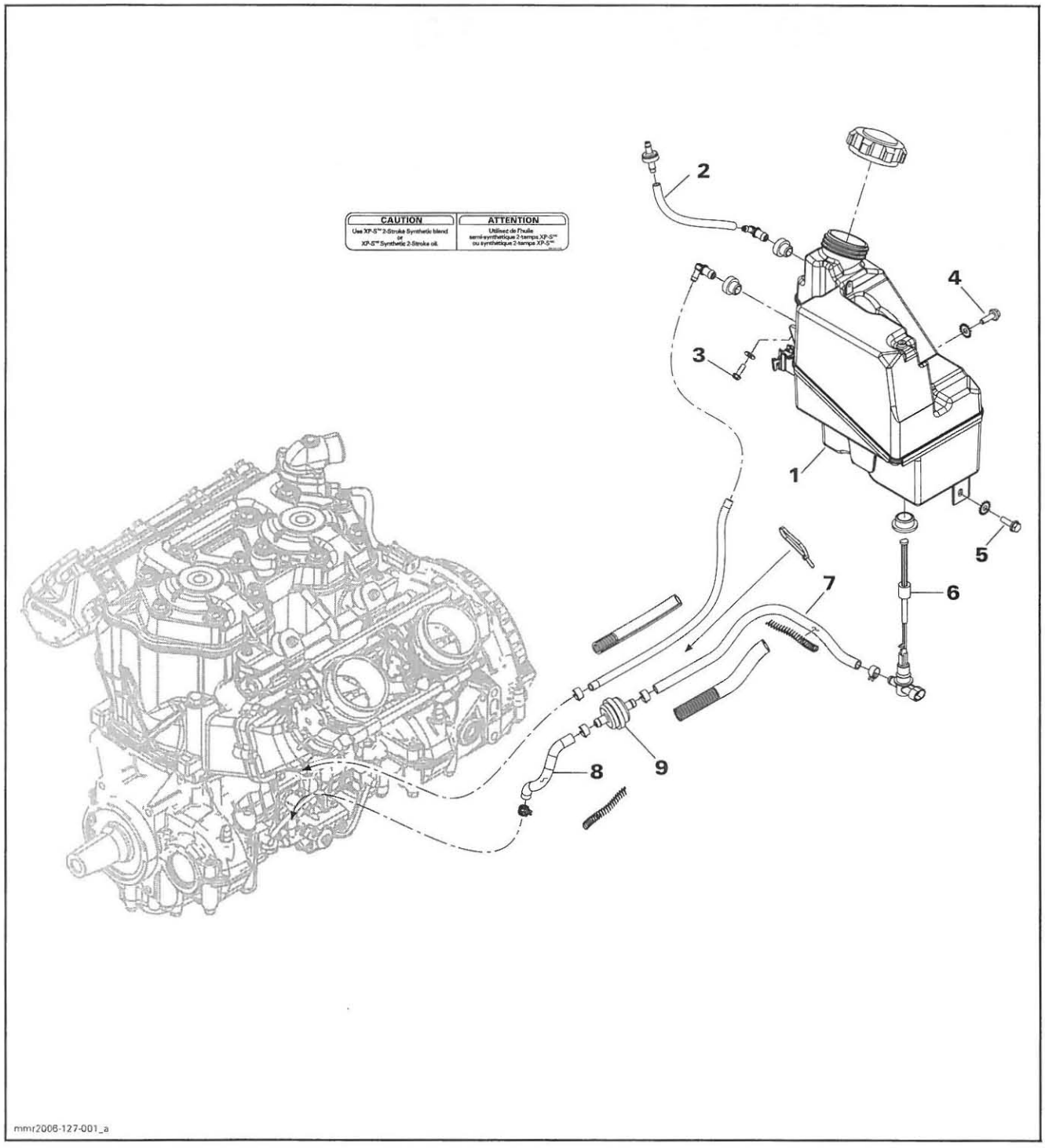
- Let burette stand upward for about 10 minutes, until liquid level is stabilized.
- Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

- Repeat the procedure for the other cylinder.
- Install a thicker or thinner cylinder/crankcase gasket (refer to *PARTS CATALOGS*) in order to obtain the specified combustion chamber volume or the nearest.

OIL INJECTION SYSTEM

SERVICE TOOLS


CAUTION
ATTENTION
1
2
3
4
5
6
7
8
9
mmr2006-127-001_a

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

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* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

CAUTION: Do not use a hose pincher on inlet/outlet hoses. This would damage the spring inside hose.

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

OIL TYPE

MODEL	OIL TYPE
2-TEC SDI	XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil (1)

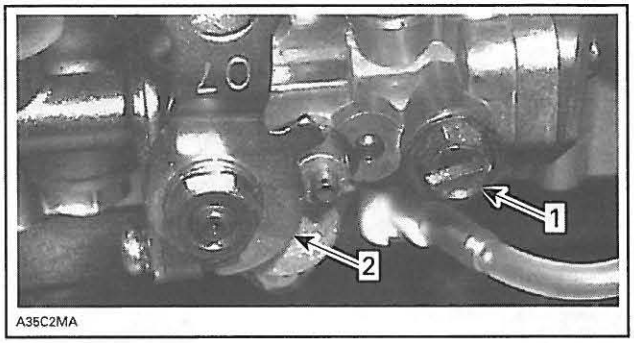
(1) **CAUTION: The XP-S synthetic 2-stroke oil and the XP-S synthetic blend 2-stroke oil are specially formulated and tested for the severe requirement of these engines. Use of any other brand two-stroke oil may void the limited warranty. Use only XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

PROCEDURES

OIL SYSTEM BLEEDING

CAUTION: Always bleed oil pump when the system has been opened.

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw until air has escaped from the line. Add injection oil as required.



1. Bleeder screw
2. Oil pump lever

Reinstall all parts.

Bleed the small oil line between pump and engine by running engine at idle while holding the pump lever in fully open position.

NOTE: Make a J hook out of mechanical wire to lift the lever.

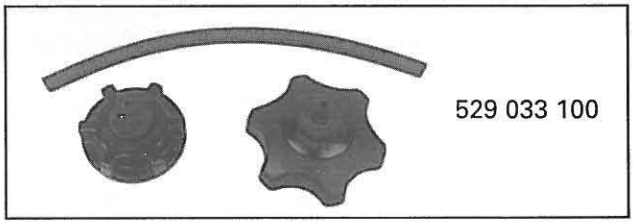
⚠ WARNING

Do not operate throttle mechanism. Secure the rear of the vehicle on a stand.

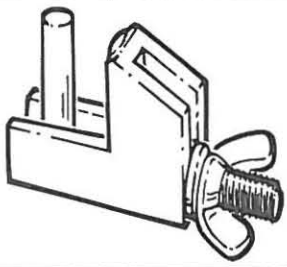
OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil reservoir **no. 1** and all other component of oil system.

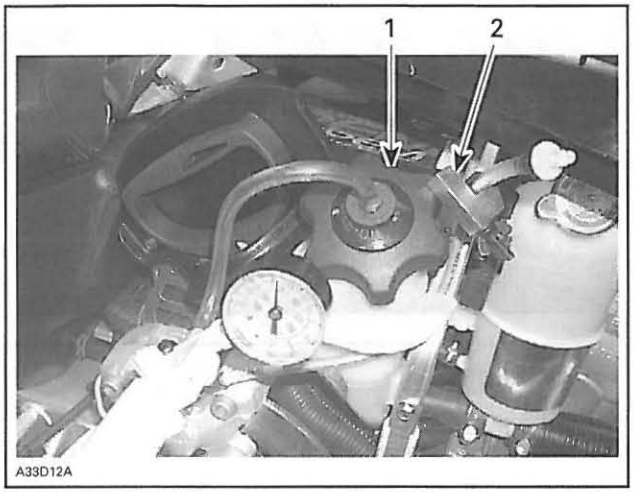
Install special cap of leak testing kit (P/N 529 033 100) on oil reservoir.



Install hose pincher (P/N 295 000 076) on oil reservoir check valve outlet hose **no. 2**.

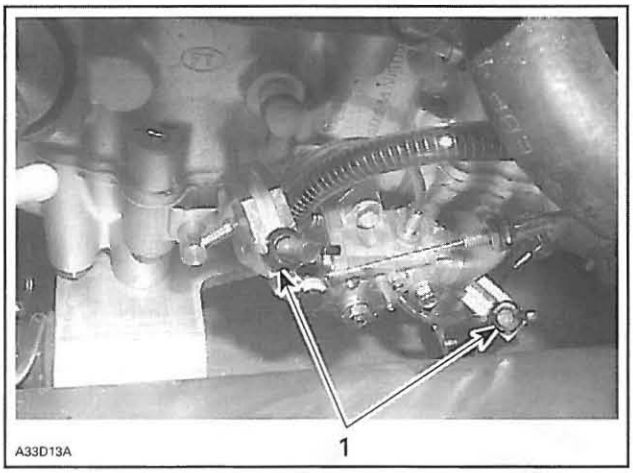


295 000 076



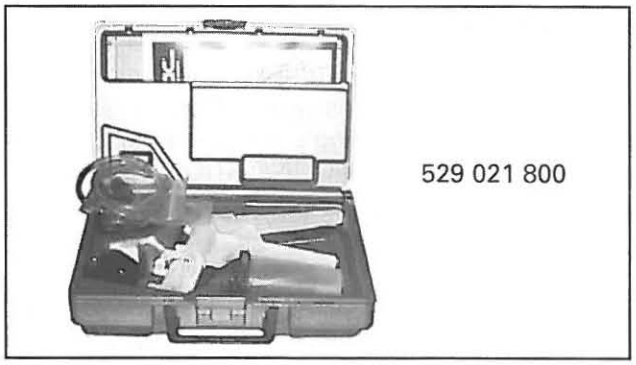
TYPICAL
1. Special cap on reservoir
2. Hose pincher on check valve outlet hose

Remove air silencer and throttle body. Lift engine to gain access to the oil pump hoses. Install small hose pincher (P/N 295 000 076) on outlet hoses.



TYPICAL
1. Hose pinchers on outlet hoses

Use vacuum/pressure pump kit (P/N 529 021 800).



529 021 800

Connect pump to special cap.

Pressurize oil system as follows.

PRESSURE	TIME TO HOLD PRESSURE
21 kPa (3 PSI)	3 minutes

If pressure drops, locate leak(s) and repair/replace leaking component(s).

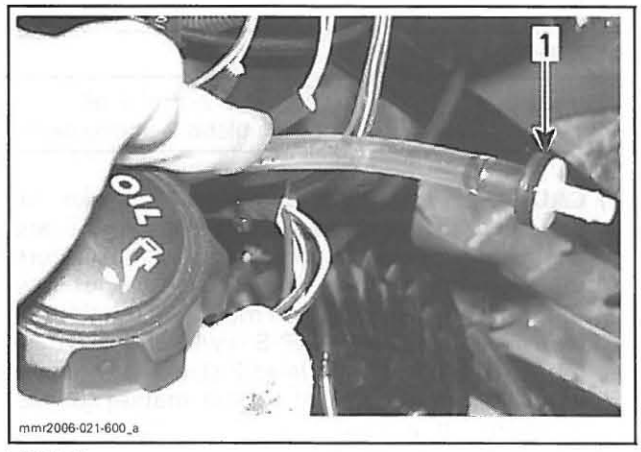
NOTE: An oil pump shaft test must be done to complete the oil system leak test. Refer to *LEAK TEST* for the procedure.

Check Valve

It allows air to get into the reservoir. To verify this one-way check valve, remove it along with the hose. Make sure that it holds pressure and that it does not let air go through.

CAUTION: If check valve does not allow air to enter, serious engine damage will occur.

When replacing/installing check valve, insert its black side into vent line.



TYPICAL
1. Black side here

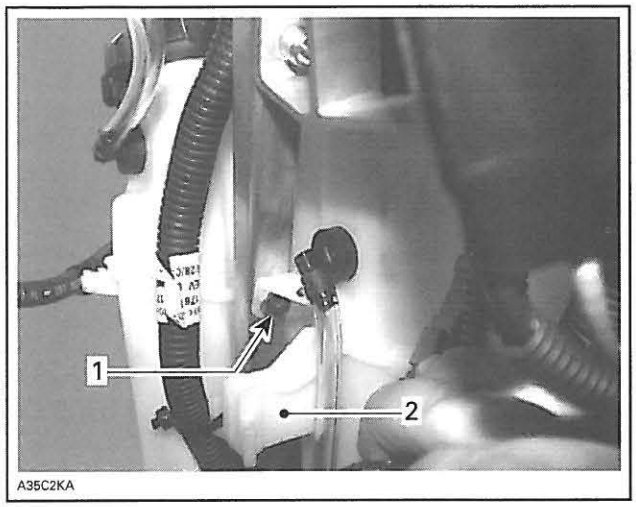
OIL RESERVOIR

Removal

On Left Side of Vehicle:

Remove air box and throttle body.

Remove upper screw **no. 3** that attach oil injection reservoir **no. 1** to frame.



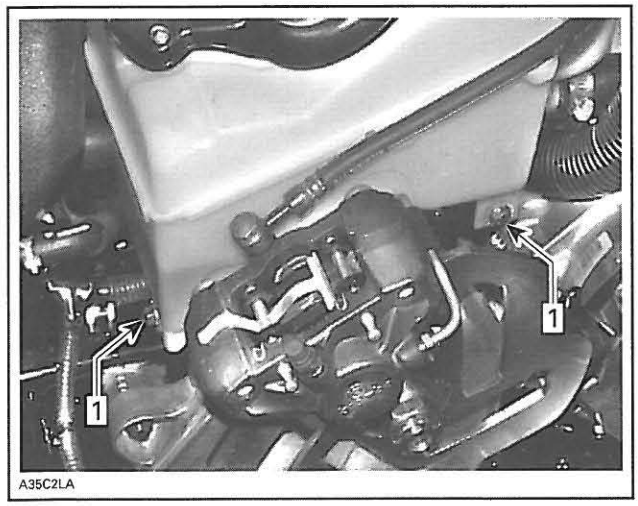
1. Upper reservoir screw
2. Location of cooling reservoir

On Right Side of Vehicle:

Empty injection oil reservoir **no. 1** by siphoning injection oil.

Remove:

- rewind starter handle
- lower screws **no. 4** and **no. 5**.



1. Lower reservoir screws

NOTE: Cut the ties retaining the wiring harness and brake hose.

Installation

For installation, reverse the removal procedure.

OIL LEVEL SENSOR

Removal

To remove the sensor **no. 6**, use the following procedure.

Remove injection oil reservoir, as mentioned above.

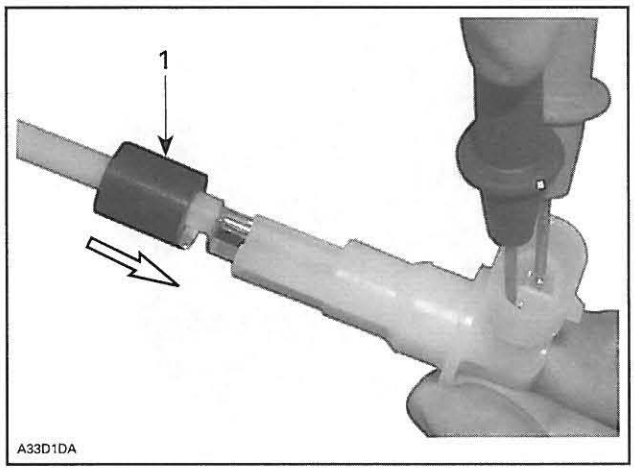
Unplug sensor connector.

Pull injection oil level sensor out of reservoir.

Before replacing the injection oil level sensor, check it according to the following procedure:

CAUTION: Do not remove or bend the reed switch protective float magnet. It can damage the reed switch glass.

With the float magnet ring at the lowest position. Using an ohmmeter, probe the connector.



1. Float magnet at the lowest position

MEASURE	SWITCH CONDITION
Closed circuit (close to 0 Ω)	Good
Open circuit or resistive circuit greater than 0.5 Ω	Defective

Installation

For installation, reverse the removal procedure.

OIL FILTER

Removal

Lift engine. Use the following procedure:

- Remove drive and driven pulleys.

- Remove primary air intake silencer and throttle body.
- Unscrew engine support nuts.
- Remove the PTO spark plug and install the spark plug lift ring (P/N 529 035 830).
- Lift engine and remove the left engine support from engine.
- Remove the MAG intake adaptor.

Siphon injection oil reservoir.

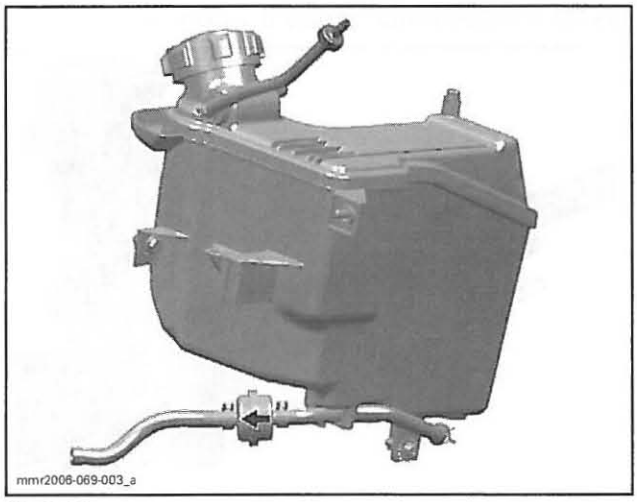
Disconnect oil filter hose **no. 7** from the injection oil level sensor **no. 6**.

Disconnect oil hoses **no. 7** and **no. 8** from the oil filter **no. 9** and remove it.

Installation

For installation, reverse the removal procedure.

The filter must be installed with the arrow pointing toward the pump.



TYPICAL

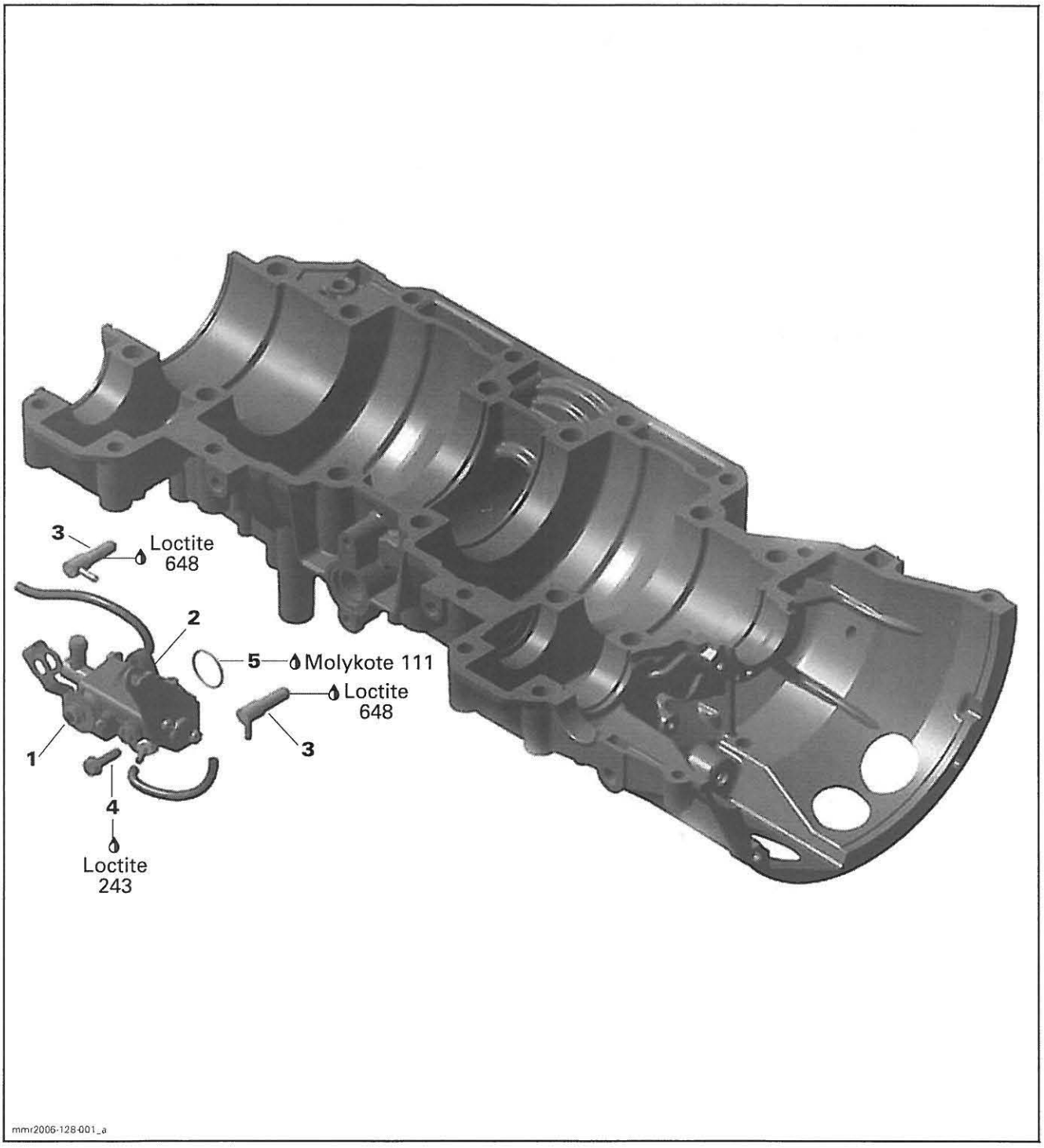
OIL INJECTION PUMP

SERVICE TOOLS

Description	Part Number	Page
oil pump cable adjuster	529 036 045	105
throttle free play wedge tool	529 036 042	104
vacuum/pressure pump kit	529 021 800	103

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 648 (green)	413 711 400	103
Molykote 111	413 707 000	104
pulley flange cleaner	413 711 809	103


3
Loctite
648
2
5
Molykote 111
Loctite
648
3
1
4
Loctite
243
mmr2006-128-001_a

OIL PUMP IDENTIFICATION

Different engines need different pumps. See identification on lever **no. 2**.

CAUTION: Always mount proper pump on engine.

ENGINE	OIL PUMP IDENTIFICATION
995 SDI	07

VERIFICATION

NOTE: Since pump is a piston type, it works when engine rotates in both forward and reverse.

NOTE: Verification cannot be done in vehicle.

Oil Pump

Remove oil pump **no. 1**. See below under *REMOVAL*.

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. Otherwise, replace pump.

Injection Nozzle

CAUTION: Do not remove injection nozzle needlessly. It is likely to be damaged.

Use vacuum/pressure pump kit (P/N 529 021 800).

529 021 800

Connect pump to injection nozzle **no. 3**.

Test check valve of injection nozzle as follows.

PUMP SETTING	TO DO	RESULT	ACTION
Set to VACUUM	Activate pump several times	Air must not flow through check valve	Success: Perform next test Failed: Replace injection nozzle
Set to PRESSURE	Slowly activate pump and listen to check valve	You should hear it release pressure at approx. 20.7 kPa (3 PSI)	Success: Check valve is good Failed: Replace injection nozzle

CLEANING

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

REMOVAL

Oil Pump

Lift engine.

Remove oil pump screws **no. 4**.

Unplug all hoses connected to oil pump **no. 1**.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

Remove oil pump and its O-ring **no. 5**.

Injection Nozzle

CAUTION: Do not remove injection nozzle needlessly. It is likely to be damaged.

Remove engine from vehicle.

Clean injection nozzle area to remove oil or dirt.

Heat injection nozzle **no. 3** then, pull it out of crankcase.

INSTALLATION

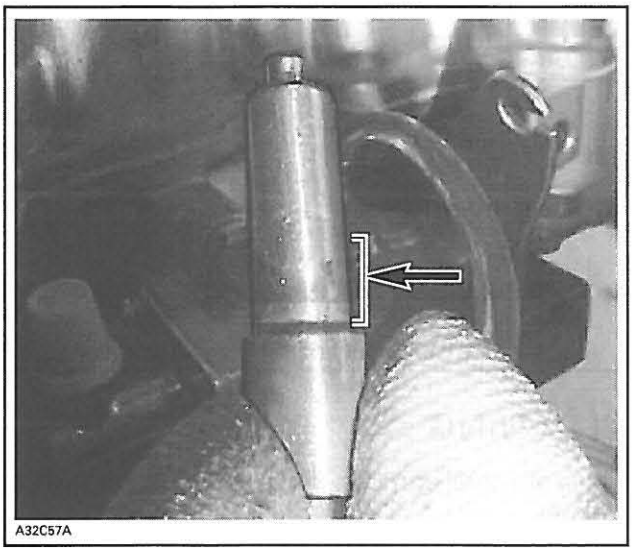
CAUTION: Always bleed oil pump when the system has been opened.

NOTE: During installation, always check for spring clips tightness.

Injection Nozzle

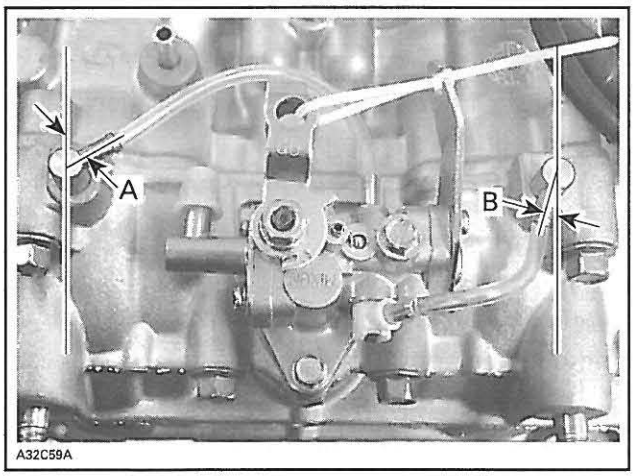
Prior to coating the injection nozzle **no. 3** with Loctite, make sure injection nozzle body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the injection nozzle (machined section). Take care that Loctite is ONLY in this area.


A32C57A

APPLY LOCTITE ON THIS AREA ONLY

Install the injection nozzle in the correct position as described on next photos into the crankcase lower side.



A32C59A

TYPICAL
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the injection nozzle carefully with a plastic hammer.

Clean the crankcase from surplus of Loctite 648 with a rag.

Injection Oil Pump

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

Apply Molykote 111 (P/N 413 707 000) on O-ring **no. 5** before installation.

Torque the oil pump screws **no. 4** to 5 N•m (44 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.

Install cable lock washer on left side of support.

Verify cable and oil pump lever operation then adjust cable.

BLEEDING

Bleed injection oil system. Refer to *OIL INJECTION SYSTEM*.

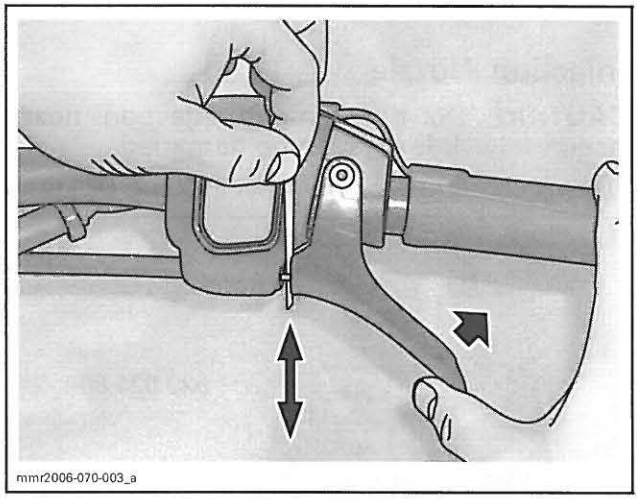
ADJUSTMENT

Before processing with the oil pump cable adjustment, verify throttle cable adjustment. Refer to *COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT*.

NOTE: Do not use marks on oil pump. Follow procedure below.

Insert the throttle free play wedge tool (P/N 529 036 042), between throttle lever and housing as shown.

Slide tool up and down until all free-play is recovered. Stop recovering free-play before throttle cam just begins to move at throttle body.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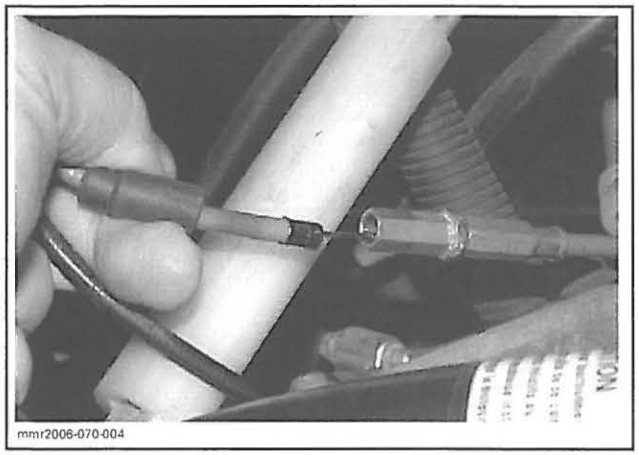
Move protector boot away and stretch oil pump cable at adjuster.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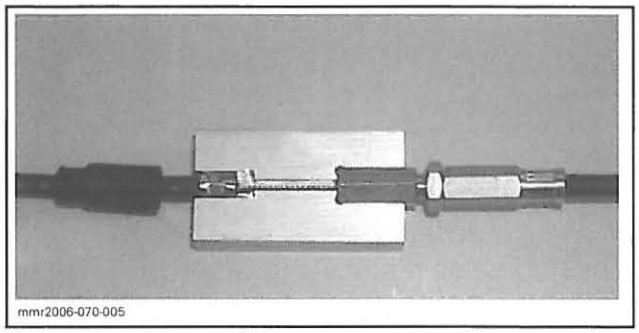
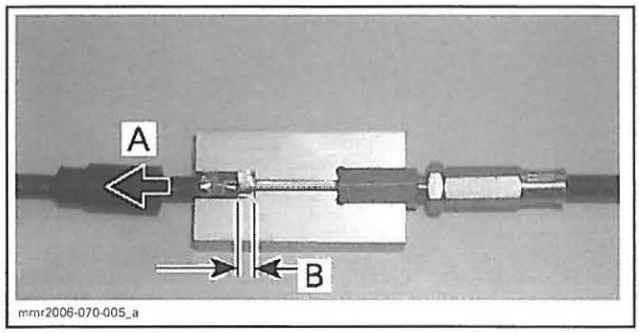
Insert the oil pump cable adjuster (P/N 529 036 045) between cable ends as per following table.


mmr2006-070-005

NOTE: If tool cannot be inserted, turn cable adjuster to "shorten" cable.

Pull cable with a force of 40 N (9 lbf) to recover all play in cable.

While still pulling, check if there is a gap as shown.



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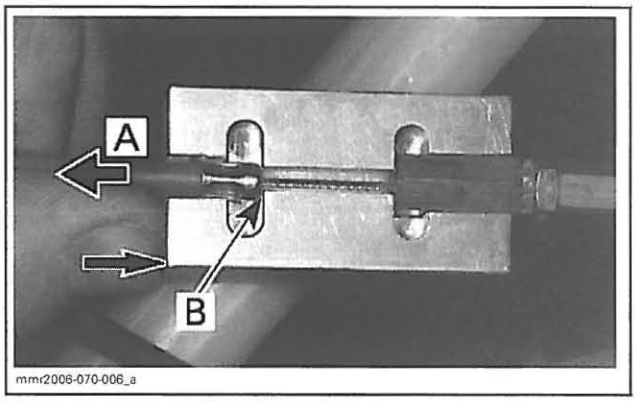
A. Pull 40 N (9 lbf)
B. Verify if there is a gap here

Turn cable adjuster as required to eliminate any gap between cable and tool.



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FINAL ADJUSTMENT WITHOUT GAP
A. Pull 40 N (9 lbf)
B. No gap

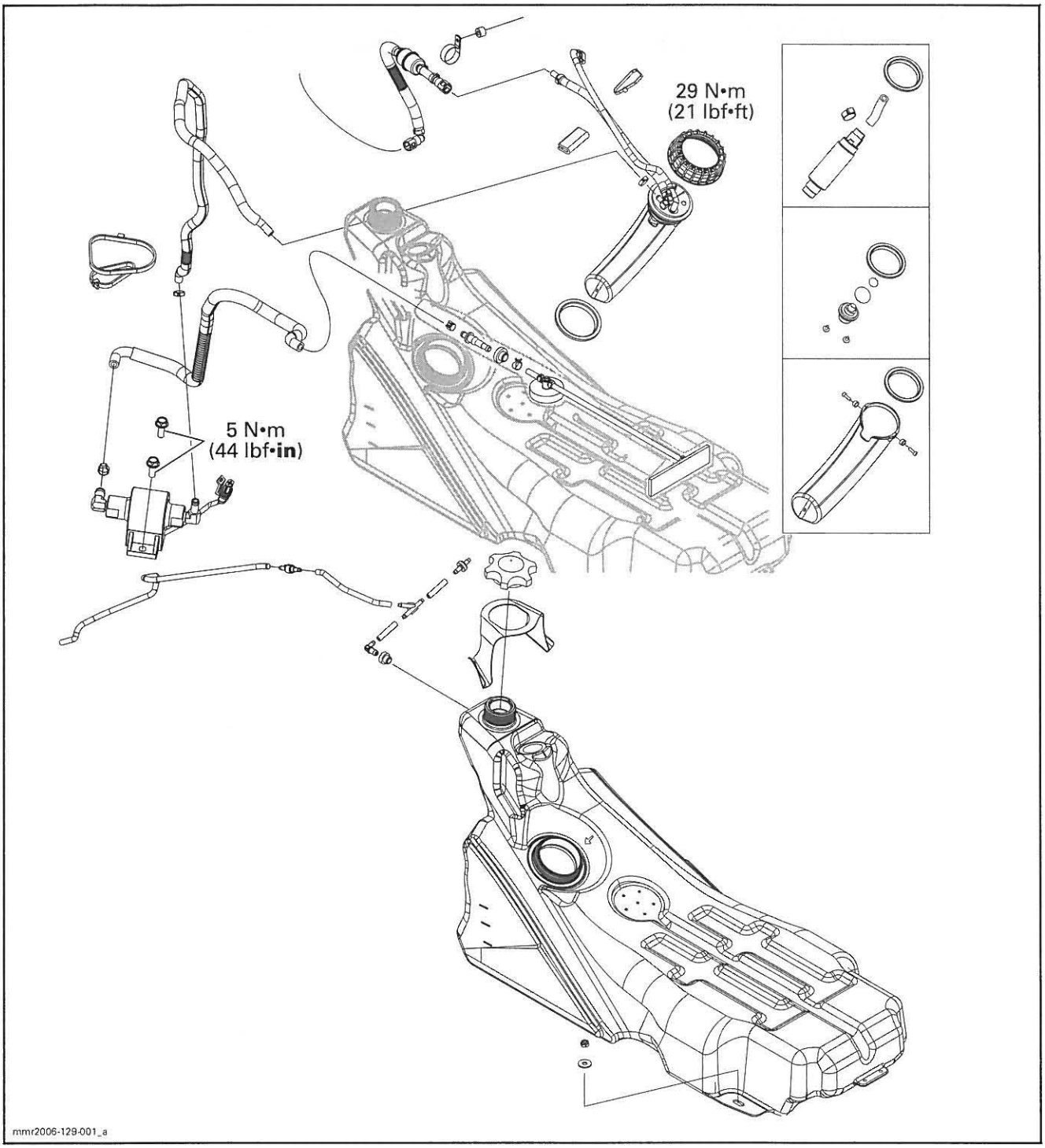
Remove oil pump cable adjuster, push back cable in adjuster and slide protector boot in place.

Remove throttle free play wedge tool.

FUEL TANK AND FUEL PUMPS

SERVICE TOOLS

Description	Part Number	Page
pliers	295 000 054	122
pliers Oetiker 1099	295 000 070	122
pressure gauge	529 036 709	111
small hose pincher	295 000 076	109
spark plug lift ring	529 035 830	115
T-fitting	529 036 023	111
vacuum/pressure pump	529 021 800	109, 111
wrench	529 035 891	121
wrench	529 035 899	117


29 N•m
(21 lbf•ft)
5 N•m
(44 lbf•in)
mmr2006-129-001_a

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 *EMS DIAGNOSTIC AND COMMUNICATION TOOLS.*

⚠ 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 and 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 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 engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove 30 amp. fuse prior to working on the fuel system.

Before working on any procedure of the fuel system, always disconnect BLACK (–) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (–) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

⚠ WARNING

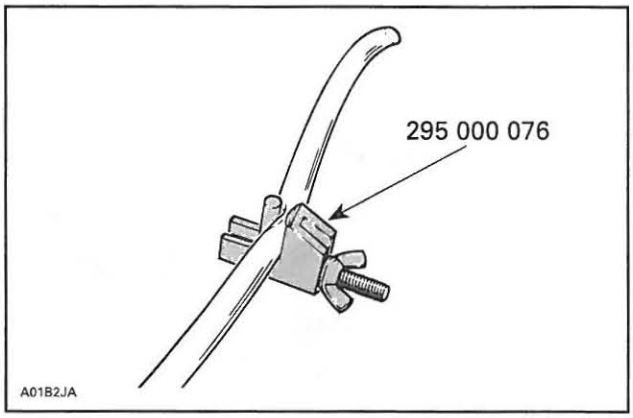
Whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or (P/N 529 032 500). Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

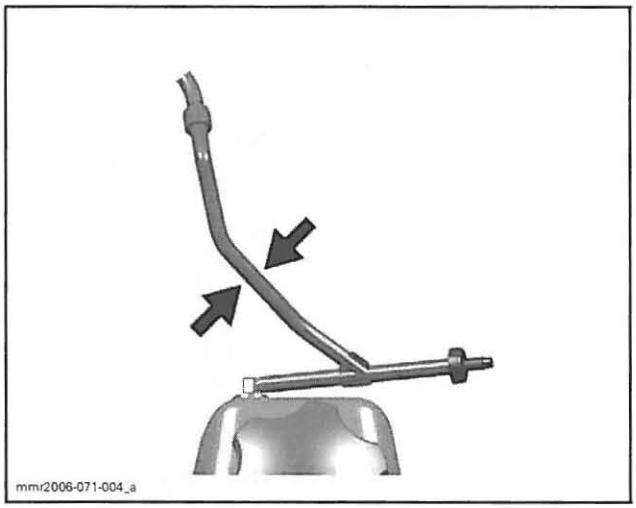
INSPECTION

FUEL SYSTEM PRESSURIZATION

Fill up fuel tank.

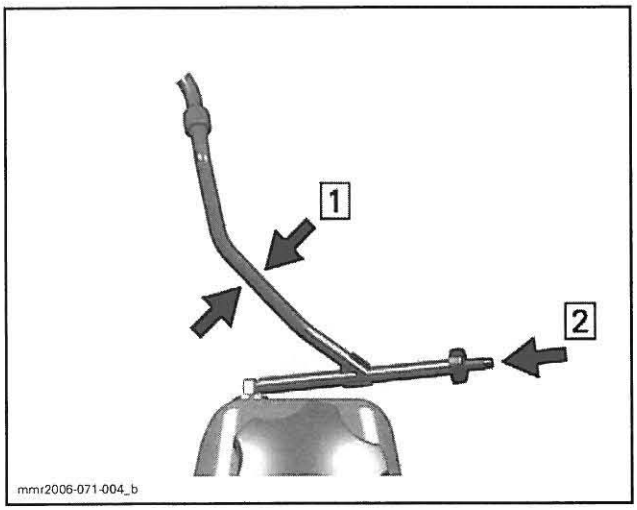
Install a small hose pincher (P/N 295 000 076) on vent line (pressure relief valve side).





PINCHER ON VENT LINE

Using the vacuum/pressure pump (P/N 529 021 800), pressurize fuel tank through vent line (check valve side).



Step 1: Install hose pincher
Step 2: Pressurize here

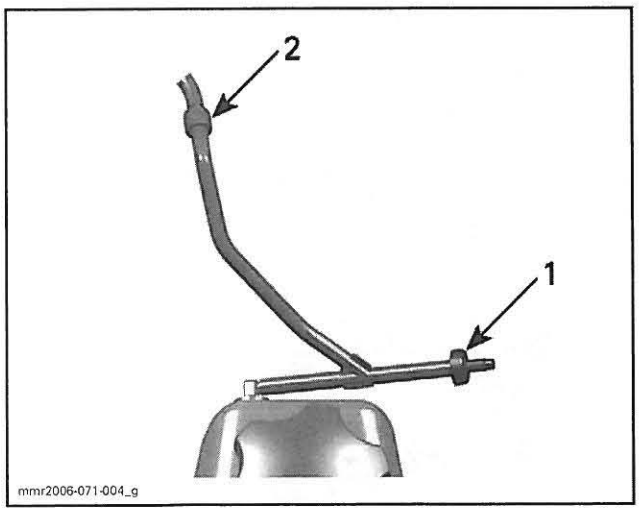
Pressurize fuel tank as follows.

PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	3 minutes

If pressure drops, locate fuel leak(s) and repair/replace leaking component(s).

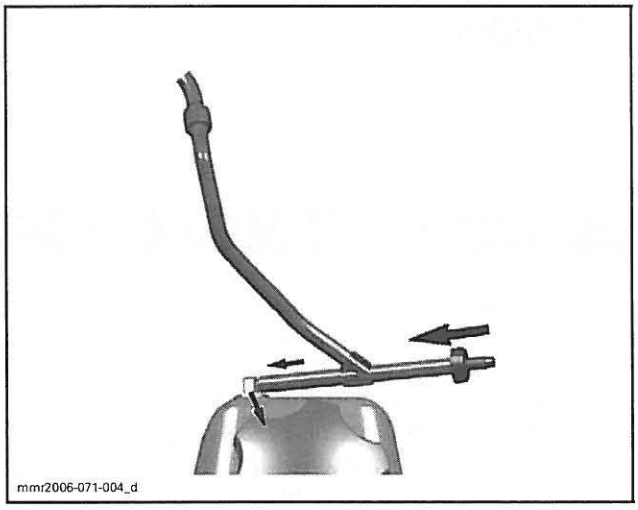
To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

Check Valve and Pressure Relief Valve

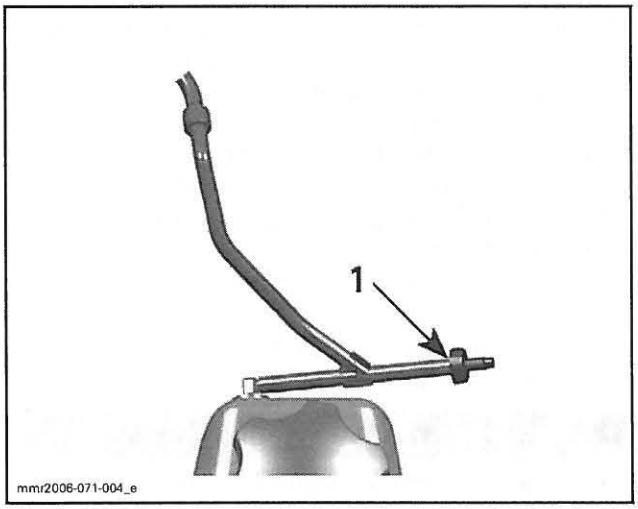


1. Check valve
2. Pressure relief valve

Air can enter fuel tank at all times through the check valve.

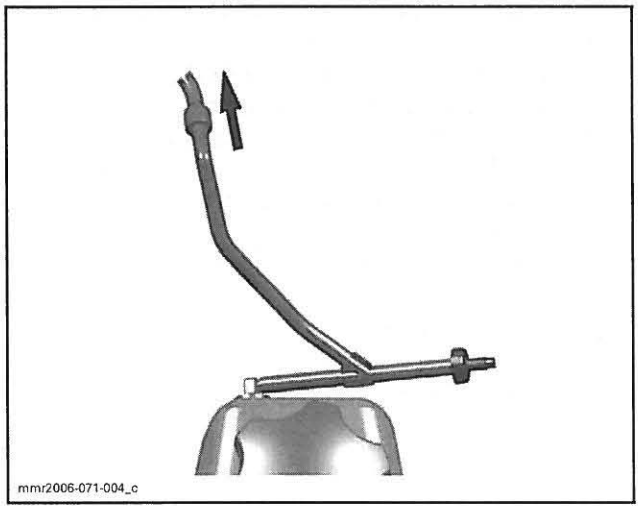


The **check valve** prevents fuel to flow out. Always reinstall valve with the black side as shown.



1. Black side here

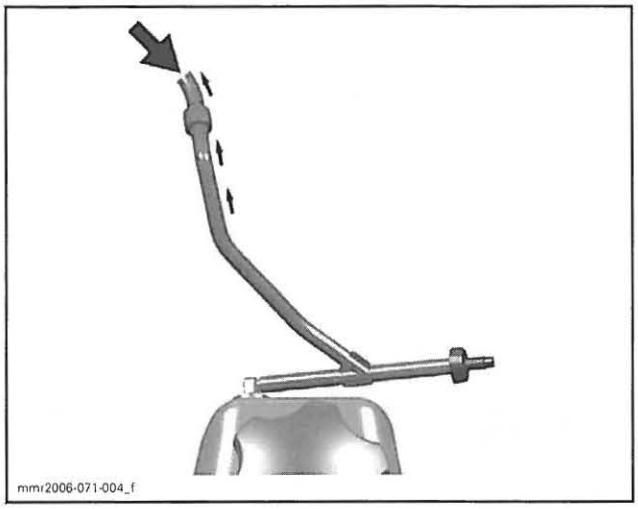
If pressure in fuel tank builds up and exceeds 2.5 - 7.6 kPa (.36 - 1.1 PSI), **pressure relief valve** opens and let excess pressure evacuate. Always reinstall valve according to arrow on valve as shown.



Test

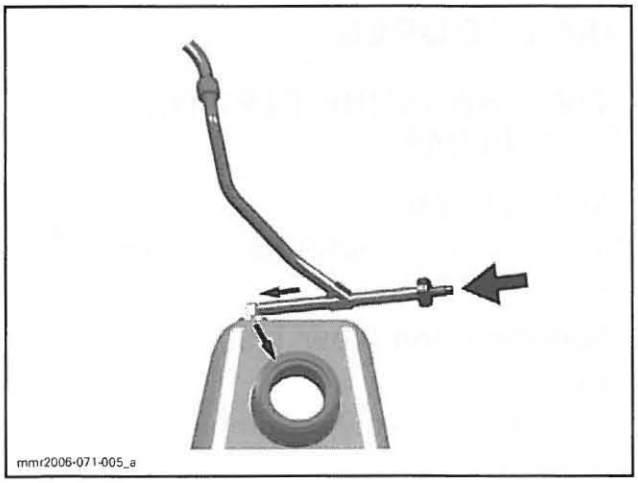
While tank is still pressurized as test above, do the following:

When removing hose pincher, alternately touch and release end of pressure relief valve. You should feel pressurized air flowing out indicating relief valve is working.



Remove fuel tank cap.

Using the vacuum/pressure pump (P/N 529 021 800), apply air pressure through check valve. Air must freely flows towards fuel tank neck.



High Pressure Test

Install tether cord on DESS post. Push the emergency switch to OFF position. Push on start button to activate electric fuel pumps.

Check for any leakage at fuel rail, injectors, in-line fuel filter and fuel hose.

FUEL PRESSURE TEST

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*. Use the **Activation** tab.

⚠ WARNING

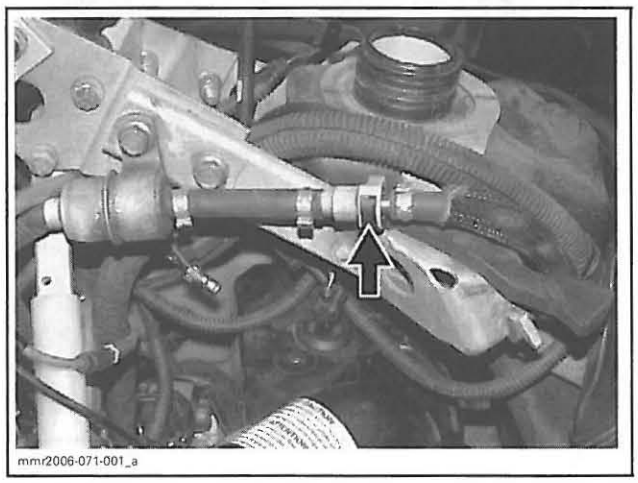
The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the high pressure electric fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

Ensure there is no leak from hoses and fittings. Repair any leak.

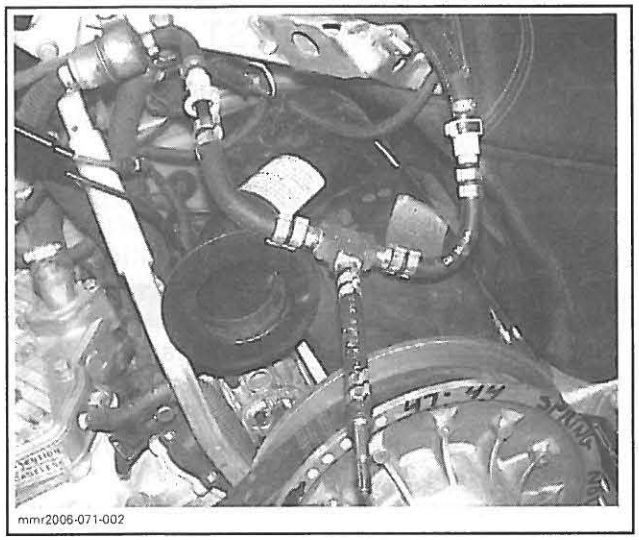
Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

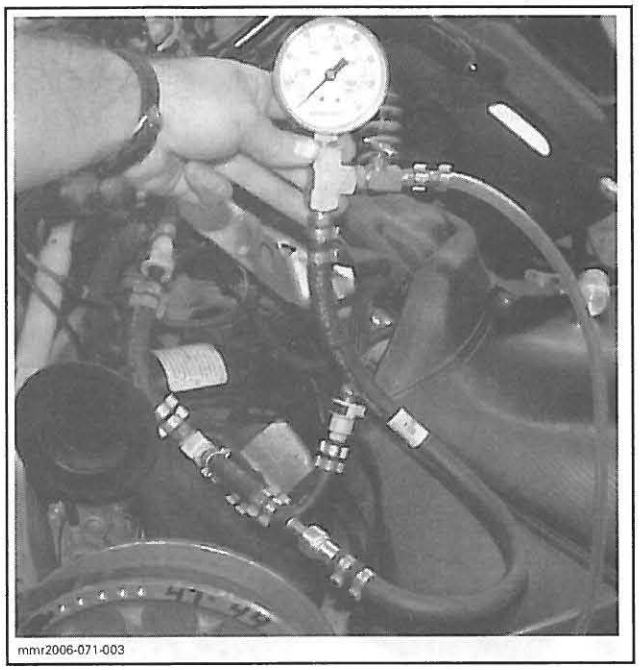


TYPICAL

Install fuel T-fitting (P/N 529 036 023) and pressure gauge (P/N 529 036 709) between disconnected hoses (in-line installation).


mmr2006-071-002

TYPICAL


mmr2006-071-003

TYPICAL

Remove tether cord cap. Depress START/RER button and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using B.U.D.S. between tests so that the gauge is "reset" to zero (0).

FUEL PRESSURE (when depressing start button)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, the high pressure electric fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the high pressure electric fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace the high pressure electric fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace the high pressure electric fuel pump.

NOTE: For resolving a fuel pressure problem, refer to *TROUBLESHOOTING* in this section.

Release fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Remove pressure gauge and T-fitting. Reinstall fuel hose.

⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

PROCEDURES

LOW PRESSURE ELECTRIC FUEL PUMP

Electrical Test

Refer to *HIGH PRESSURE ELECTRIC FUEL PUMP* in this section.

Inspection and Flow Test

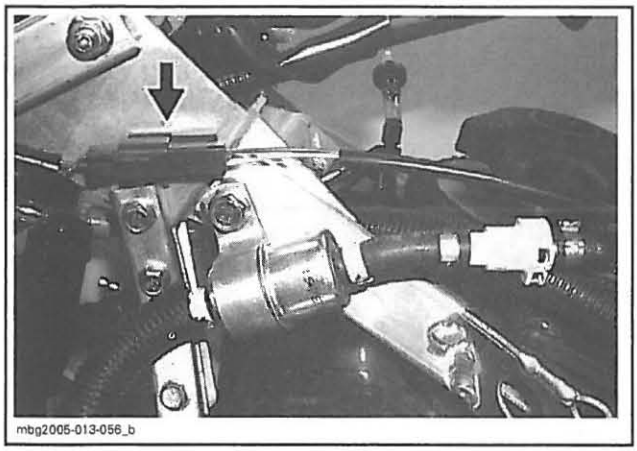
Remove seat.

Install tether cord on DESS post.

Visually check for fuel leaks around pump nipples and hoses. Repair any leak.

If pump flow is suspected, test pump in vehicle as follows.

Remove tether cord from DESS post and temporary disconnect the low pressure electric fuel pump connector.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Disconnect outlet hose from the high pressure electric fuel pump.


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Place the end of disconnected pump hose in a graduated container (for approximately 150 mL (6 oz)).

Reconnect fuel pump connector.

Use B.U.D.S to activate fuel pump. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connections.

In B.U.D.S., use **Activation** tab and press "fuel pump" button. Fuel volume should exceed the following specification.

FUEL VOLUME
104 mL (3.52 U.S. oz) minimum

Repeat test 2 - 3 times to ensure validity of results.

Replace pump if test fails.

Reinstall removed hose and secure with a new clamp.

Removal

⚠ WARNING

Never remove fuel pump nipples.

Remove tether cord from DESS post.

Remove seat.

Remove the windshield.

Remove the RH side panel.

Remove the LH side panel, unplugging the APS (Air Pressure Sensor).

Disconnect BLACK (–) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (–) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Remove dashboard.


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Drain fuel tank.

Remove console.


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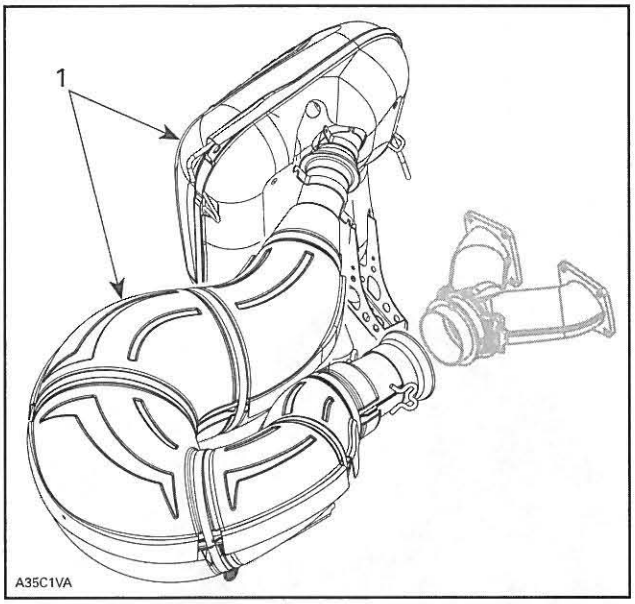
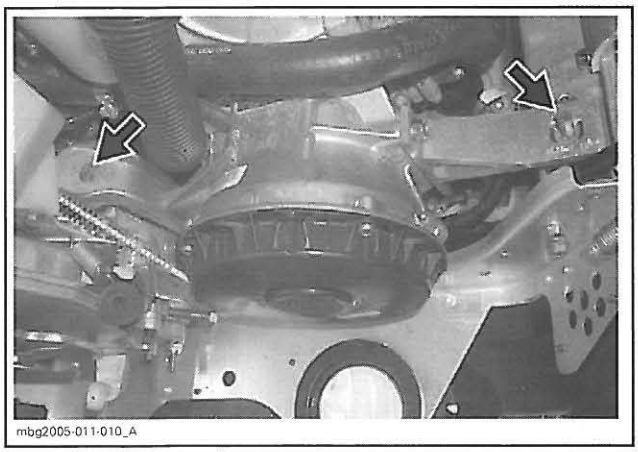
Remove tuned pipe and muffler.



1. Tuned pipe and muffler

Remove the MAG side engine mounts nuts.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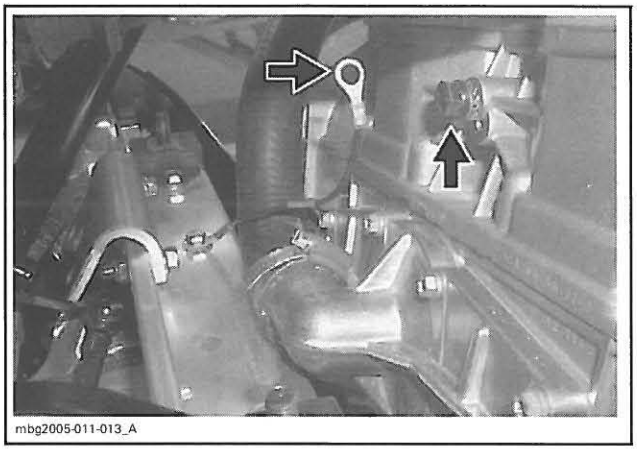
Remove the engine ground wire, located in front of the engine.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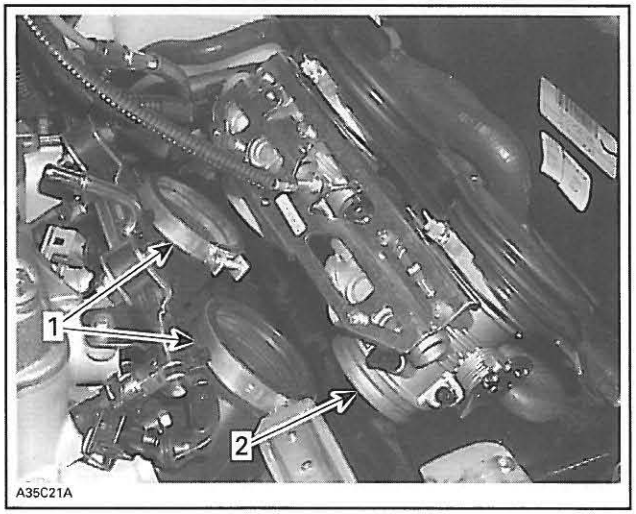
Remove the driven pulley.

Remove the air intake silencer.

Unscrew throttle body clamps.

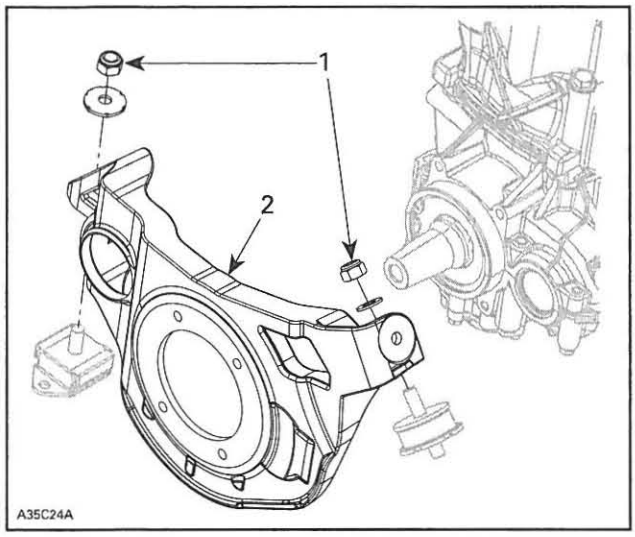
Move throttle bodies away from intake adapters.

To make room for moving the engine upward, temporarily secure throttle bodies away, using locking tie.



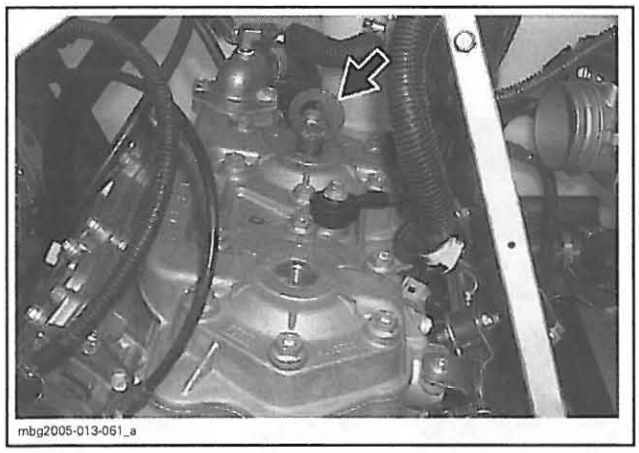
1. Clamp
2. Throttle body

Remove PTO side engine support nuts.

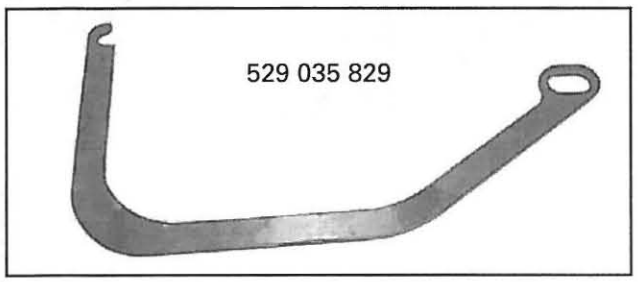


1. Engine support nuts
2. Engine support

Remove both spark plugs. Install the spark plug lift ring (P/N 529 035 830) in the MAG side spark plug hole.

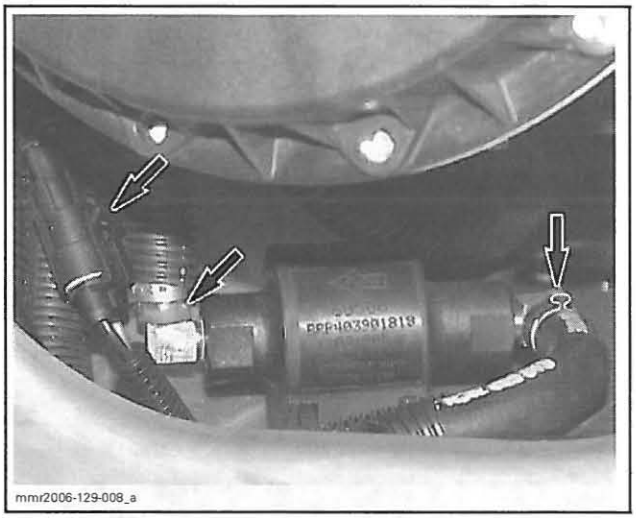


Using the engine removal hook, slightly lift the engine.

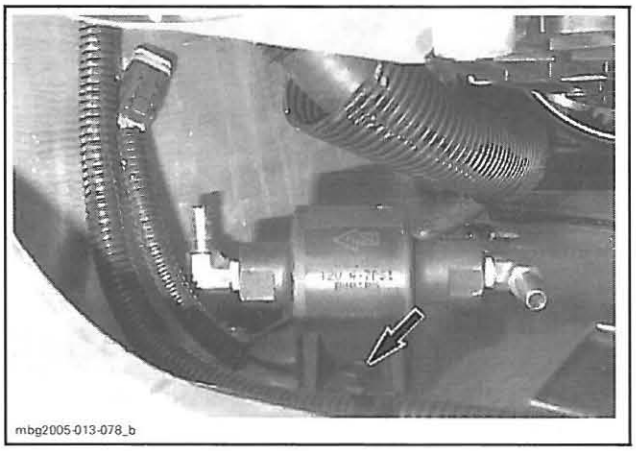


Lift the engine to make room to reach the low pressure electric fuel pump. You may use a "2 x 4" piece of wood to maintain the engine.

Disconnect electric connector and hoses from fuel pump.



Unscrew fuel pump.

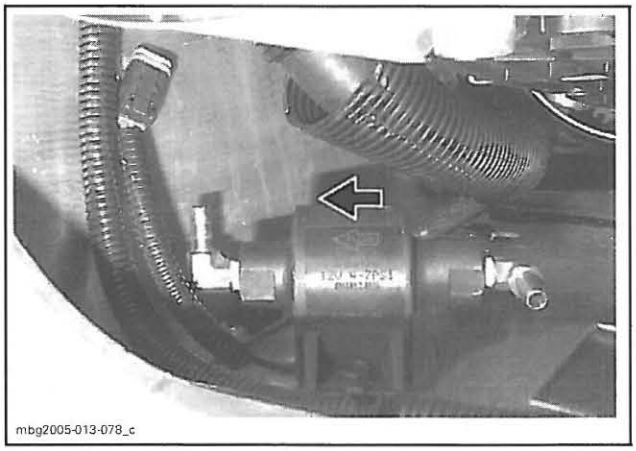


Installation

For installation, reverse the removal process but pay attention to the following.

Install fuel pump and secure to chassis.

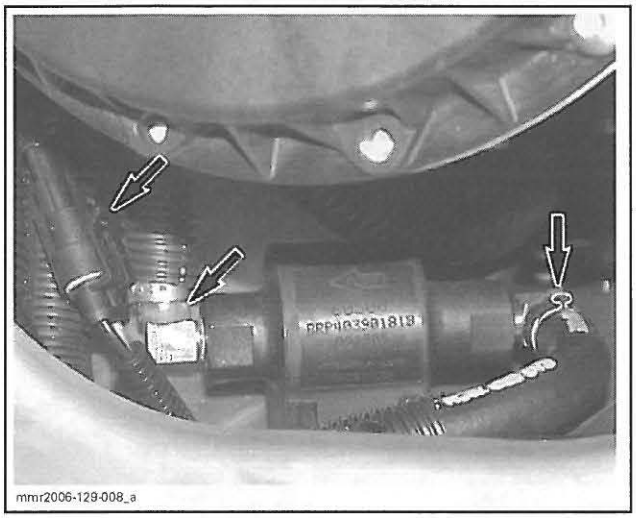
CAUTION: The arrow must point toward the rear of the vehicle.



DESCRIPTION	TIGHTENING TORQUE
Pump retaining screws	5 N•m (44 lbf•**in**)

Plug connector to fuel pump.

Install hoses to fuel pump and secure with new clamps.


mmr2006-129-008_a

Keep fuel pump hoses away from the voltage regulator/rectifier.

Perform fuel system pressure test.

⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

HIGH PRESSURE ELECTRIC FUEL PUMP

Fuel Pressure Test

Refer to *INSPECTION* in this section.

Electrical Test

NOTE: This test pertains to both electric fuel pumps since they are connected in parallel.

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system. The low pressure electric fuel pump will run at the same time.

If a pump does not work, disconnect its plug connector.

Install a temporary connector to the suspected fuel pump connector to test. Apply 12 V (+) on pin 2 and (–) on pin 1 to this test harness.

If pump does not run, replace it.

Otherwise, probe pin 2 and battery ground of fuel pump connector on vehicle harness side. When depressing the START/RER button, you should read battery voltage for approximately 2 seconds (then, the voltage will drop). If battery voltage does not appear, the problem can be in fuse, relay(s), harness or in fuel pump connector. Repair or replace appropriate part.

Check continuity between pin 1 of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector B. If there is no continuity the problem is in the harness. Otherwise, try a new ECM.

Removal

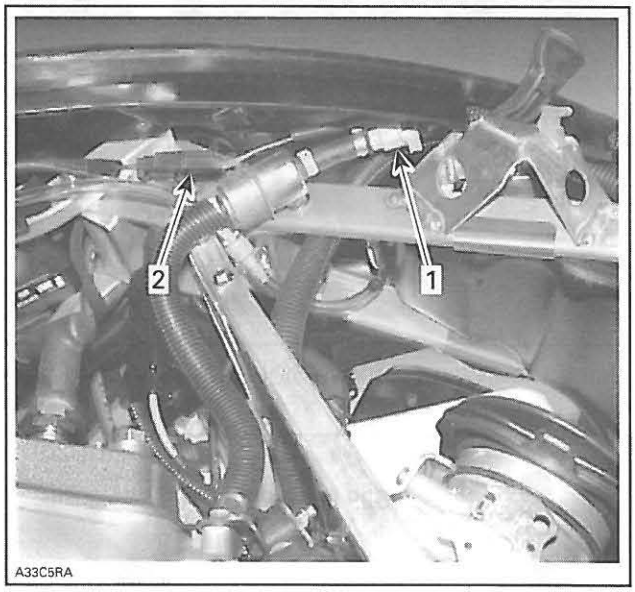
Remove seat, refer to *BODY*.

Using B.U.D.S., release pressure from fuel system. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Drain fuel tank as much as possible.

Disconnect fuel supply hose from fuel filter line ass'y.

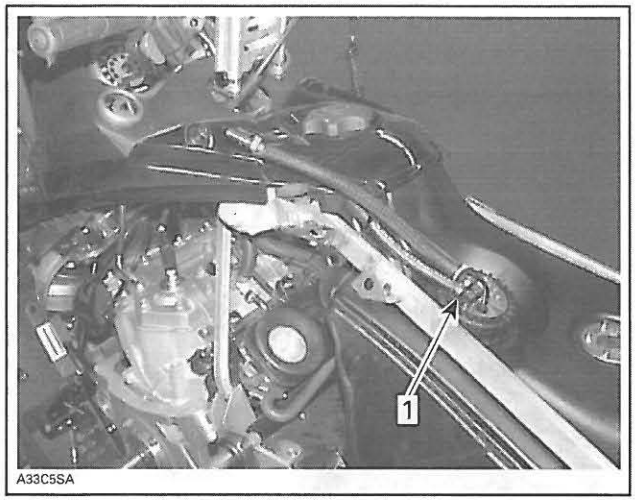
Disconnect the high pressure electric fuel pump connector.



A33C5RA

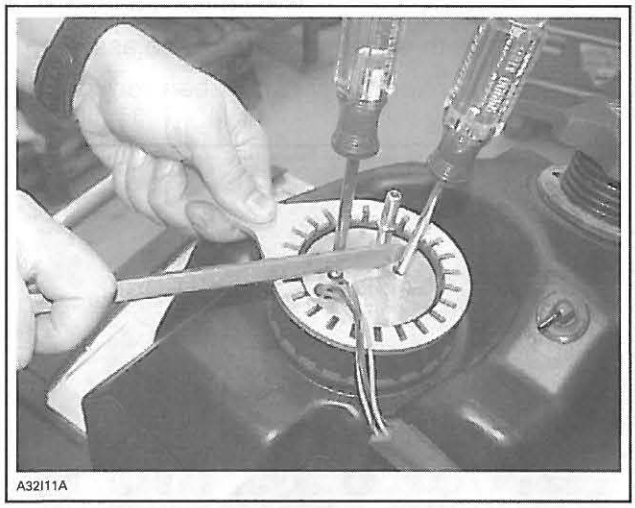
1. Disconnect fuel filter line ass'y
2. Unplug connector

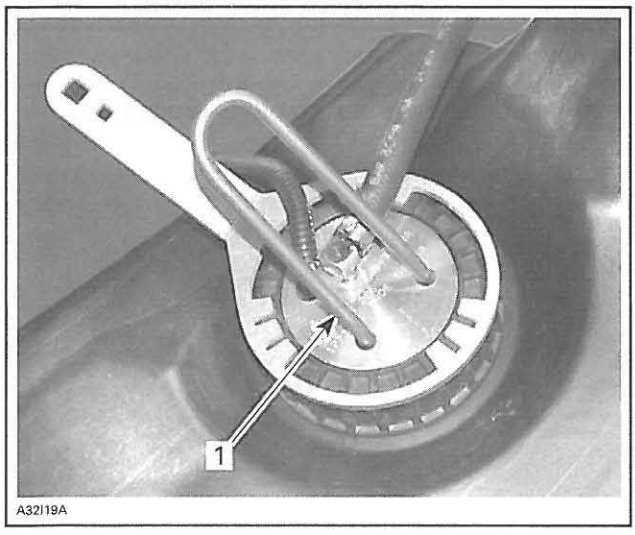
Disconnect hose coming from the low pressure electric fuel pump.



1. Disconnect hose

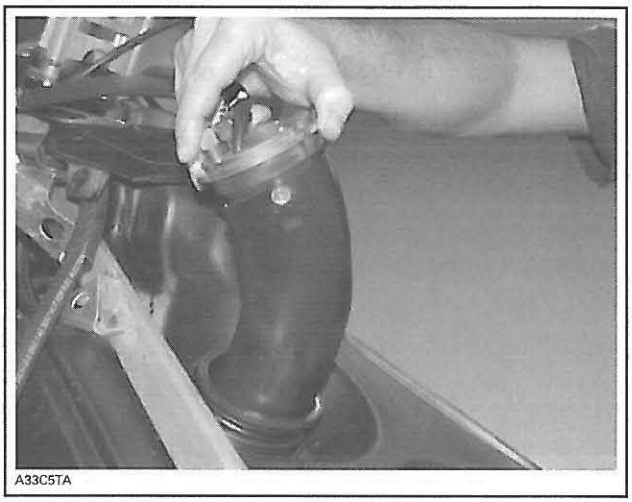
With two screwdrivers or a bent rod holding the flange, unscrew the fuel pump nut using fuel pump nut wrench (P/N 529 035 899).





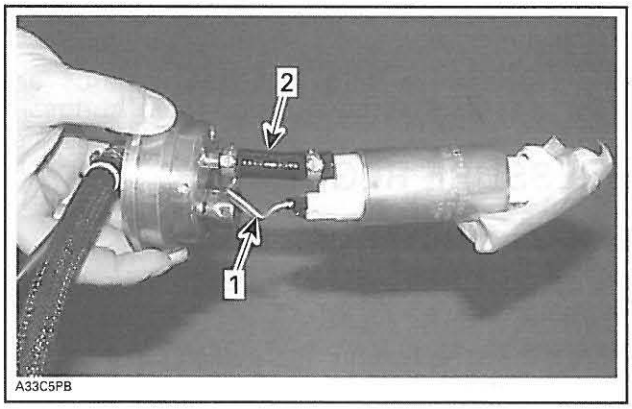
1. Bent rod

Remove fuel pump assembly.



Disconnect pump electric connector.

Disconnect hose from pump.



1. Electrical connect
2. Pump hose

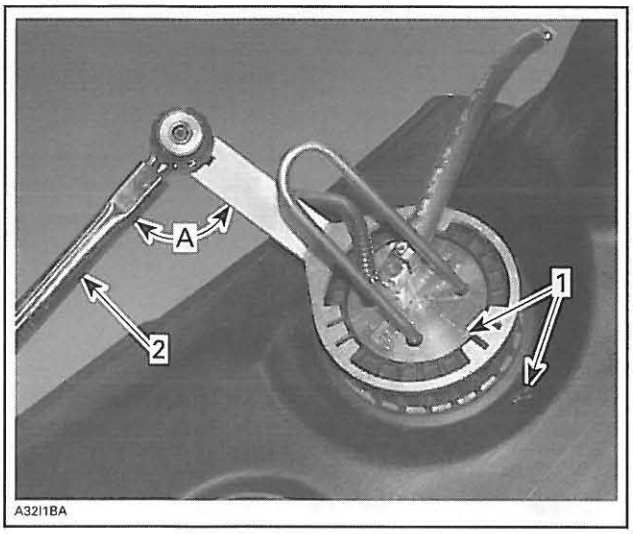
Installation

For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Align the arrow on fuel pump assembly with the one on fuel tank. Keep arrows aligned when tightening fuel pump assembly.

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 27 - 30 N•m (20 - 22 lbf•ft).



A32I1BA

1. Arrows
2. Torque wrench
A. 90°

Use a new clamp to secure hose to fuel pump fitting.

CAUTION: Make sure that hose clamps are tight to avoid that they turn on their fittings.

PRESSURE REGULATOR

Replacement

Remove the high pressure electric fuel pump as explained above.

Remove 2 screws retaining regulator to pump assembly flange.

Replace O-rings with new ones. Install them in pump assembly flange bore.

CAUTION: Regulator O-rings must be installed in pump assembly flange bore.

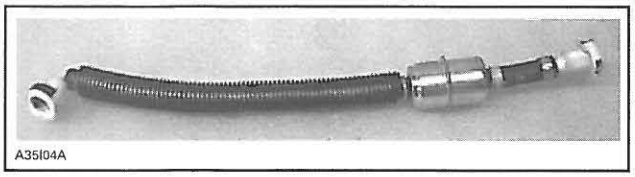
Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump assembly as explained above.

IN-LINE FUEL FILTER

Replacement

Fuel filter, inlet and outlet hoses come as an assembly.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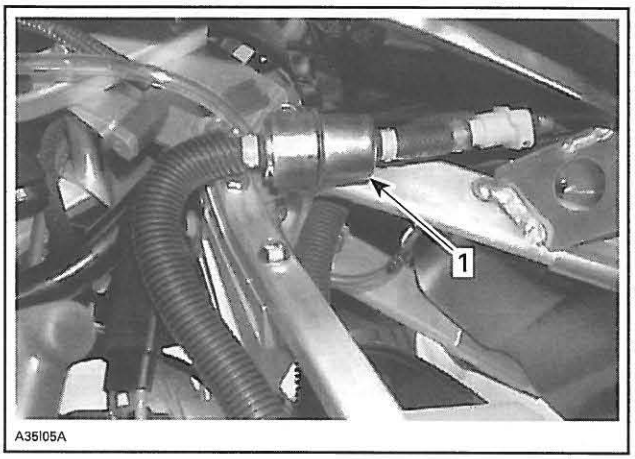
FUEL FILTER LINE ASS'Y

The fuel filter line ass'y is located on LH side of the vehicle underneath console.



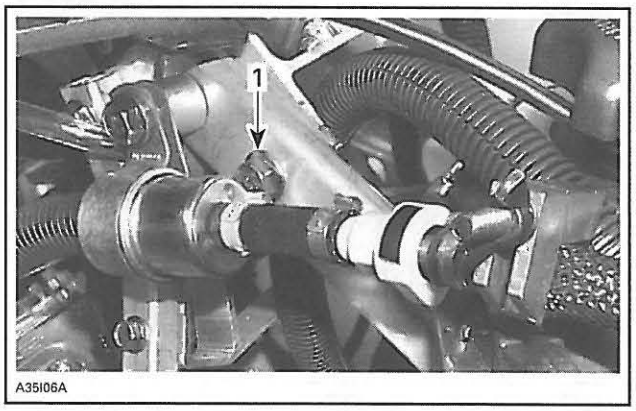
A35I05A

1. Fuel filter line ass'y

Using B.U.D.S. release pressure from fuel system. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Disconnect both ends of fuel filter line ass'y.

Unscrew fuel filter support nut then remove the filter.



A35I06A

1. Unscrew fuel filter support

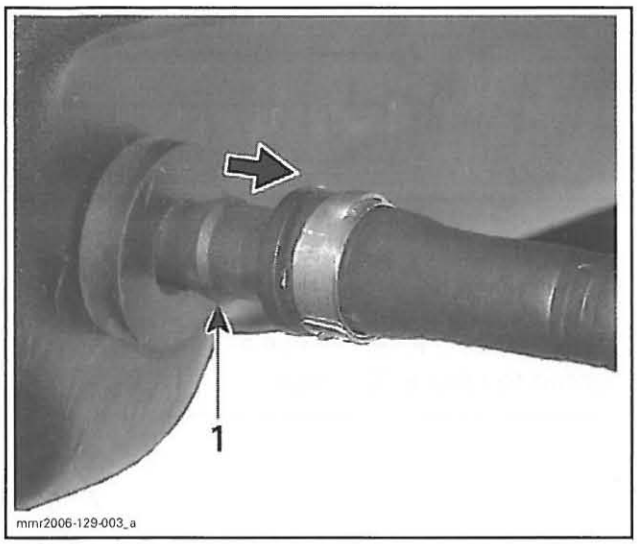
Installation is reverse of removal procedure.

IN-TANK FUEL STRAINER

Removal

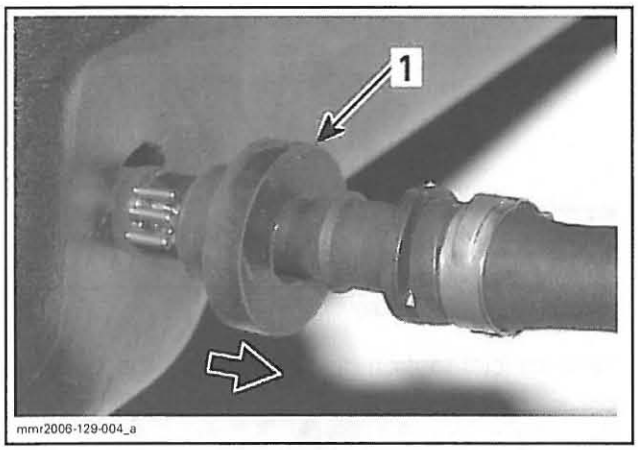
Drain fuel tank.

Pull out fuel tank fitting **no. 5** from grommet.



1. Fuel tank fitting

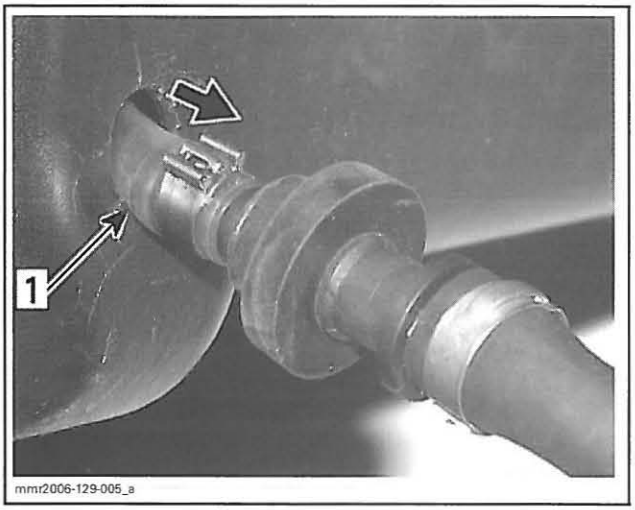
Pull out grommet from fuel tank.



1. Grommet

Models with a Single Pickup

Pull out pickup hose with strainer.

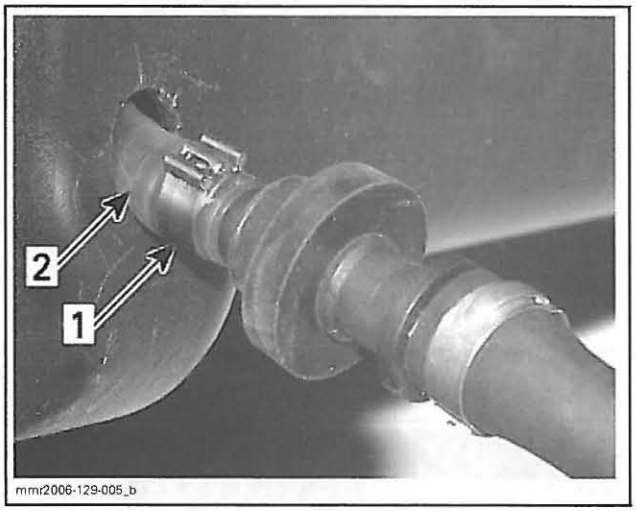


1. Pickup hose

Models with Dual Pickups

CAUTION: Do not remove pickups needlessly. Reinstallation is likely to be tough without a new installation kit.

Cut Oetiker clamp and separate hose from fuel tank fitting.



1. Oetiker clamp
2. Separate hose from fuel tank fitting

Remove the high pressure electric fuel pump. Refer to *HIGH PRESSURE ELECTRIC FUEL PUMP* in this section.

Pull out fuel pickups from fuel tank opening.

All Models

Replace strainer or pickup if clogged and grommet.

Installation

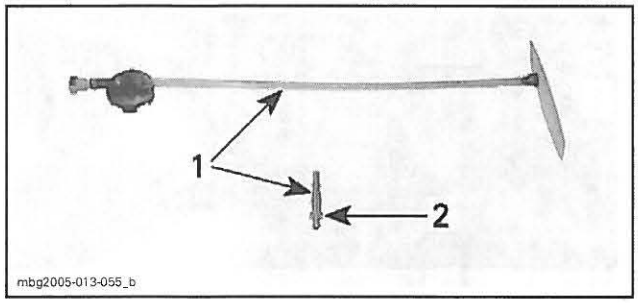
Installation is reverse of removal procedure. Pay attention to the following details.

Models with Dual Pickups

Install grommet in fuel tank.

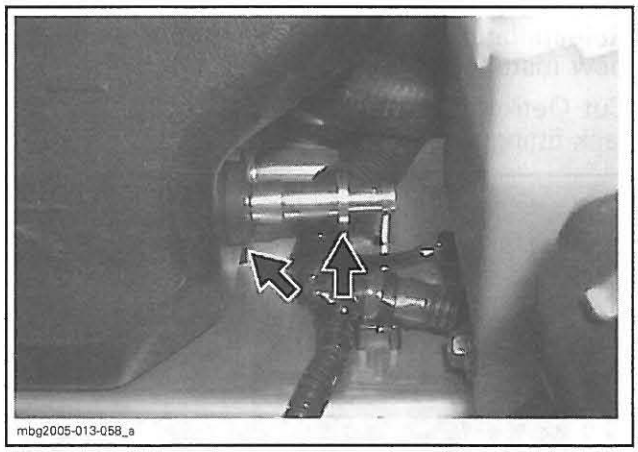
Discard the previously removed fuel tank fitting.

Use the following kit to install new pickups.



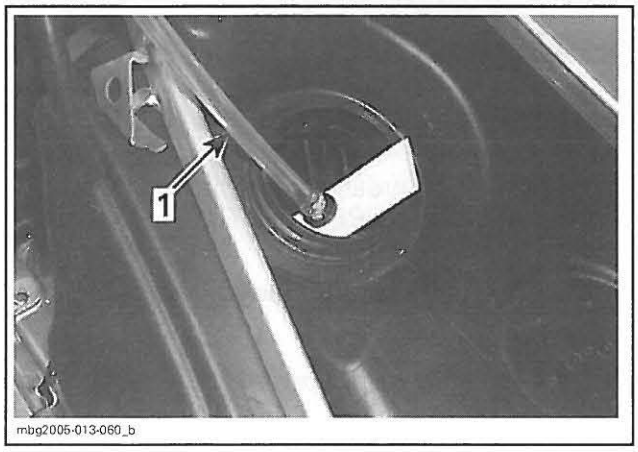
1. Complete fuel pickup kit ass'y: P/N 590 177 100
2. Fuel tank fitting only: P/N 415 129 111

Insert the new fuel tank fitting in grommet.



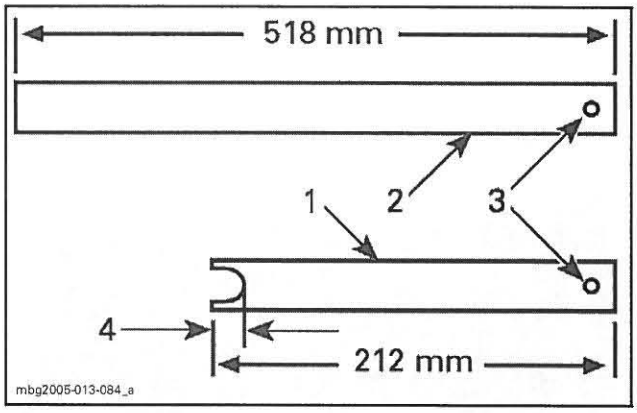
FUEL TANK FITTING IN GROMMET

Insert the new fuel pickup assembly through fuel tank opening.



1. Insert fuel pickup

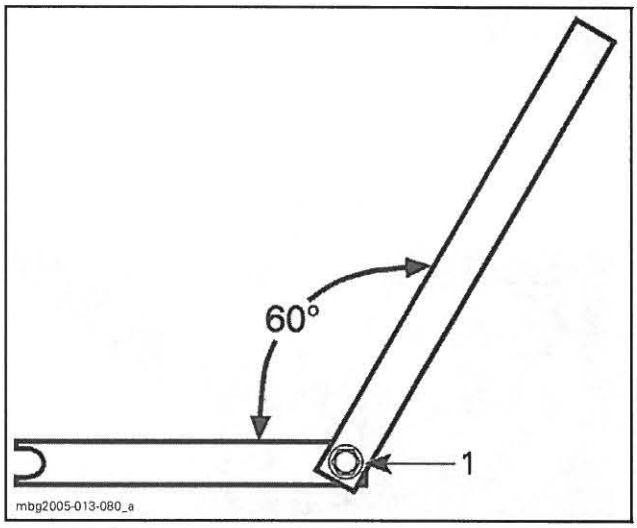
A special tool is needed to hold and connect the quick connect fitting to the fuel tank fitting. You can build it as follows.



1. Steel plate 212 x 25 x 3 mm (8.346 x 1 x .125 in)
2. Steel plate 518 x 25 x 3 mm (20.394 x 1 x .125 in)
3. 6 mm (0.25 in) dia. hole
4. 15 mm (0.591 in) drill bit to create opening

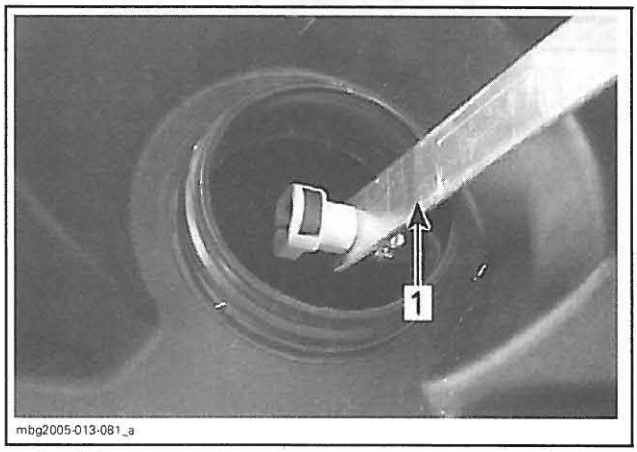
Assemble both plates with a screw and nut.

Tighten to keep a 60° angle.



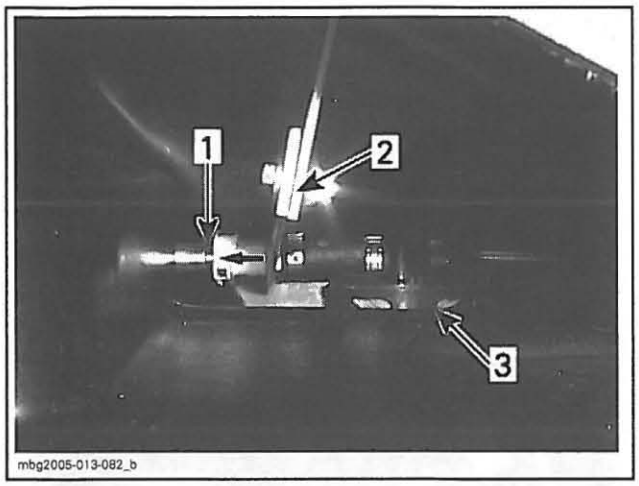
1. Tighten screw (tool at 60°)

Place special tool on quick connect fitting.



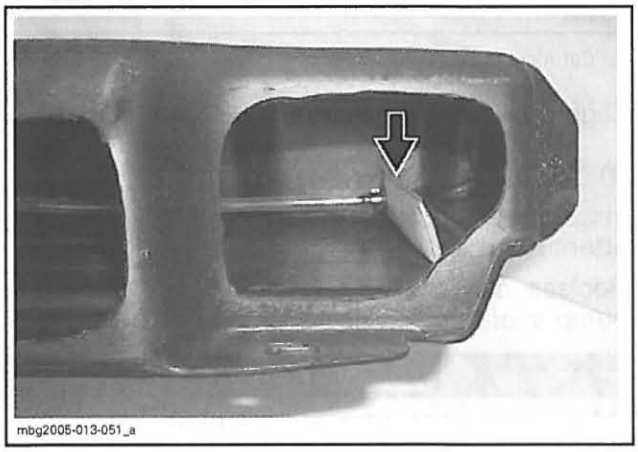
1. Special tool

CAUTION: Front pickup screen must face bottom of fuel tank.



1. Fuel tank fitting
2. Special tool pushing quick connect fitting
3. Pickup screen facing bottom of tank

CAUTION: Be sure to hear a "click" when coupling quick connect fitting. Push and pull several times quick connect fitting to ensure connection is secure. Rear pickup must rest flat at bottom of fuel tank.



Reinstall high pressure fuel pump.

Models with a Single Pickup

To facilitate the installation, grommet should be on smaller diameter of fuel tank fitting.

Install grommet on fuel tank then push fuel tank fitting through grommet.

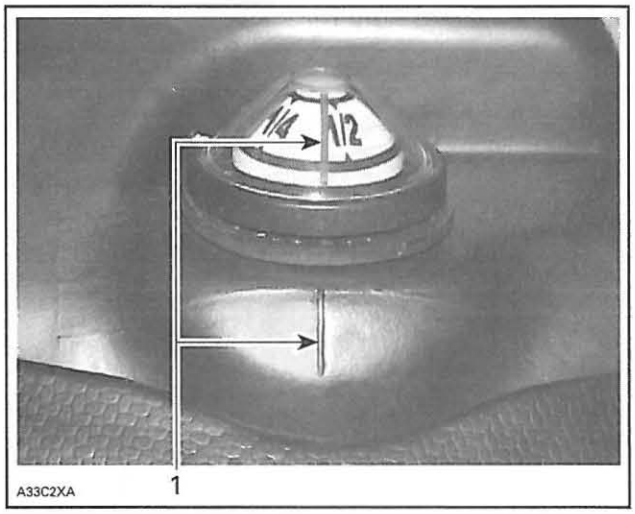
FLOAT-TYPE FUEL LEVEL GAUGE

Replacement

To remove gauge from fuel tank, pull gauge out of its grommet then remove grommet.

For reinstallation, proceed as follows:

- Install grommet halfway on gauge.
- Insert grommet in fuel tank until it bottoms.
- Firmly push gauge in grommet until it bottoms and so that its red line aligns with the line on the fuel tank.



1. Align red line with line on tank

ELECTRIC FUEL LEVEL SENSOR

Fuel level sensor is integrated to the high pressure fuel pump.

A 0.5 amp. fuse protects fuel level sensor circuity in fuse box.

FUEL TANK

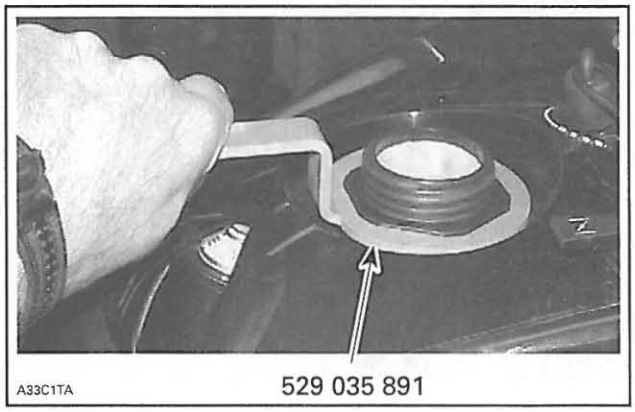
Removal

Using B.U.D.S., release pressure from fuel system. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Remove seat, refer to *BODY*.

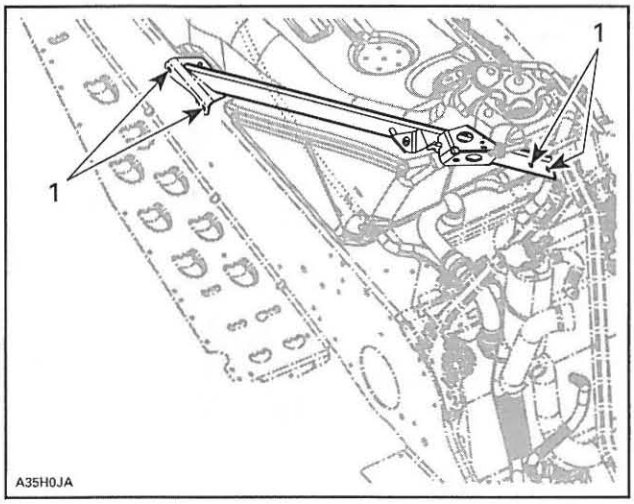
Remove fuel tank cap.

Remove filler neck plastic nut using wrench (P/N 529 035 891).



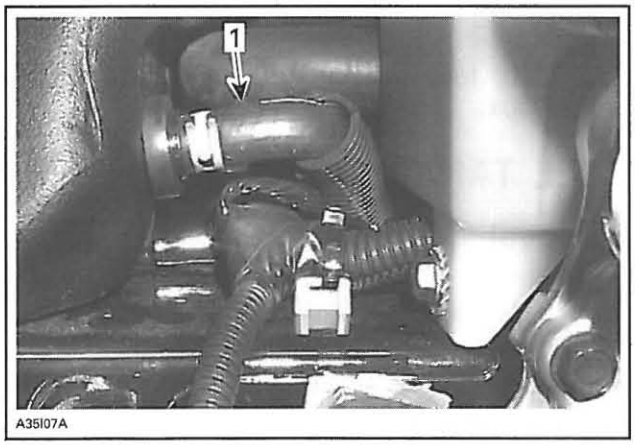
TYPICAL

Remove on both sides, fuel tank aluminum braces and discard the following:
- Torx screws M8 x 13
- elastic flanged nuts M8.

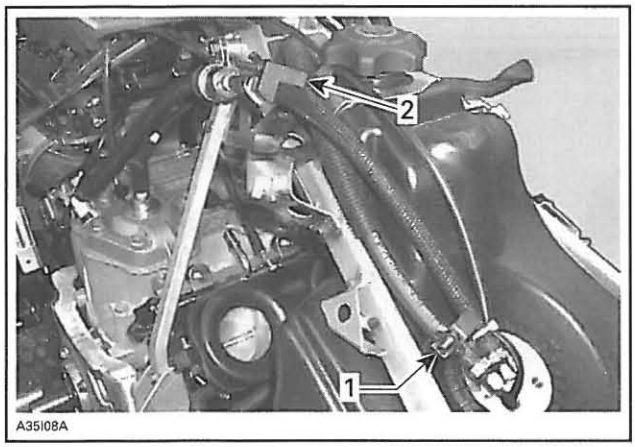


1. Unscrew the following on both sides

Install a hose pincher on the following hoses:



1. Fuel tank outlet hose

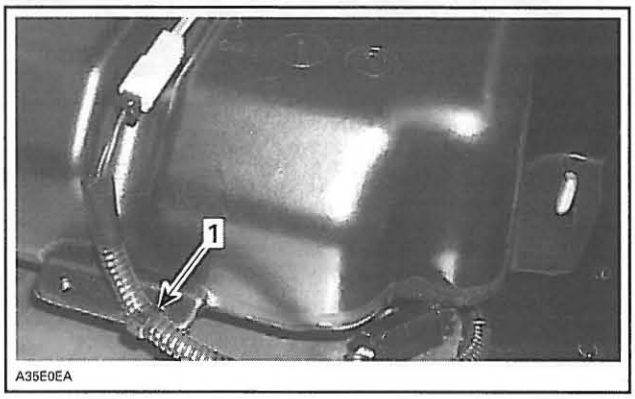


1. High pressure fuel pump INLET hose
2. High pressure fuel pump OUTLET hose

Unplug the following hoses:
- fuel tank outlet hose
- high pressure electric fuel pump inlet hose
- high pressure electric fuel pump outlet hose from in-line fuel filter
- fuel tank vent hose.

Unplug high pressure electric fuel pump connector.

Cut locking tie holding wiring harness to fuel tank at rear.



1. Cut locking tie

Slightly lift console then remove fuel tank.

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

Replace clip on the low pressure electric fuel pump inlet hose.

⚠ WARNING

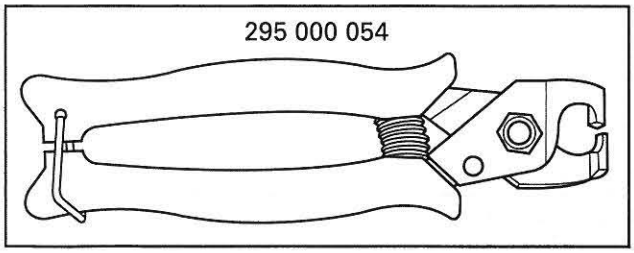
Make sure vent tube is not kinked.

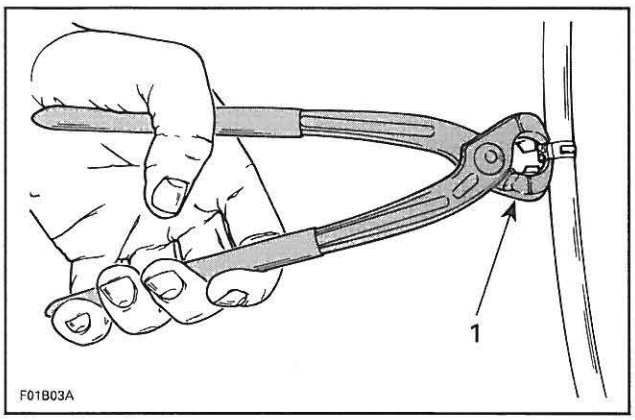
Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Aluminum braces Torx screws M8 x 13	2.5 N•m (22 lbf•**in**)
Seat/fuel tank	7 N•m (62 lbf•**in**)
Filler neck plastic nut	11 N•m (97 lbf•**in**)

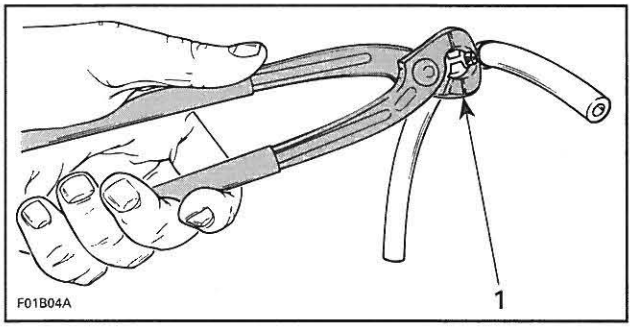
OETIKER CLAMPS

To secure or cut Oetiker clamps on fuel lines, use pliers Oetiker 1099 (P/N 295 000 070) or pliers (P/N 295 000 054).

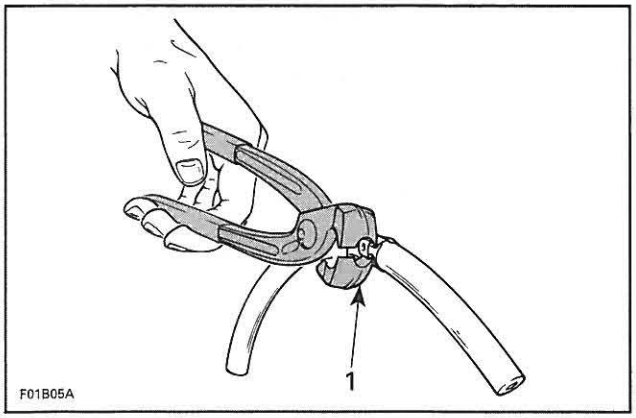




1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

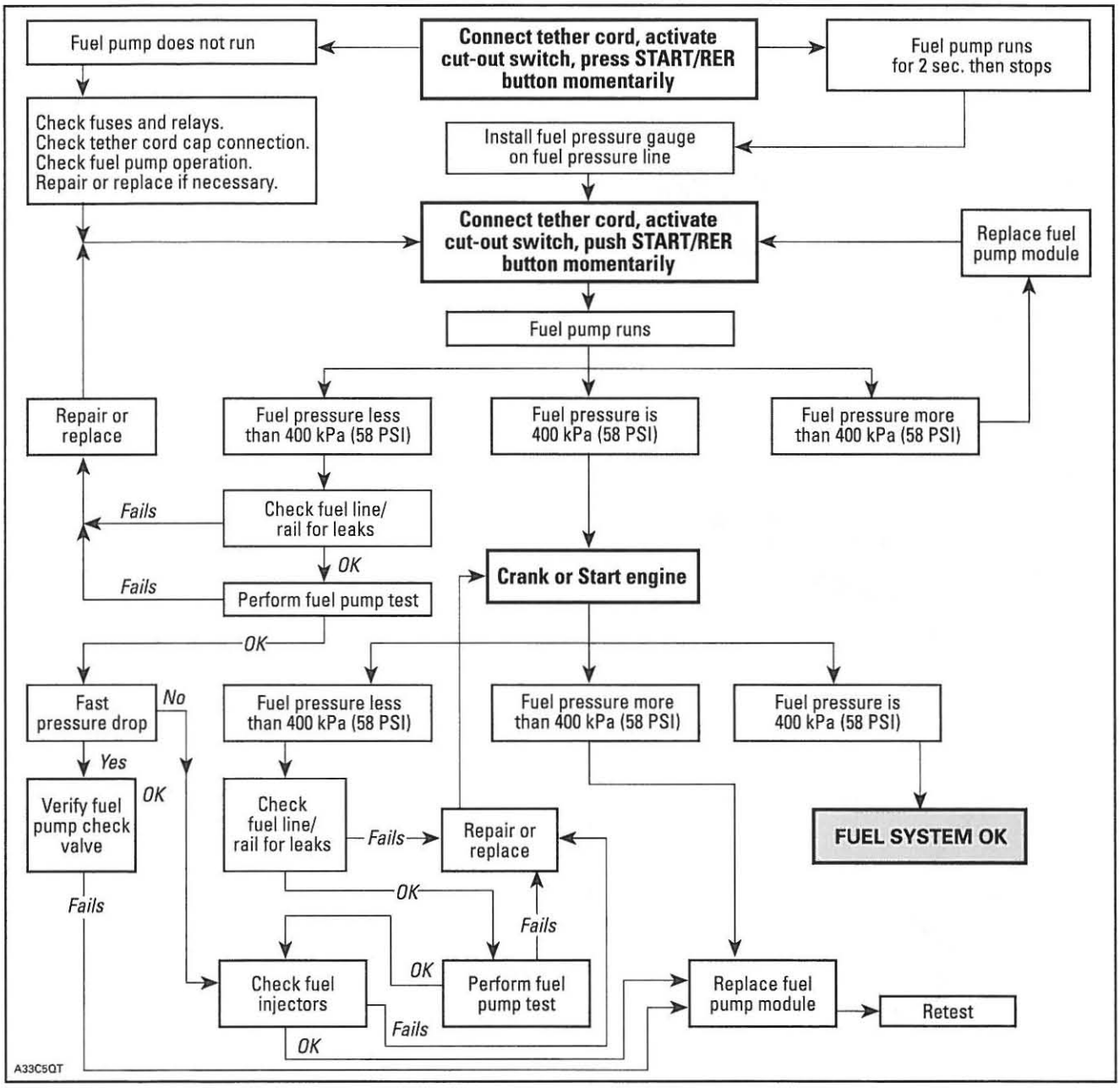
⚠ WARNING

Use of improper fuel lines could compromise fuel system integrity.

TROUBLESHOOTING

FUEL SYSTEM DIAGNOSTIC FLOW CHART

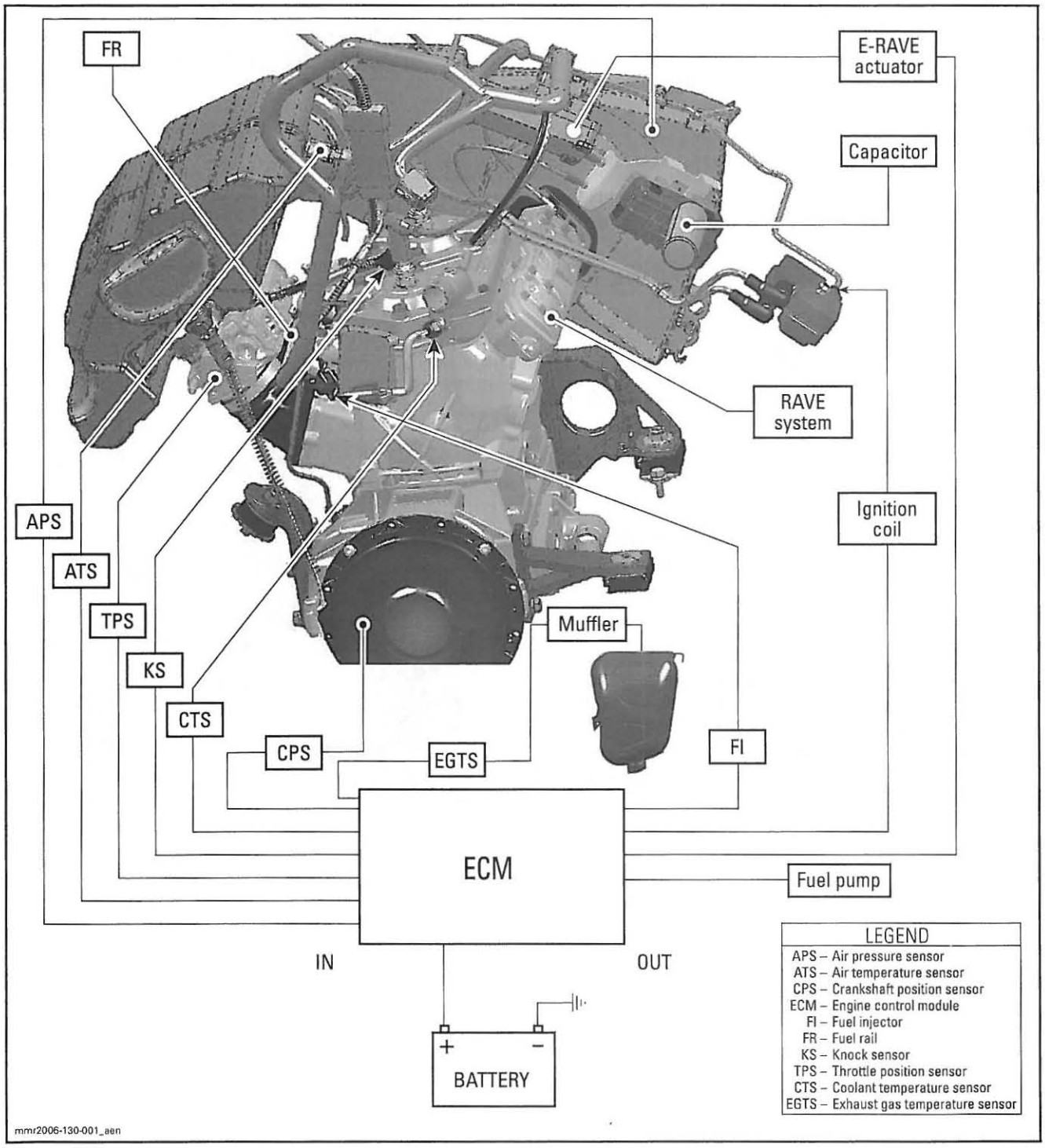
NOTE: Before proceeding with any test, make sure the low pressure electric fuel pump works properly.



OVERVIEW

SERVICE TOOLS

Description	Part Number	Page
VCK (Vehicle Communication Kit)	529 035 981	130



OPERATING PRINCIPLE

For this SDI 2-stroke engine, a highly advanced engine management system (EMS) has been used to ensure a high power output combined with cleaner combustion. An ECM (Engine Control Module) calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the transfer port of each cylinder.

CHARGING SYSTEM

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 480 watts.

AC current is rectified and regulated between 13.4 and 15 volts for the vehicle electrical system. It supplies the ECM with DC current.

Vehicle 12-volt battery supplies the ECM with DC current.

IGNITION SYSTEM

Double ignition coil has two separate windings, one for each spark plug.

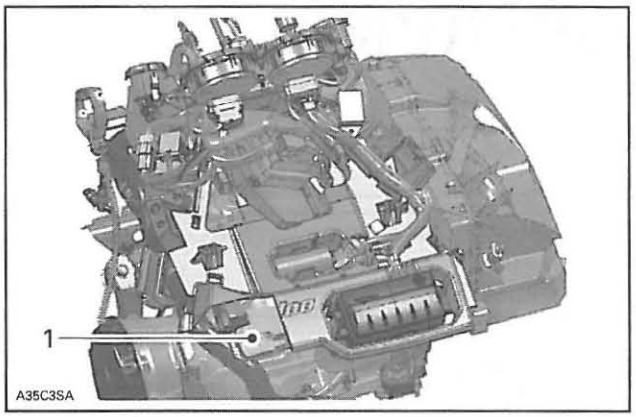
Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate windings circuits are switched to ground through the ECM. Each winding provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Match reference (PTO and MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

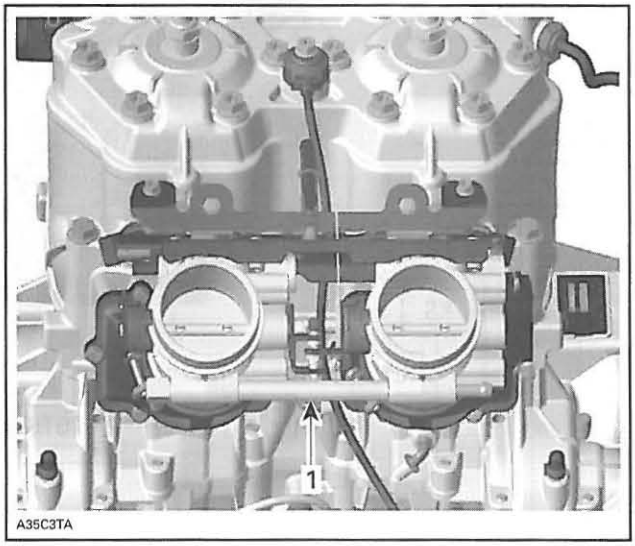
Double ignition coil is located underneath multi function plate.



1. Ignition coil

AIR INDUCTION

Through air filter mounted LH side panel, air goes into air intake silencer. The ECM measures at this point air pressure and temperature. Then, air for combustion is drawn through two throttle bodies mounted on the engine intake side. Fitted on this dual throttle body, there is a TPS (Throttle Position Sensor) that sends information to the ECM. The air continues through the reed valves into the cylinder base then the crankcase.



THROTTLE BODY ASSEMBLY
1. Coolant-heated line

FUEL DELIVERY SYSTEM

External Electric Fuel Pump

An external electric fuel pump is used to supply fuel to the electric fuel pump reservoir located inside fuel tank. This reservoir is the fuel supply for the electric fuel pump. This system allows a more consistent fuel delivery under extreme riding angles and when the fuel tank level is low, which increases the fuel range per tank.

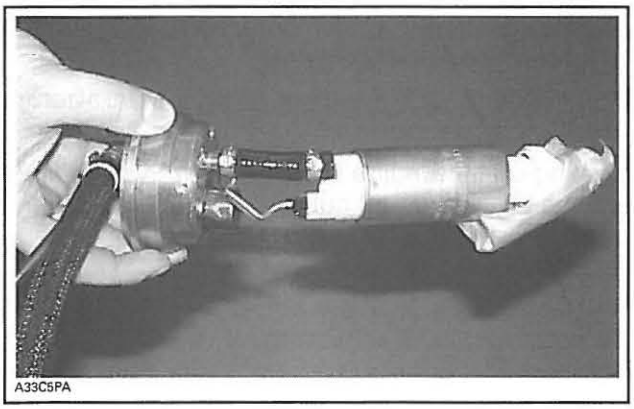
NOTE: A bypass hole in the upper section of the pump reservoir allows fuel to enter or exit the reservoir depending of the conditions.

Refer to *FUEL TANK AND FUEL PUMP* for an exploded view of the fuel system.

In-tank Electric Fuel Pump and Fuel Pressure Regulator

They provide fuel pressure and flow rate to the system.

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel pressure regulator. The fuel pump inlet includes a filter.


A33C5PA

The fuel pressure regulator controls the pressure in the system and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at 400 kPa (58 PSI).

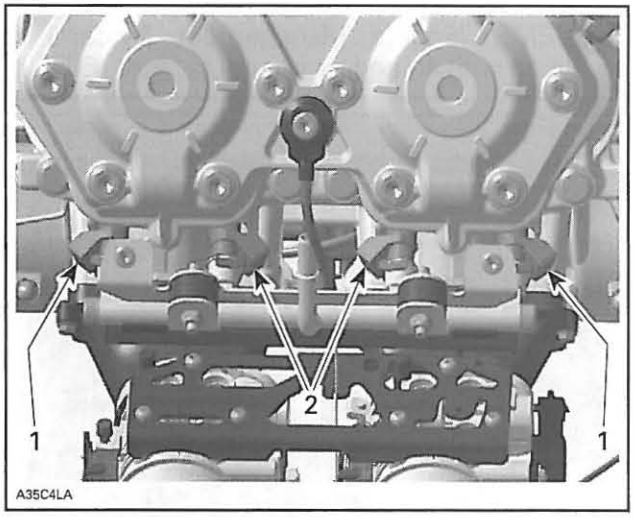
Fuel Rail

The fuel rail is a small tube on which the four injectors are mounted. It ensures at all times that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump module.

Fuel Injectors

Fuel injectors (two different types per cylinder) are used to inject fuel into the transfer port of cylinder.

- Outer injectors are responsible for idle speed and part load condition.
- Inner injectors will be activated at 6500 RPM for wide open throttle condition.



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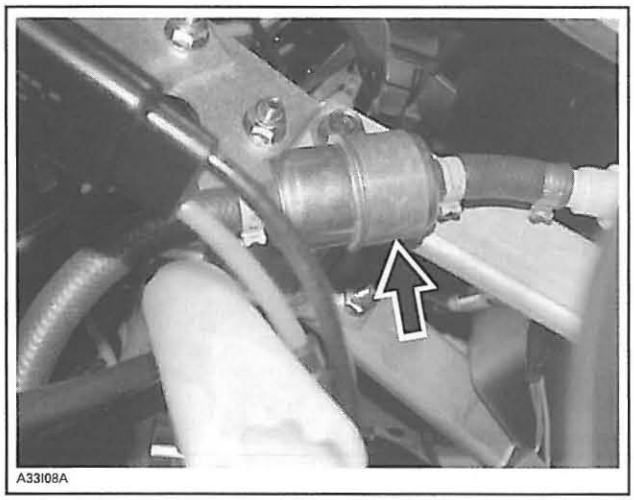
1. Outer injectors (blue)
2. Inner injectors (brown)

In-Line Fuel Filter

The in-line 10 micron fuel filter is fastened under the steering console. It should be replaced annually.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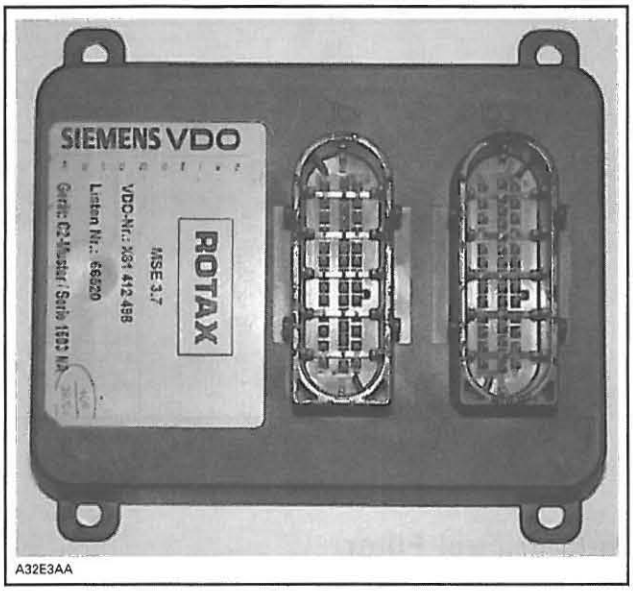
TYPICAL

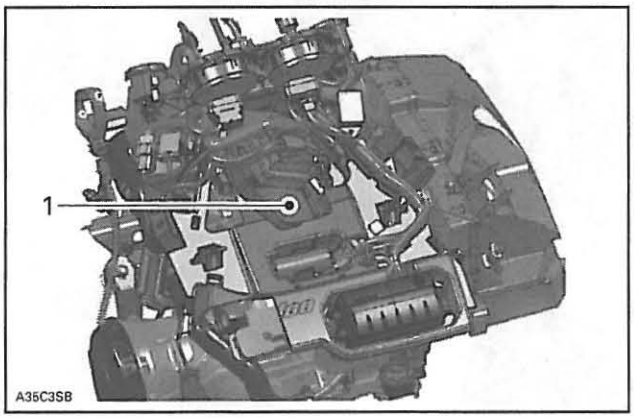
ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an engine control module (ECM).



TYPICAL — ECM

The ECM is mounted in the front of the vehicle above the multi function plate.



1. ECM location

The ECM is responsible for the following functions:
- power distribution
- fuel injection
- ignition
- start/stop functions
- E-RAVE actuator control
- DESS (Digitally Encoded Security System)
- RER (Rotax Electronic Reverse)
- monitoring system
- diagnostic mode
- engine modes of operation.

Power Distribution

Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: Engine-related sensors and injectors are continuously powered from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

Manual Start Models

The system uses 3 relays: an ignition/injectors, electric fuel pumps and starting system relay (R1), a second for the lighting system and the accessories (R2) and a third for the capacitor circuit (R4).

While cranking, the magneto sends AC current to the voltage regulator/rectifier that in turn, sends a signal to the ECM. This wakes up the Engine Management System and activate the starting system relay (R1) and the capacitor relay (R4). Just a small rotation of the engine is needed to wake-up the ECM.

The RER switch may also be used to wake-up the Engine Management System.

Waking-up the EMS before doing a start attempt result in faster start-up.

Waking-up the Engine Management System powers the ECM, the fuel pumps, the ignition coil, the injectors, and the gauges.

The battery is required to supply current mainly to the fuel pumps to allow a fuel pressure buildup. An easy way to acknowledge if the Engine Management System is woken-up, verify if gauges are lit up.

The capacitor has two functions. It is used to stabilize battery voltage when voltage from the voltage regulator/rectifier is charging the small battery. It also gives the possibility to be able to start the engine even if the battery is very low. In this case, starting the engine may be more difficult and will require the very complete stroke of the starting rope.

The capacitor relay prevents the capacitor to be connected to the battery when the engine is not running to allow safe vehicle maintenance (disconnection and reconnection of the capacitor).

Electric Start Models

The system uses 2 relays: an ignition/injectors, fuel pumps and starting system relay (R1) and a headlights and accessories relay (R2).

When the START/RER switch is activated, it wakes up the EMS and power the starting system relay (R1), the ECM, the fuel pumps, the ignition coil, the injectors, and the gauges. Then, if the cut-off switch and the DESS switch are in position to allow starting and START/RER switch is hold, the starter solenoid relay is activated.

All Models

When engine reaches approximately 800 RPM, the ECM activates the headlights and accessory relay (R2).

Gauges Current Supply

Gauges are supplied with current for 30 seconds when connecting the tether cord cap on its post and momentarily pressing the START/RER switch.

NOTE: On electric start models, setting engine cut-out switch to OFF will prevent engine starting.

NOTE: Each time the tether cord cap is connected to the post and START/RER switch is depressed, the fuel pumps is activated for 2 seconds to build up pressure in the fuel injection system.

Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the tether cord cap is left on the post when the engine is not running for more then 30 seconds. The ECM will remain offline until the electric starter or the rewind starter is activated. The ECM will shut down all outputs after 5 seconds when the tether cord cap is removed.

Fuel Injection

The ECM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

Ignition

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

Knock Sensor

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

E-Rave

Refer to *E-RAVE SYSTEM* section.

Digitally Encoded Security System (DESS)

Refer to *DIGITALLY ENCODED SECURITY SYSTEM (DESS)* section.

Rotax Electronic Reverse (RER)

Refer to *ROTAX ELECTRONIC REVERSE (RER)* section.

Monitoring System

The ECM monitors the electronic components of the engine management system and other components of the electrical system.

When a fault occurs, it sends a signal to the check engine LED or also to the beeper to inform the driver of a particular condition. Refer to the *DIAGNOSTIC PROCEDURES*.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The beeper will also be activated intermittently.

High Coolant Temperature Warning Device

When the coolant temperature is getting too high, the ECM sends out signals to the beeper and the high temperature LED. This occurs at 95°C (203°F).

EGTS Warning Device

NOTE: The sensor is installed on Summit SDI **but is not used** unless a sea-level calibration has been installed in ECM with B.U.D.S. software.

When the exhaust gas temperature is getting too high, the following occurs.

- At approximately 600°C (1112°F), the ECM enrichens the fuel mixture to reduce muffler temperature. A lack of performance may be felt. Normal operation resumes when temperature drops.
- At approximately 700°C (1292°F), the ECM sends out signals to the high temperature LED. In addition, the ECM goes in limp home mode and limit engine speed to approximately 7500 RPM. Engine needs to be stopped and restarted to resume normal operation.

Diagnostic Mode

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981) to see the fault codes. Refer to the *DIAGNOSTIC PROCEDURES* section.

Engine Modes of Operation

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start up, idle, warm up, normal operation, drowned mode and limp home.

Drowned Mode (Flooded Engine)

Electric Start Models Only

If the engine does not start and is fuel-flooded, the drowned mode can be activated to prevent fuel injection and to cut ignition while cranking.

Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Press the START/RER button.

⚠ WARNING

Do not attempt to use the rewind starter. The drowned mode is active only by using the electric starter.

The engine should be cranked for 20 seconds. Release START/RER button and throttle lever.

Restart engine normally.

NOTE: If the engine does not start, it may be necessary to replace the spark plugs.

Limp Home Mode

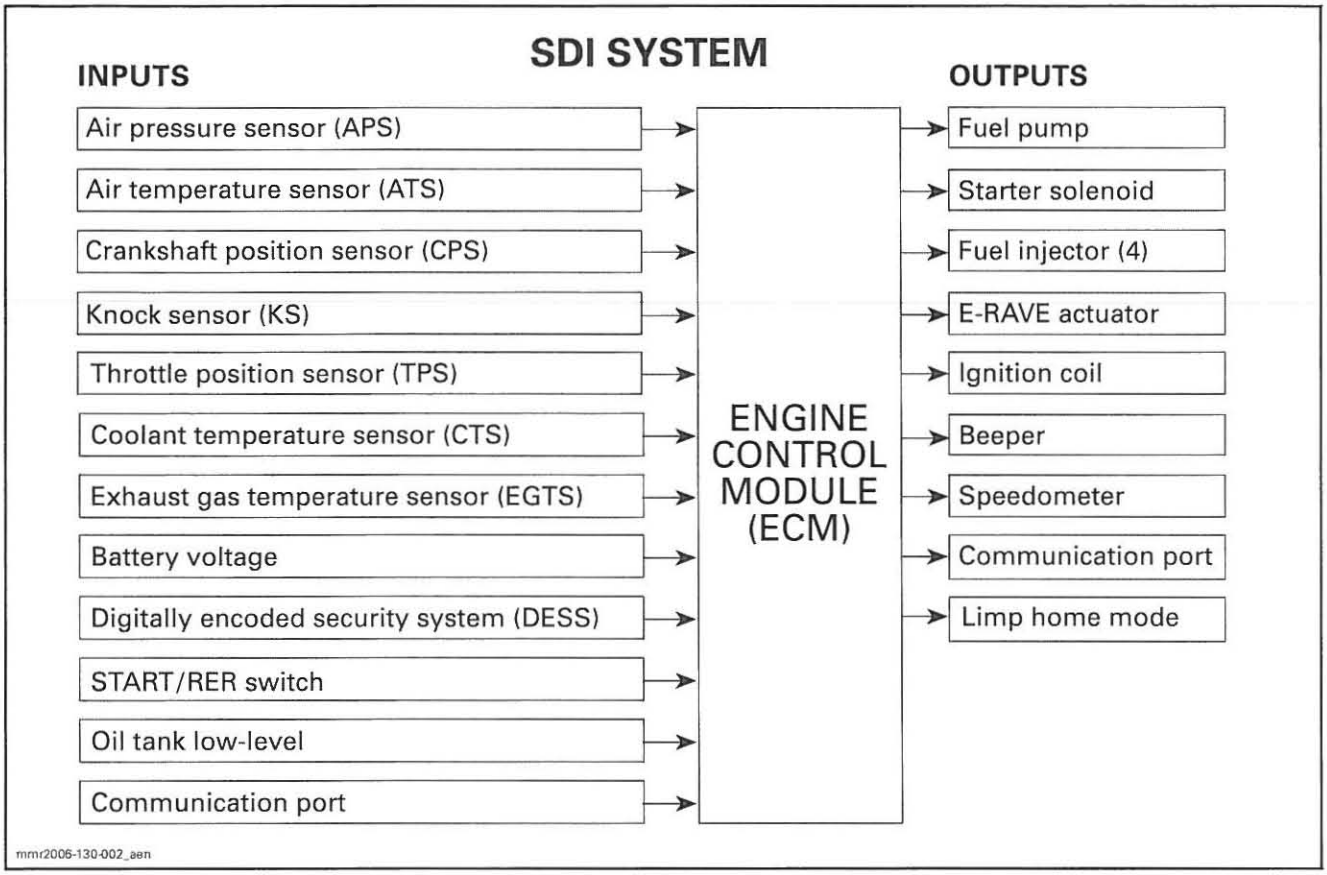
The ECM may automatically set default parameters to ensure the adequate operation of the vehicle if a component of the engine management system is not operating properly.

NOTE: Sensor failures will not lead automatically to a limp home mode. The check engine LED will turn on and in some cases the beeper.

The engine RPM may be limited if some critical components fail. In this case, releasing throttle and letting the engine returning to idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on DESS post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the *DIAGNOSTIC PROCEDURES* for a complete chart.

ENGINE MANAGEMENT SYSTEM FUNCTIONS



As shown in the SDI SYSTEM illustration, the ECM is the central point of the engine management system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for optimum engine operation.

EMS DIAGNOSTIC AND COMMUNICATION TOOLS

SERVICE TOOLS

Description	Part Number	Page
Communication kit	529 035 981	137
DESS post interface	529 036 019	141–142
MPI-2	529 036 018	140, 142
Optional extension cable	529 035 697	140
Optional extension cable	529 035 703	137
Supply T-harness	529 035 869	137–138, 141–142

DIAGNOSTIC

GENERAL

Warning lights in speedometer and/or a beeper provide signals as vehicle operation feedback or to indicate a problem. Refer to the following tables for more information.

When there is a problem, EMS (Engine Management System) can provide fault codes to ease the troubleshooting. Refer to *EMS FAULT CODE TABLES* in this section.

Fault codes can be read with B.U.D.S. software. Refer to *COMMUNICATION TOOLS* further in this section for more information.

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

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 their states. For more information pertaining to the faults code status and report, refer to B.U.D.S. online help.

Many fault codes at the same time is likely to be burnt fuse(s).

Here is the basic order suggested to diagnose a suspected engine management related problem:

- Check if the engine management system (EMS) pilot lamp lights up. If so, use the B.U.D.S. software and look for fault codes to diagnose the trouble.
- Check all fuses, relays, battery and capacitor (if so equipped).
- Check fuel pressure (on fuel injection models).
- Check spark plugs condition.
- Check all connections of the wiring harness.

EMS FAULT CODE TABLE

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0106	Off	Off	Air pressure sensor voltage out of range.
P0337	Off	Off	No crankshaft signal detected.
P0336	Off	Off	High engine RPM detected.
P0339	Off	Off	Crankshaft signal fault.
P0654	Off	Off	Tachometer RPM signal shorted to battery.
P0654	Off	Off	Tachometer RPM signal open circuit or shorted to ground.
P0617	Off	Off	Starter relay shorted to battery.
P0616	Off	Off	Starter relay open circuit or shorted to ground.
P1670	Off	Off	Beeper shorted to battery.
P1671	Off	Off	Beeper open circuit or shorted to ground.
P0650	Off	Off	EMS pilot lamp shorted to battery.
P0650	Off	Off	EMS pilot lamp open circuit or shorted to ground.
P1675	Off	Off	Relay 2 shorted to battery.
P1676	Off	Off	Relay 2 open circuit or shorted to ground.
P1148	Off	Off	Safety fuel cut off detected.
P1611	Off	Off	P+ test of ISC output signal failed.
P0513	Off	Off	Incorrect DESS® key.
P0601	Off	Off	Faulty module (software of hardware damaged).
P1677	Off	Off	Relay 3 shorted to battery.
P1678	Off	Off	Relay 3 open circuit or shorted to ground.
P1648	Off	Off	Battery lamp shorted to battery.
P1649	Off	Off	Battery lamp open circuit or shorted to ground.
P0655	Off	Off	Engine temperature lamp shorted to battery.
P0655	Off	Off	Engine temperature lamp open circuit or shorted to ground.
P1646	Off	Off	Engine temperature lamp shorted to battery.
P1647	Off	Off	Engine temperature lamp open circuit or shorted to ground.
P0648	Off	Off	DESS lamp shorted to battery.
P0648	Off	Off	DESS lamp open circuit or shorted to ground.
P1654	Off	Off	Oil lamp shorted to battery.
P1658	Off	Off	Oil lamp open circuit or shorted to ground.
P0117	Blink	Off	Engine temperature sensor voltage too low.
P0118	Blink	Off	Engine temperature sensor voltage too high.
P0116	Blink	Off	Engine temperature sensor functional problem.
P0112	Blink	Off	Air temperature sensor voltage too low.
P0113	Blink	Off	Air temperature sensor voltage too high.
P0111	Blink	Off	Air temperature sensor functional problem.
P0427	Blink	Off	Exhaust temperature sensor voltage too low.
P0428	Blink	Off	Exhaust temperature sensor voltage too high.
P0426	Blink	Off	Exhaust temperature sensor functional problem.
P0107	Blink	Off	Air pressure sensor voltage too low.
P0108	Blink	Off	Air pressure sensor voltage too high.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0608	Blink	Off	Sensor's power supply voltage too low.
P0608	Blink	Off	Sensor's power supply voltage too high.
P0232	Blink	Off	Fuel pump shorted to battery.
P0231	Blink	Off	Fuel pump open circuit or shorted to ground.
P0080	Blink	Off	RAVE® solenoid shorted to battery.
P0079	Blink	Off	RAVE® solenoid open circuit or shorted to ground.
P0326	Blink	Off	Knock sensor signal below minimum noise.
P1502	Blink	Off	TOPS functional problem.
P0351	Blink	Off	No ignition output cylinder # 1 (MAG for 2 cyl. engine).
P0352	Blink	Off	No ignition output cylinder # 2 (PTO for 2 cyl. engine).
P0262	Blink	Off	Injector cyl. # 1 OR outer MAG injector (2 cyl.), shorted to battery.
P0261	Blink	Off	Injector cyl. # 1 OR outer MAG injector (2 cyl.), open circuit or shorted to ground.
P0265	Blink	Off	Injector cyl. # 2 OR outer PTO injector (2 cyl.), shorted to battery.
P0264	Blink	Off	Injector cyl. # 2 OR outer PTO injector (2 cyl.), open circuit or shorted to ground.
P0268	Blink	Off	Injector cyl. # 3 OR inner MAG injector (2 cyl.), shorted to battery.
P0267	Blink	Off	Injector cyl. # 3 OR inner MAG injector (2 cyl.), open circuit or shorted to ground.
P0271	Blink	Off	Inner PTO injector shorted to battery.
P0270	Blink	Off	Inner PTO injector open circuit or shorted to ground.
P0122	Blink	Off	Throttle position sensor voltage too low.
P0123	Blink	Off	Throttle position sensor voltage too high.
P0601	Blink	Off	TPS learns unlikely or checksum fault.
P1102	Blink	Off	Throttle position sensor adaptation failure.
P1104	Blink	Off	Throttle position sensor adaptation canceled.
P1655	Blink	Off	DESS® shorted to battery.
P1656	Blink	Off	DESS® line shorted to ground.
P0604	Blink	Off	RAM fault.
P0605	Blink	Off	EEPROM fault.
P0602	Blink	Off	MPEM not coded.
P0605	Blink	Off	EEPROM checksum fault.
P0605	Blink	Off	Coding ID checksum fault.
P0605	Blink	Off	Coding checksum fault.
P0605	Blink	Off	Programming checksum fault.
P1549	Blink	Off	Very high exhaust temperature detected (1).
P0562	Off	2 s beep/min.	Battery voltage too low.
P0563	Blink	2 s beep/min.	Battery voltage too high.

(1) The beeper turns on when exhaust temperature is higher than 800°C (1472°F). When exhaust temperature reaches 850°C (1562°F), engine speed is limited to 5250 RPM.

EMS FAULT CODES SUPPLEMENTAL INFORMATION

EMS Blinking Light without Fault Code

When the EMS light blinks and no fault code is reported with B.U.D.S. software, this indicates a failure of the E-RAVE system. Refer to *E-RAVE SYSTEM* for troubleshooting.

Fault Code P0616

Manual Start Models

This code will always be present. Disregard this code, as it is not applicable. Since the starter relay wiring is factory-installed, the ECM detects an open circuit because the starting relay is not installed.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups; out of range and adaption failure faults.

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.	Reconnect.
Check if sensor is loose.	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion.	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test).	Repair.
Inspect wiring and sensor (resistance test).	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test).	Replace sensor and reset **Closed Throttle**.

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 "Adaption Failure":

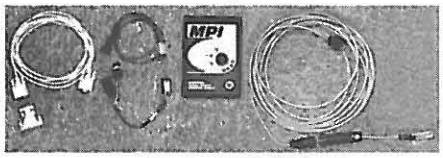
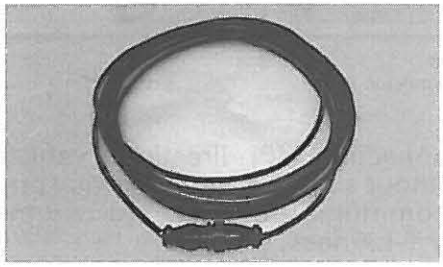
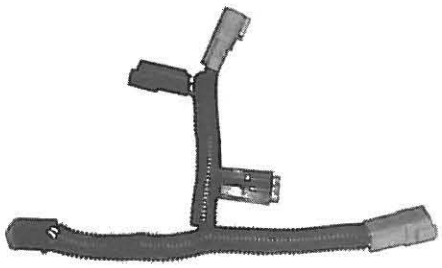
- Idle speed is out of range.
- Engine stops, when throttle is released quickly.
- Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
Throttle body has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
ECM has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
Throttle cable too tight.	Adjust cable and reset **Closed Throttle**.
Sensor is loose.	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose.	Fix and reset **Closed Throttle**.
Adjustment screw worn or loose.	Adjust idle speed screw using B.U.D.S.

COMMUNICATION TOOLS

Two different MPI (Multi-Purpose Interface) can be used with B.U.D.S. software: MPI and MPI-2. Refer to the following for proper connections.

MPI (Multi-Purpose Interface)

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
Communication kit (P/N 529 035 981) 	X	X
Optional extension cable (P/N 529 035 703) 	X	X
Supply T-harness (P/N 529 035 869) 	X	X

MPI Supply

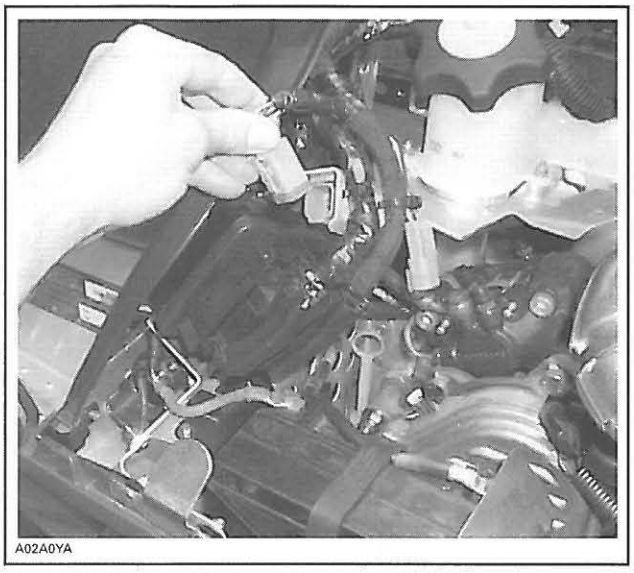
The MPI can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

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 the 6 pin connector from the protective cap on the right side of the vehicle.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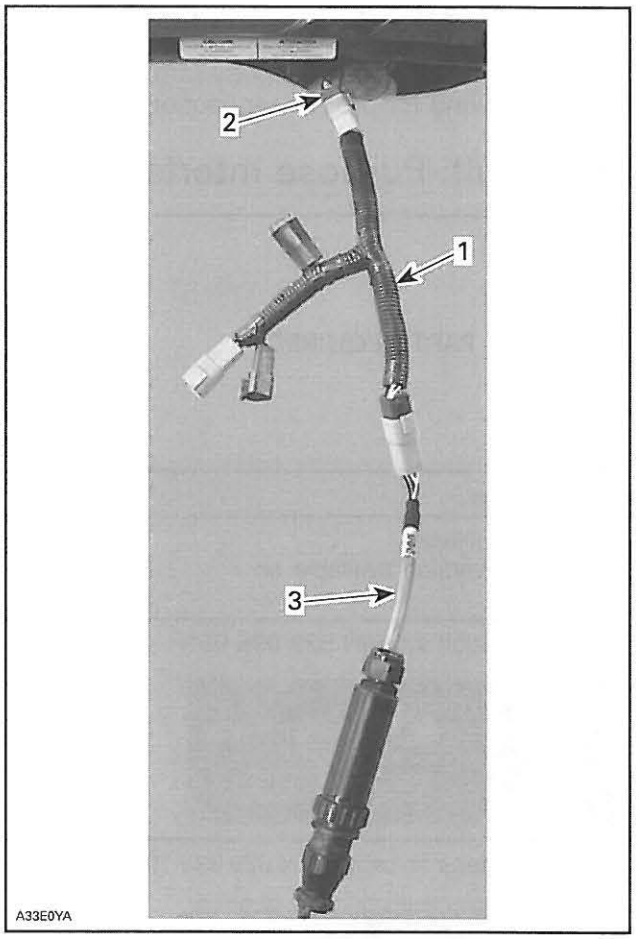
Connect Supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.

Connect the 6-pin diagnostic cable from MPI to supply T-harness.



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1. *Supply T-harness*
2. *Vehicle 6-pin connector*
3. *MPI cable*

CAUTION: Connecting MPI directly to vehicle connector (without supply T-harness) may prevent proper communication. Always use the proper supply T-harness.

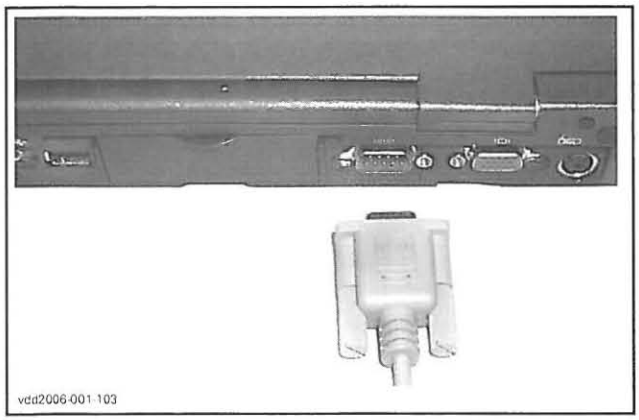
These models do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply T-harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.

CAUTION: Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

NOTE: It is suggested to disconnect headlights fuse and to turn off heated grips to reduce battery discharge rate.

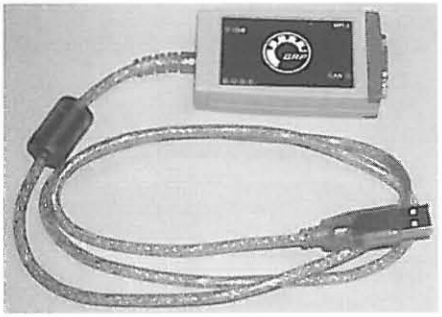
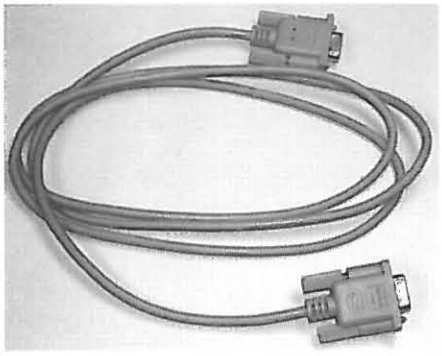
NOTE: Some components will generate heat when leaving vehicle in diagnostic mode for a long period. Always disconnect MPI supply harness and supply cable from vehicle/battery when not working on vehicle.

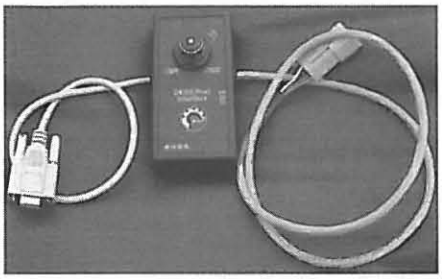
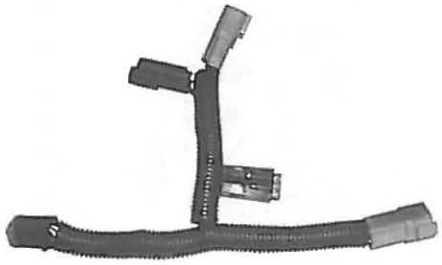
Connect remaining MPI connector to the serial port of a PC (personal computer).



Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

MPI-2 (Multi-Purpose Interface)

PART REQUIRED	OPERATION TO PERFORM	
	– 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 (P/N 529 035 697) 	X	X

PART REQUIRED	OPERATION TO PERFORM	
	– 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	X
Supply T-harness (P/N 529 035 869) 	X	X

MPI-2 Supply

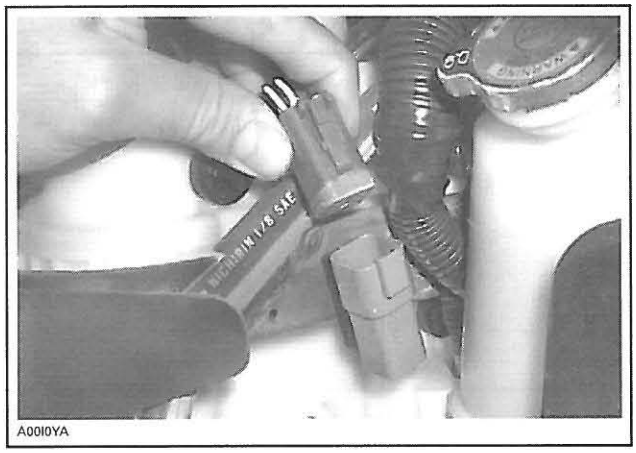
The MPI can use the vehicle power for its supply. Two AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI-2 specification if a power supply is used.

Connections with Vehicle

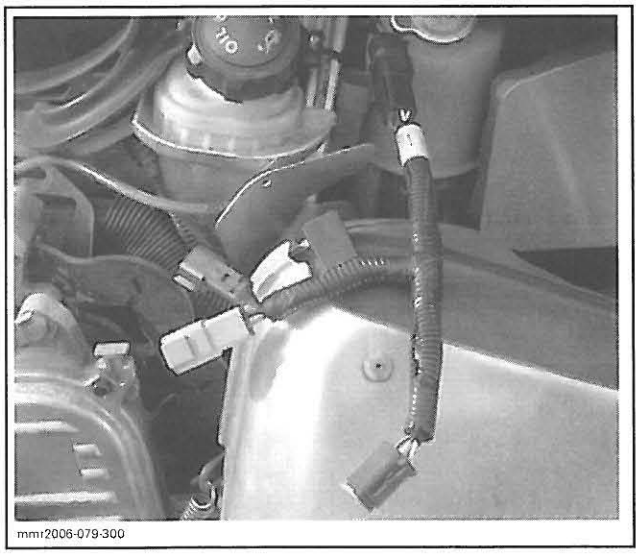
⚠ WARNING

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.

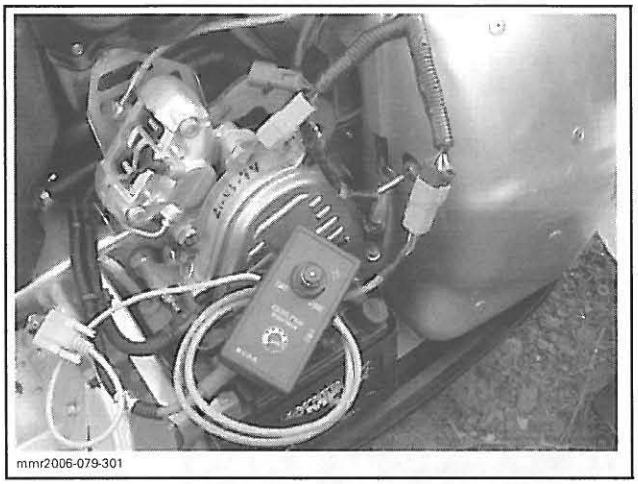
Remove the 6-pin connector from the protective cap on the right side of the vehicle.


A00I0YA

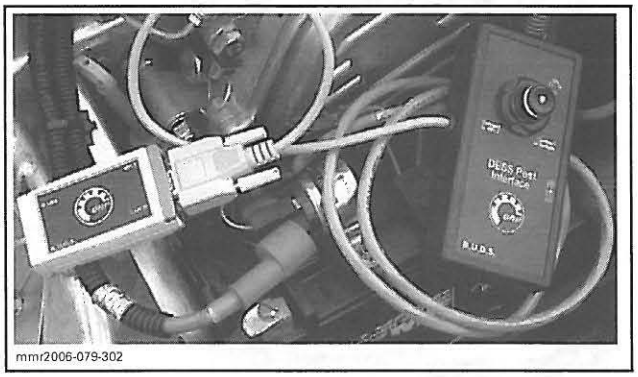
Connect Supply T-harness (P/N 529 035 869), to vehicle 6-pin connector.


mmr2006-079-300

Connect DESS post interface (P/N 529 036 019), to supply T-harness connector.


mmr2006-079-301

Connect MPI-2 (P/N 529 036 018) to DESS post interface.



mmr2006-079-302

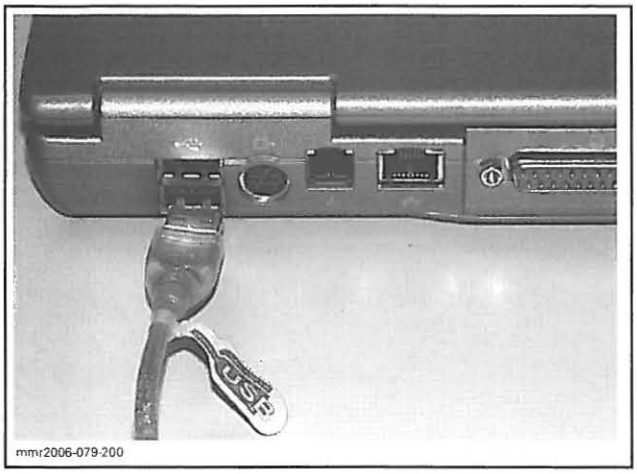
These models do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply T-harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.

CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

NOTE: On all models, it is suggested to disconnect headlights fuse and to turn off heated grips to reduce battery discharge rate.

NOTE: Some components will generate heat when leaving vehicle in diagnostic mode for a long period. Always disconnect MPI supply harness and supply cable from vehicle/battery when not working on vehicle.

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.*

B.U.D.S. SOFTWARE

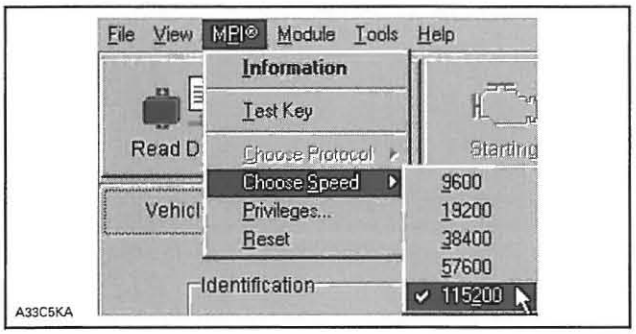
B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow electrical component inspection, diagnostic options and adjustments such as the closed throttle.

For more information pertaining to the use of the B.U.D.S. software, use its help which contains detailed information on its functions.

When using the service action suggested in the Fault section of B.U.D.S., for instance, a system circuit referred to as DA-35, means connector "A" on the ECM and the contact 35.

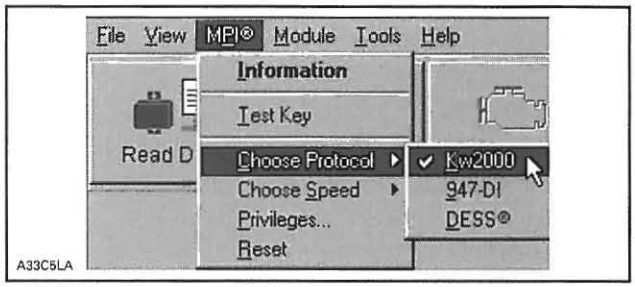
When using the B.U.D.S. software:

- ensure that 115200 speed is properly selected in "**MPI**" under "**Choose speed**"



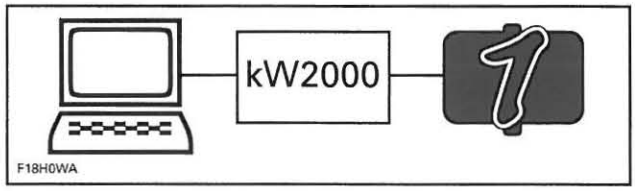
NOTE: If you are using an old PC computer, it may be necessary to use a slower speed so that the communication works.

- ensure that the protocol "kW2000" is properly selected in "**MPI**" under "**Choose protocol**



- ensure the status bar shows the kW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 indicates that the ECM is recognized by the MPI.



CONNECTION SUCCESSFUL

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

- ECM is not powered-up
- wrong protocol is used
- bad connection between MPI and ECM.

COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	148
Fluke 111 multimeter	529 035 868	146, 164
hose pinchers	295 000 076	155
pusher	529 036 036	153

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	153
Loctite 5910	293 800 081	159, 163
pulley flange cleaner	413 711 809	155

GENERAL

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine and drive system are present:

- good transmission system operation
- good engine compression and properly operating mechanical components, no leaks etc.
- fuel pump connection and fuel lines without leaks.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than that of a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

- Use B.U.D.S. to release the fuel pressure in the system. Look in the **Activation** section.

⚠ 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 and work in a well ventilated area. 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. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove main fuse prior to working on the fuel system. After performing a pressure test, release the pressure.

- Always disconnect battery properly or remove main fuse prior to working on the fuel system. Refer to *CHARGING SYSTEM* section.

Fuel Rail and Hose

Pressure at fuel rail is supplied and controlled by the electric fuel pump.

When a repair is completed, ensure that hose between fuel rail and fuel pump is properly secured in the supports. Then, perform a fuel pressure test. Refer to *FUEL SYSTEM*.

To remove fuel rail, refer to *FUEL INJECTORS* in this section.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. The fuel pump is started and pressure quickly builds-up each time the tether cord cap is installed and the START/RER button is depressed (or rewind starter is pulled).

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

- battery
- capacitor (manual start models)
- fuses
- relays
- DESS
- ignition (spark)
- ground connections
- wiring connectors.

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.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) 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 (injectors, fuel pump, ignition coils and starter solenoid) are continuously supplied by the battery when the start button is depressed or if engine is rotated (with the rewind starter). Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.

To perform verifications, use the Fluke 111 multimeter (P/N 529 035 868) should be used.

Pay particular attention to ensure that terminals are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: **Ensure all terminals are properly crimped on wires and connector housings are properly fastened.**

Before replacing an 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 replugging the ECM. 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. Clean terminals properly and then coat them prior to assembling as follows:

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine – any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The value of a resistor varies with the temperature. The value for common resistor or windings (such as solenoid) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the value **decreases** as the temperature increases. Use this table for sensor resistive values at given temperature.

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
- 40	- 40		72412	
- 30	- 22	28000	38681	
- 20	- 4	14500	21529	734
- 10	14	9000	12431	474
0	32	5500	7418	314
10	50	3500	4582	214
20	68	2500	2919	149
30	86	1750	1912	106
40	104	1200	1284	77
50	122	875	883	56
60	140	600	622	42
70	158	450	448	32
80	176	320	328	25
90	194	239	245	19
100	212	180	186	15
110	230	148	143	
120	248	119	112	
130	266	90	88	
135	275		79	
140	284		71	
145	293		64	
150	302		57	

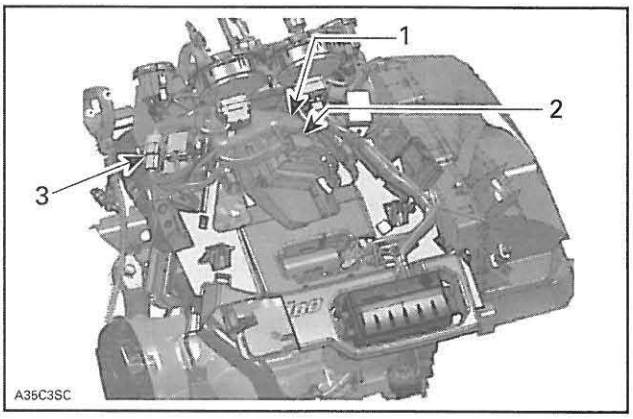
TEMPERATURE SENSOR TABLE		
TEMPERATURE		RESISTANCE (OHMS)
°C	°F	EGTS
- 40	- 40	170
- 20	- 4	185
0	32	201
25	77	220
50	122	239
100	212	276
150	302	313
200	392	349
250	482	385
300	572	420
350	662	454
400	752	488
450	842	521
500	932	554
600	1112	618
700	1292	679
800	1472	738
900	1652	795
1000	1832	849

The resistive 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 room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun (ensure not to heat excessively) while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

A good test would be to put sensor in a container filled with ice and water and measure resistance. Then, boil water and read resistance again. According to the table above, an ATS value would be approximately 5500 Ω with ice/water (0°C (32°F)) and 180 Ω with boiling water (100°C (212°F)).

Connector Identification

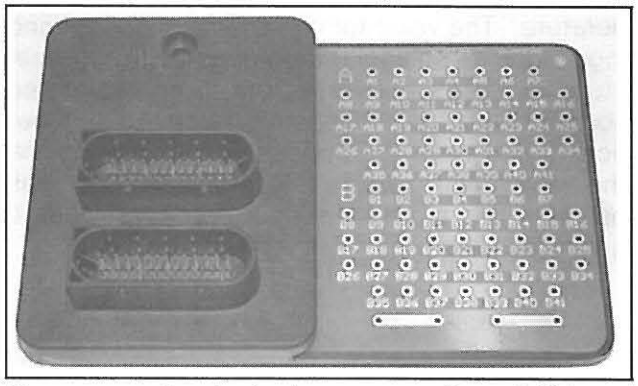


1. ECM connector "A"
2. ECM connector "B"
3. Engine/vehicle connector

ECM Connectors

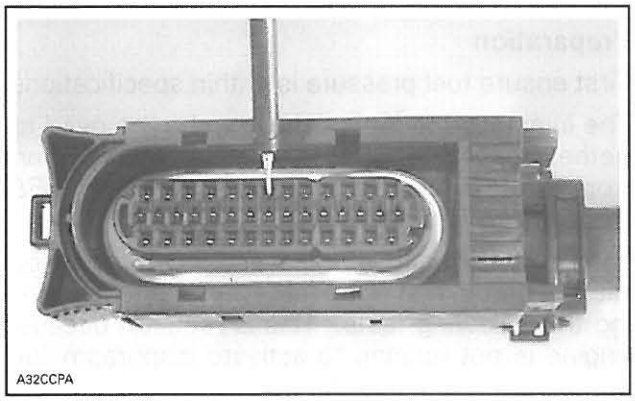
Probing Recommended Procedure

The most recommended and safest method to probe ECM connector terminals is to use the ECM adapter (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.



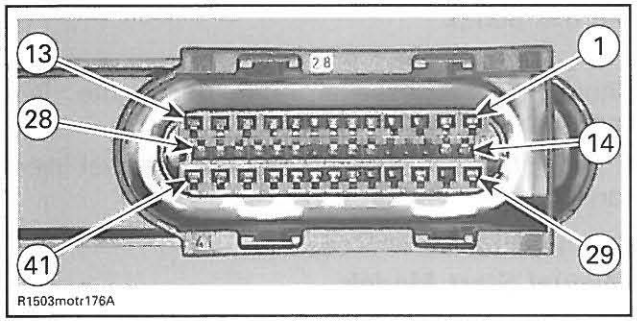
Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool holes.

CAUTION: If not using the ECM adapter, probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this could lead to improper function of the engine management system.



PROBE ONLY TOP OF TERMINAL

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.

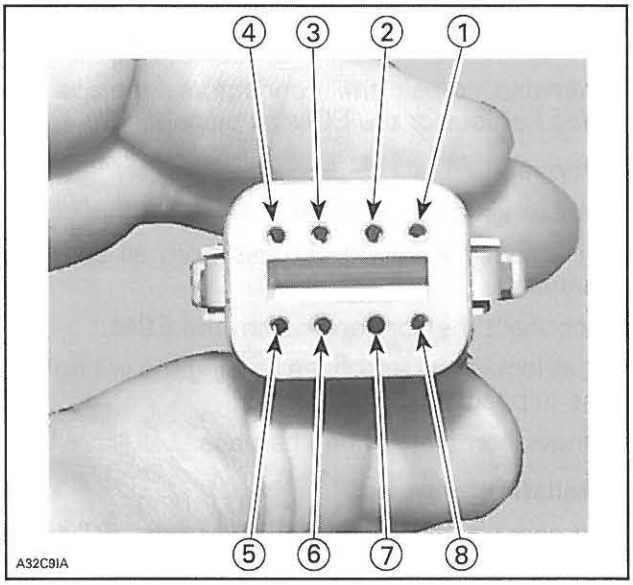


TERMINAL IDENTIFICATION OF ECM CONNECTOR (WIRING HARNESS SIDE)

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

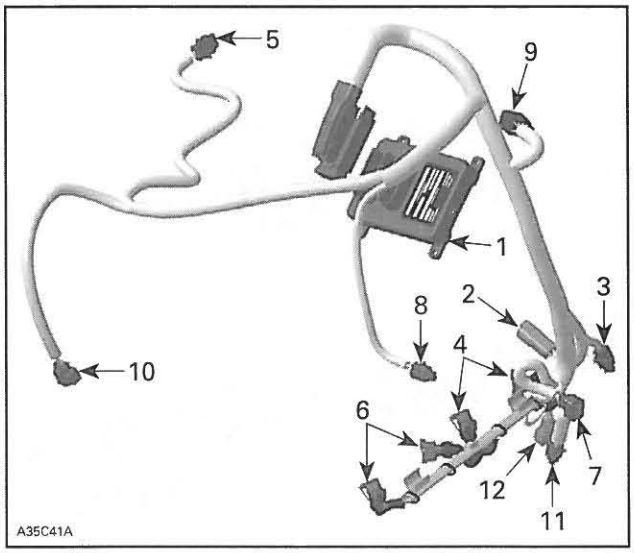
Engine/Vehicle Connector

Use this illustration to locate the terminal numbers on the engine/vehicle connector of the wiring harness when performing tests.



TERMINAL IDENTIFICATION OF ENGINE/VEHICLE CONNECTOR (WIRING HARNESS SIDE)

Engine Wiring Harness



1. *ECM*
2. *CTS connector*
3. *EGTS connector (NOT USED)*
4. *Fuel injector connector (cylinder MAG side)*
5. *Ignition coil connector*
6. *Fuel injector connector (cylinder PTO side)*
7. *TPS connector*
8. *ATS connector*
9. *Engine/vehicle connector*
10. *APS connector*
11. *KS connector*
12. *CPS connector*

Resistance Test

Check continuity of the circuits according to the wiring diagram in the *WIRING DIAGRAMS* 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.

Removal

Remove air intake silencer.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the connector from the ECM.

Cut all locking tie which are holding the wiring harness in position.

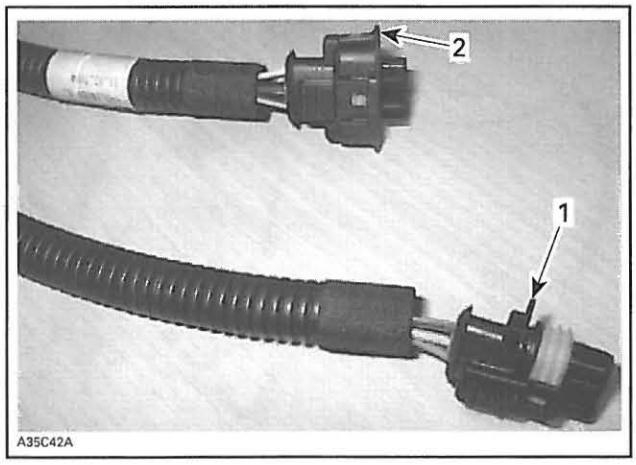
Remove complete wiring harness.

Installation

First connect the connector "A" to the ECM and the engine/vehicle connector to the vehicle wiring harness.

Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

NOTE: Pay attention not to mix the ignition coil connector and the APS connector. Refer to the illustration below for visual difference.



1. Ignition coil connector — open housing
2. APS connector — closed housing

Install all remaining parts, which have been removed.

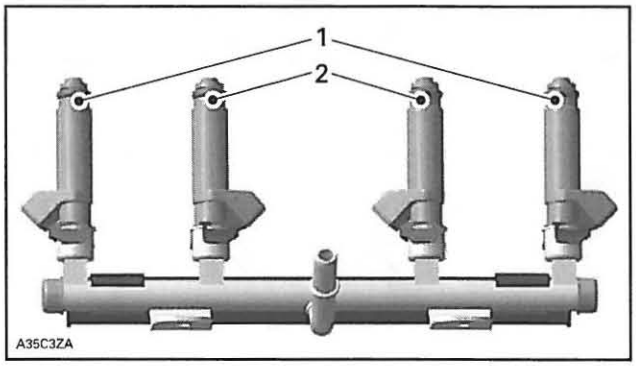
TESTING PROCEDURES

ELECTRIC FUEL PUMPS

Refer to *FUEL SYSTEM*.

FUEL INJECTORS

NOTE: Two different types of fuel injectors per cylinder are used.



1. MAG/PTO outer injectors (blue)
2. MAG/PTO inner injectors (brown)

Leakage Test and Fuel Flow Measurement

Preparation

First ensure fuel pressure is within specifications.

The injectors and fuel rail have to be removed together from the engine. Do not remove injectors from the fuel rail. Refer to *FUEL INJECTOR REPLACEMENT* as necessary.

To ensure continuous fuel availability for the electric fuel pump, first fill up fuel tank prior to performing the following tests. This is required because engine is not running to activate diaphragm fuel pump with the crankcase pulses.

Leakage Test

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and press the engine START/RER button to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

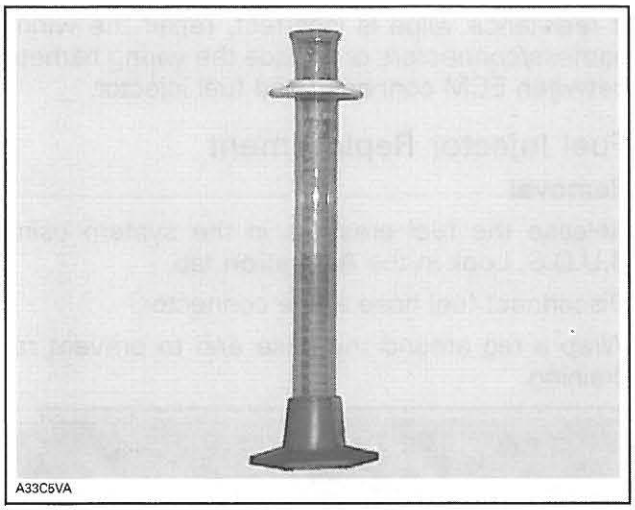
Fuel Injector Flow Measurement

Manual Start Models

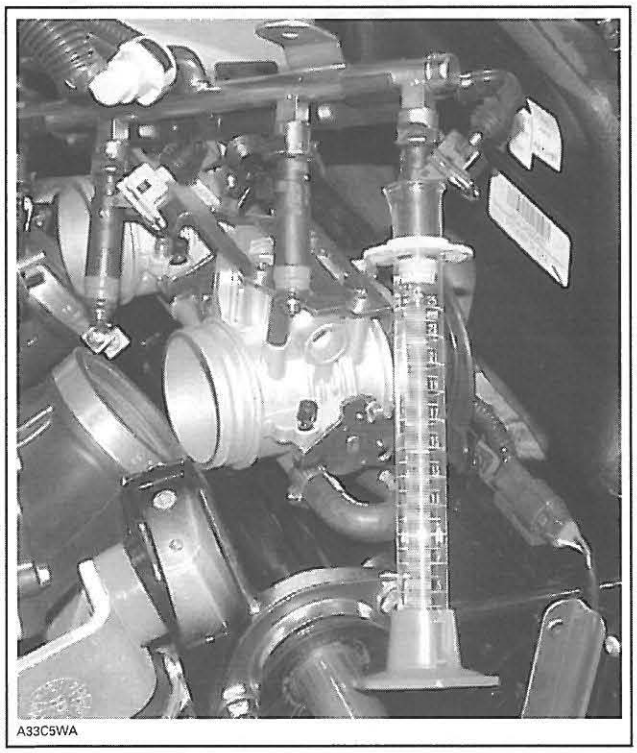
To continuously supply the electric fuel pump for the tests, an external 12 V battery is required. The small battery on the vehicle is not sufficient.

All Models

Use an appropriate burette graduated for 25 mL (.85 U.S. oz). The Pyrex® no 3075 (or equivalent) works fine.


A33C5VA

Place injector inside top of burette.


A33C5WA

Use B.U.D.S. software.

Install the tether cord cap on the DESS post and press the engine START/RER button to wake up the ECM.

Use appropriate wires and connect fuel pump directly to battery posts to continuously supply fuel pump.

Energize the appropriate injector under **Injector Flow Measurement** in **Activation** tab.

Energize each injector individually and measure the gas volume injected. Quantity of gas must be within the following specifications.

INJECTOR	VOLUME OF FUEL mL (U.S. oz)
Blue	16 ± 1 (.54 ± .03)
Brown	21 ± 1.5 (.71 ± .03)

If an injector is out of specification, retest it 2 - 3 times. If it still fails, replace it.

If all injectors fail, it is unlikely a failure of injectors. First ensure your reading from the burette is appropriate (pay attention to the division lines). Ensure fuel tank is full. Test for leaks in fuel system, fuel pump pressure, filter condition (in-line and in tank).

Properly reinstall parts.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Use B.U.D.S. software.

Energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Wake up ECM using START button and measure voltage between terminal 1 (of injector on harness side) and battery ground.

If 12 V is read, disconnect connector "A" from the ECM and check continuity of circuit as per following table. If it is good, try a new ECM.

CIRCUIT NUMBER (ECM CONNECTOR "A")	TERMINAL 2 OF INJECTOR HARNESS
A-15	MAG (outer)
A-33	PTO (outer)
A-14	MAG (inner)
A-30	PTO (inner)

If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

Resistance Test

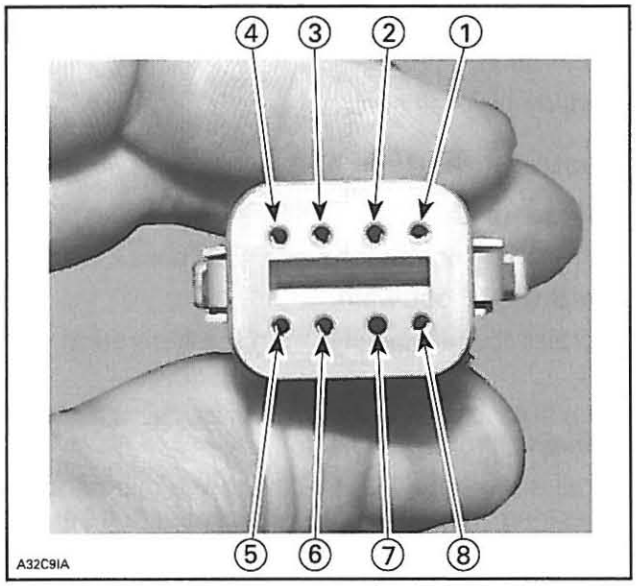
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

If resistance value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector "A" from the ECM as well as the engine/vehicle connector.

Using a multimeter, check resistance value between terminals as shown in the table below.



ENGINE/VEHICLE CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector, MAG (outer)	4 (Engine/vehicle connector) and A-15 (ECM connector)
Fuel injector, MAG (inner)	3 (Engine/vehicle connector) and A-14 (ECM connector)
Fuel injector, MAG (outer)	4 (Engine/vehicle connector) and A-33 (ECM connector)
Fuel injector, MAG (inner)	3 (Engine/vehicle connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM connector and fuel injector.

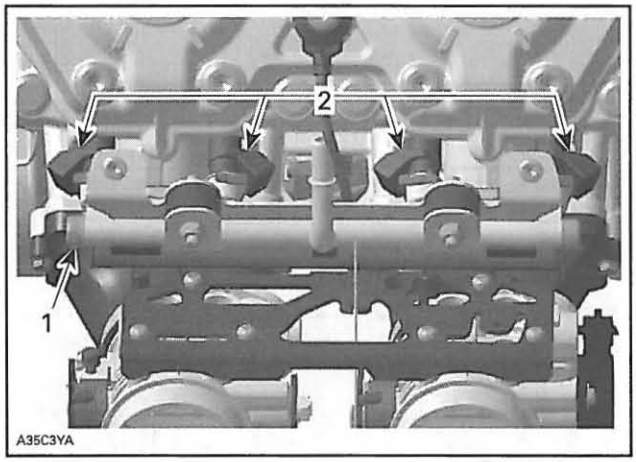
Fuel Injector Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Disconnect fuel hose at the connector.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel rail
2. Fuel injectors

Disconnect wiring harness from the four fuel injectors.

Remove the harness support from the fuel rail.

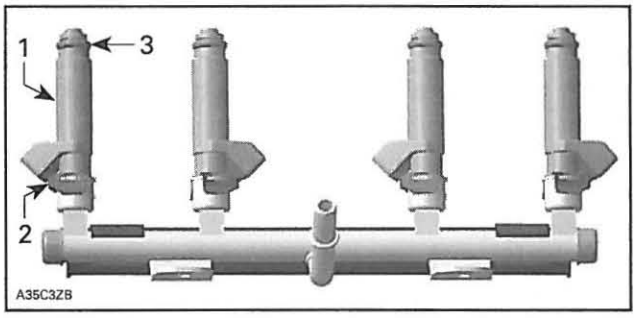
NOTE: It is not necessary to cut the tie raps of the harness support.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

Remove and discard injector spacers in cylinders.



FUEL RAIL AND INJECTORS
1. Fuel injector
2. Injector clip
3. O-ring

Remove the injector clip. Fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Pay attention not to mix up the inner and outer injectors. Refer to table and illustration above.

Replace O-rings with new ones.

NOTE: A thin film of engine oil should be applied to O-rings to ease fuel injector installation in fuel rail and cylinders.

Install new injector spacers in cylinders using pusher (P/N 529 036 036).

NOTE: Install new spacers every time injectors are installed.

Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

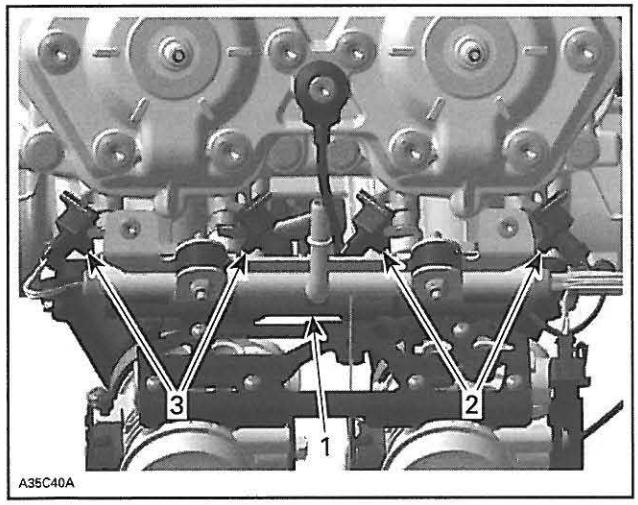
When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

Attach the harness support to the fuel rail.

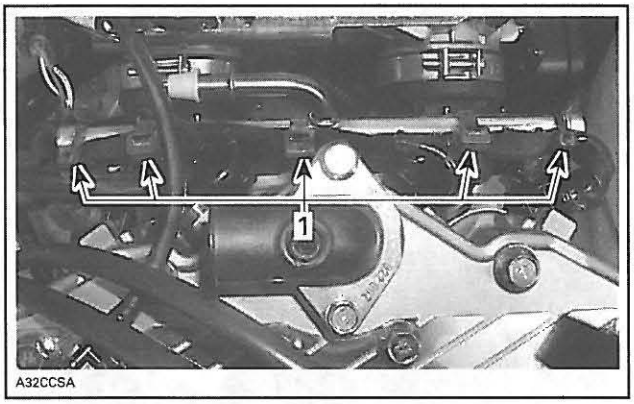
Add dielectric grease (P/N 293 550 004) to injector electrical connector.

Reconnect fuel injector connectors.

NOTE: The grey colored connectors are for cylinder MAG side.



1. *Harness support*
2. *Grey fuel injector connectors — MAG*
3. *Black fuel injector connectors — PTO*



1. *Locking ties*

⚠ WARNING

Perform a fuel high pressure test and ensure that there is no leak. Refer to *FUEL SYSTEM.*

ENGINE CONTROL MODULE (ECM)

General

ECM SUPPLY PINOUT	
FUNCTION	PIN
Power (Vdc)	11
Signal from voltage regulator to wake up ECM at cranking (manual start only)	36
Ground	1, 2, 9, 32, 41

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the B.U.D.S. software. Use **Replace ECM** in the **ECM** menu. Follow instructions provided by the help system.

NOTE: If the old ECM can still communicate, it must be read inside B.U.D.S. prior to removing it from the vehicle to carry vehicle information and history to the new ECM.

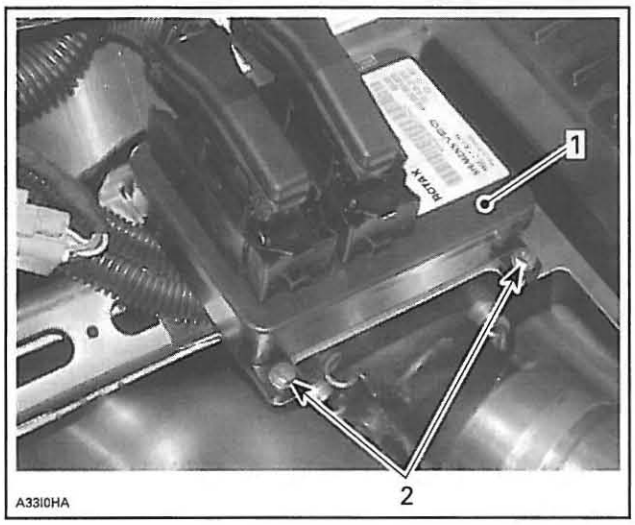
ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.



1. ECM
2. Retaining screws

Unscrew all retaining screws and remove the engine ECM from its support.

Install the new ECM to the support.

Reconnect ECM connectors to ECM, and then battery cables.

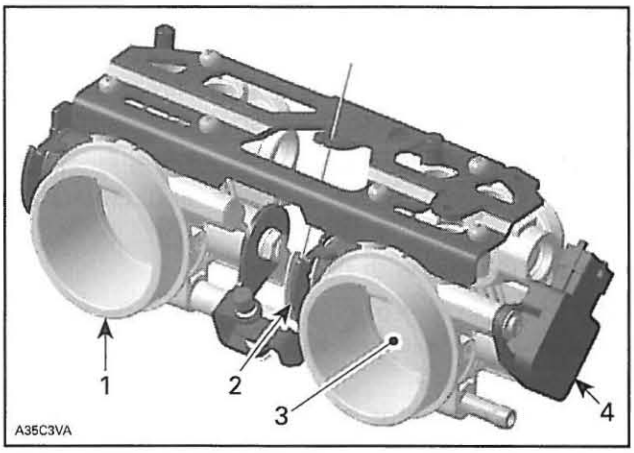
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 6000 RPM to be sure no fault appears.

THROTTLE BODY



1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: The throttle body is designed to be tamper proof. Changing the zero position stop screw or synchronization screw or modifying them in any way will not increase performance but may cause poor startability and erratic idling.

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.
- Throttle plate is loose, worn or damaged.
- TPS is loose.
- Corroded or damaged wiring or connectors.
- Throttle body or ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

Refer to *THROTTLE POSITION SENSOR (TPS)* in this section.

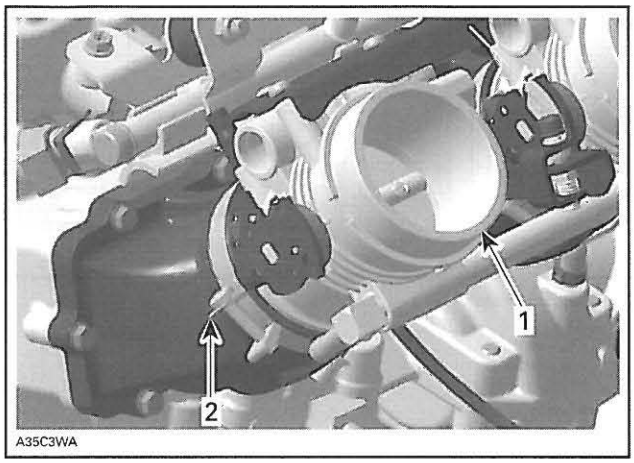
Replacement

Removal

To remove the throttle body from engine, proceed as follows:

- Disconnect connectors from ATS (Air Temperature Sensor) and APS (Air Pressure Sensor).
- Remove air intake silencer from throttle body.

- Install hose pinchers (P/N 295 000 076) on inlet and outlet coolant hoses connected to throttle body.
- Disconnect fuel line.
- Remove clamps and hoses for throttle body heating from nipples.
- Disconnect connector from TPS.
- Disconnect throttle cable.
- Unscrew retaining clamps of throttle body.



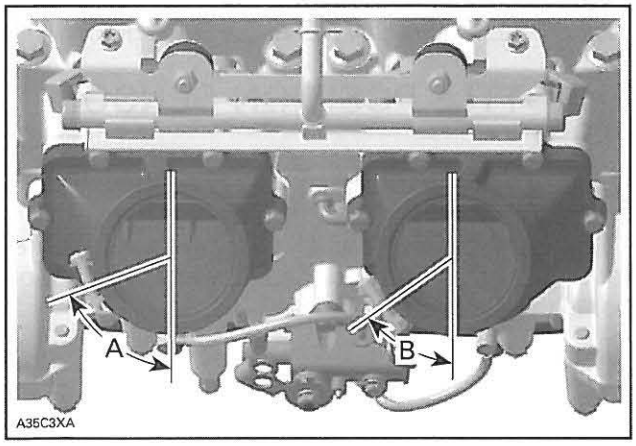
1. Throttle body
2. Clamp

- Slightly pull throttle body out.

Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention to the following details.

Make sure that the retaining clamps are positioned as shown in the following illustration.



A. PTO side — 70°
B. MAG side — 55°

Refill engine coolant. If an important quantity of coolant was spilled, bleed cooling system. Refer to *COOLING SYSTEM* section.

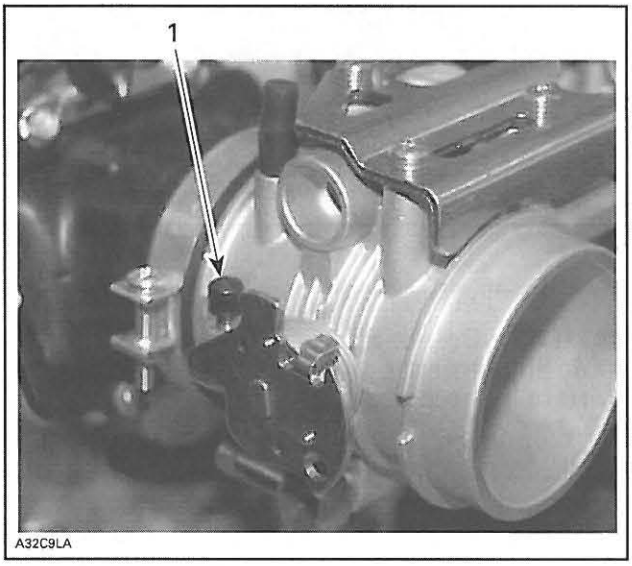
Adjustment

Throttle Body Synchronization

CAUTION: It is not allowed to perform any change on the synchronization screw.

Before installation, clean throttle plates and bores with pulley flange cleaner (P/N 413 711 809).

NOTE: The throttle body is designed as a single part for both cylinders. No synchronization is required as it has already been done at the factory. However, proceed with throttle cable and closed TPS adjustments as described below.

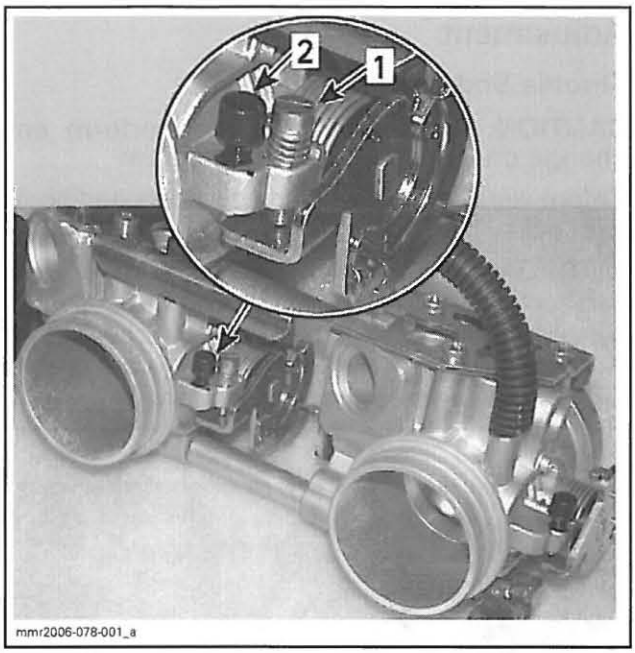


THROTTLE BODY
1. Zero position stopper screw

CAUTION: It is not allowed to perform any change on the zero position stopper screw.

The adjustment of the zero position stopper screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the zero position stopper screw (the capped one) or the idle speed adjustment would be impaired. Besides, no adjustment could be performed by the dealer nor the factory to correct the zero position stopper screw. The throttle body would need to be replaced.



TYPICAL
1. *Idle speed screw*
2. *Zero position stopper screw*

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

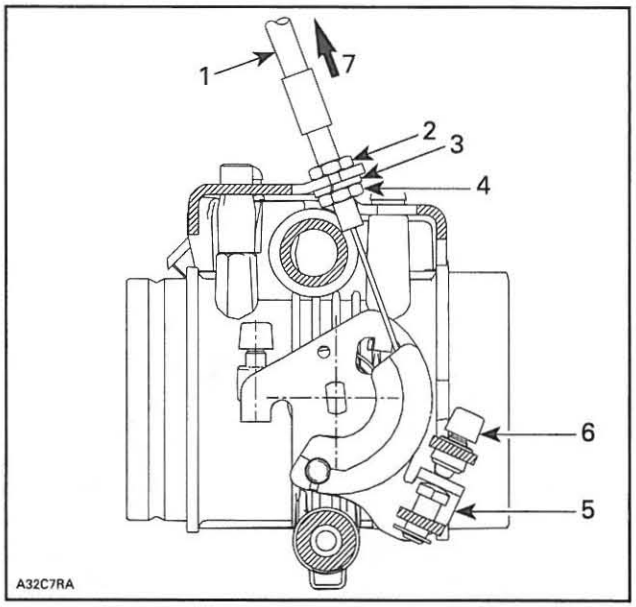
The only screw that has to be adjusted is the idle speed screw and it has to be adjusted only with the closed throttle reset procedure or for high altitude application. This has to be done only if the ECM or throttle body are replaced or if screw has been tampered with by mistake. Refer to *THROTTLE POSITION SENSOR (TPS)* in this section.

Throttle Cable Adjustment

Handlebar and throttle cable must be at their normal position.

Adjust top nut to have a small cable free-play at idle position.

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



1. *Cable sheath*
2. *Upper nut*
3. *Lock washer*
4. *Lower nut*
5. *Throttle lever*
6. *Adjusting screw*
7. *Pull in this direction*

Activate the throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension on the cable.

Use B.U.D.S. software.

Perform the wide open verification. In **Monitoring** tab check if throttle opening is within 82° to 86° when in wide open position on throttle lever.

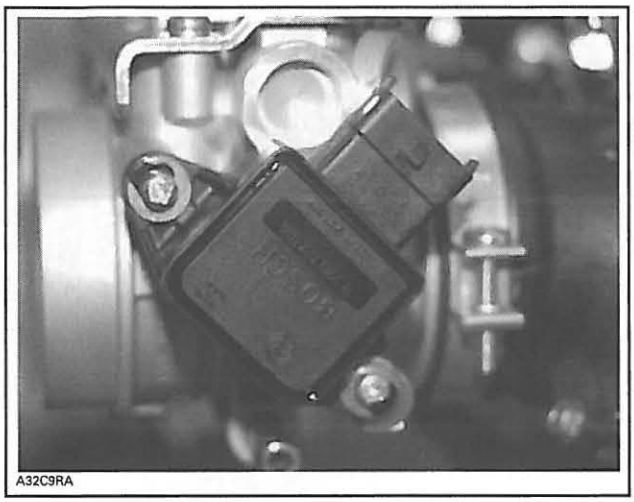
Closed Throttle Reset

Perform the **Closed Throttle** reset as described in *THROTTLE POSITION SENSOR (TPS)* below.

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 shaft angle.



TYPICAL — THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to *THROTTLE BODY* above.

The ECM may generate several fault codes pertaining to the TPS. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for more information.

Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Use B.U.D.S. software.

Use the **Throttle Opening** display under **Monitoring**.

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.

Voltage Test

Check the voltage output from ECM to the throttle position sensor.

Disconnect plug connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab. To see the connector terminal locations, temporarily remove the connector shield joining the harness.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Connect a voltmeter between terminal 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between terminal 3 on wiring harness TPS connector and terminal 24 on wiring harness ECM connector.

If tests are good, replace the TPS.

If voltage tests are not good, continue to check the resistance of the rest of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector "A" from the ECM.

Using a multimeter, check resistance value as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
TERMINAL	TERMINAL	RESISTANCE Ω	
A-24	A-25	2500	1000
A-25	A-39	1600 - 2400	1600 - 2400
A-24	A-39	1000	2500

NOTE: The resistance value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

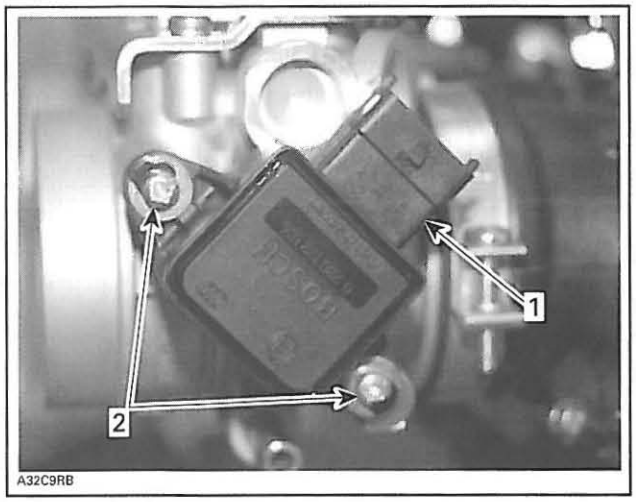
If resistance values are incorrect, replace TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



TYPICAL — THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**. See below.

Closed Throttle Reset

Ensure throttle body synchronization and throttle cable are properly adjusted prior to performing this setting.

NOTE: This operation performs a reset of the values in the ECM.

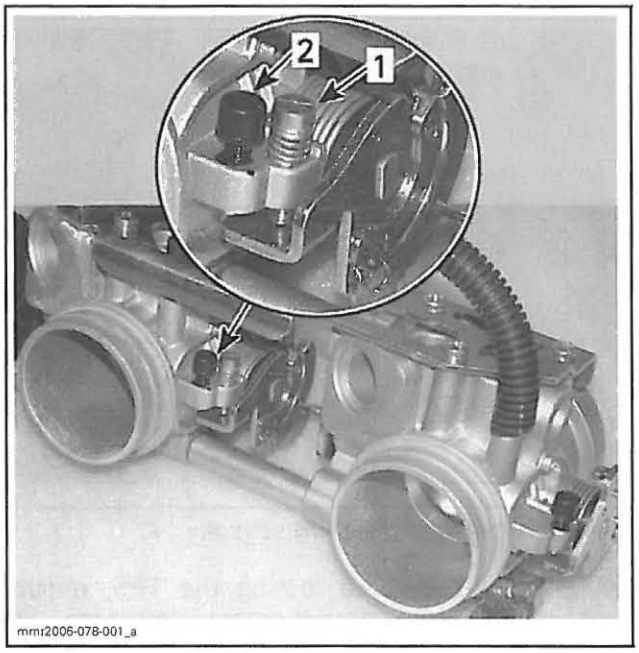
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body or ECM is replaced.

CAUTION: An improperly set TPS may lead to poor engine performance.

Use the B.U.D.S. software to perform this adjustment.

Unscrew idle speed screw until there is no contact between stop lever and stopper screw (capped screw). If necessary, loosen the throttle cable. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate.



1. *Idle speed screw*
2. *Zero position stopper screw*

Push the **Reset** button in the **Setting** section of B.U.D.S.

Re-power up the ECM by pushing the START/RER button momentarily.

The throttle opening displayed in B.U.D.S. should be 0.00 (0.1 maximum).

If TPS is not within the allowed range while resetting the **Closed Throttle**, the ECM will generate a fault code and will not accept the setting.

Now, the idle speed screw has to be adjusted. To do this, screw in the idle speed screw until B.U.D.S. throttle opening displays value as per following table.

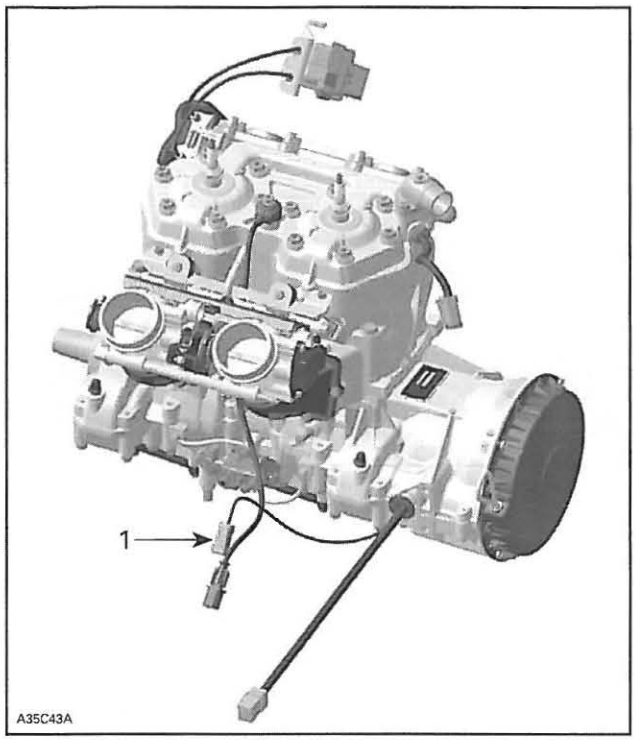
MODEL	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
Mach Z	4.8°	N.A.
Summit	4.5°	5.0°

If throttle cable has been loosen during the procedure, adjust throttle cable.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for more information.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is used for forward and reverse.



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals coming from CPS while cranking engine. Voltage should be within 1 - 2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 190 Ω and 300 Ω.

Otherwise, replace the CPS.

If resistance tests good, **reconnect** the CPS and disconnect the connector "A" on the ECM.

Using a multimeter, recheck resistance value between terminals 5 and 19.

If resistance value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

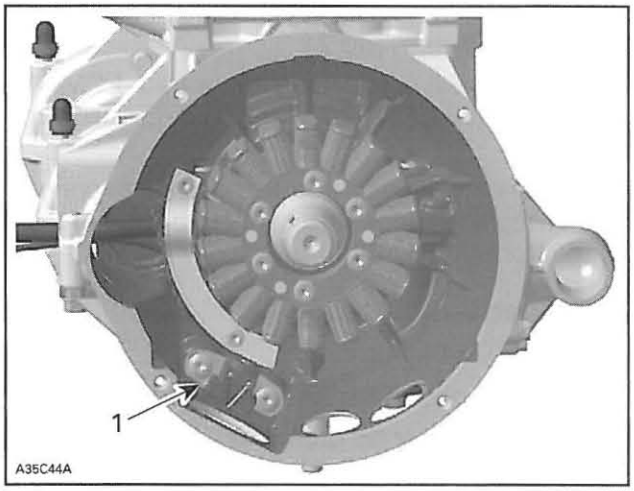
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Remove muffler.

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to *MAGNETO SYSTEM*.

Remove CPS.



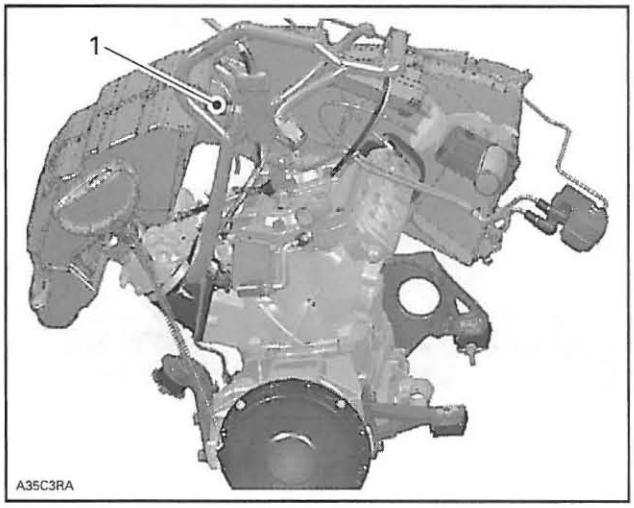
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Apply Loctite 243 on the CPS retaining screws, then torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

Refer to *ELECTRICAL SYSTEM* at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the ATS and disconnect the connector "A" on the ECM.

Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new 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 ATS.

Replacement

Unplug ATS connector.

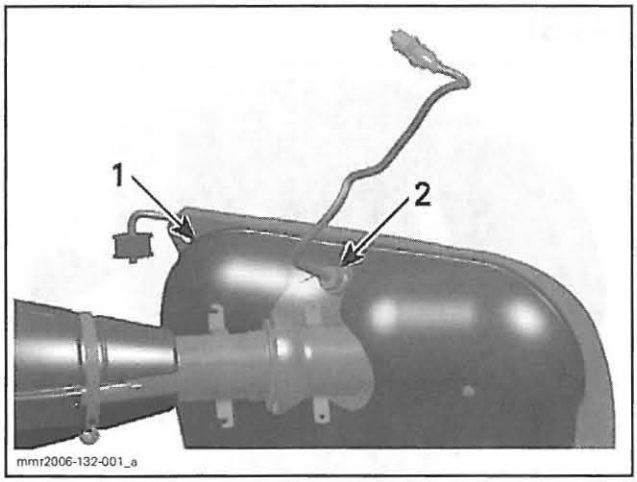
Pull the ATS out of the air intake silencer.

Spray soapy water on grommet. Install grommet on air intake silencer then push the sensor in place.

Reconnect it.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)

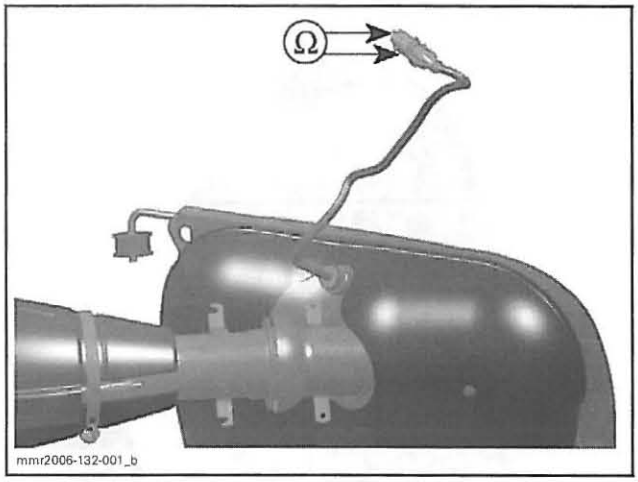
NOTE: The sensor is installed on Summit SDI **but is not used** unless a sea-level calibration has been installed with B.U.D.S. software.



1. *Muffler*
2. *Exhaust gas temperature sensor (EGTS)*

Resistance Test

Unplug connector from EGTS and check resistance of sensor.



Resistance should be 210 Ω at 20°C (68°F).

Otherwise, replace EGTS sensor.

If resistance tests good, reconnect the EGTS and disconnect the connector "A" from ECM.

Using a multimeter, recheck resistance value between terminals 10 and 26.

If resistance value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this section.

If resistance value is incorrect, repair/replace wiring harness between ECM connector and EGTS sensor.

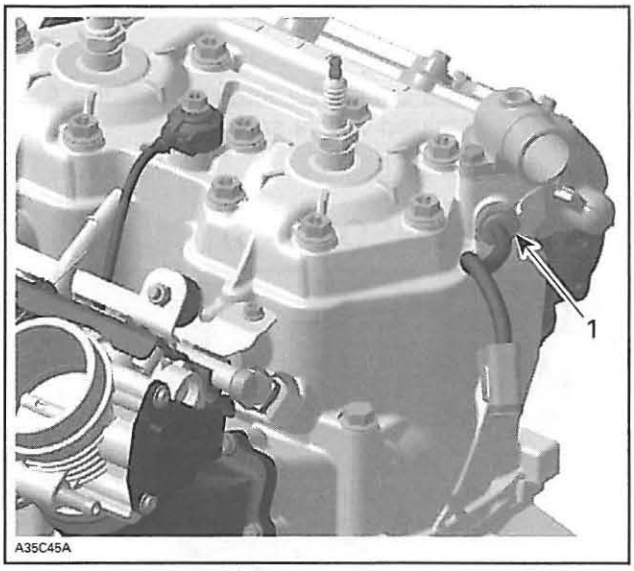
Replacement

Disconnect EGTS connector and remove EGTS.

Apply Loctite 518 on threads of the EGTS then install.

Replug connector.

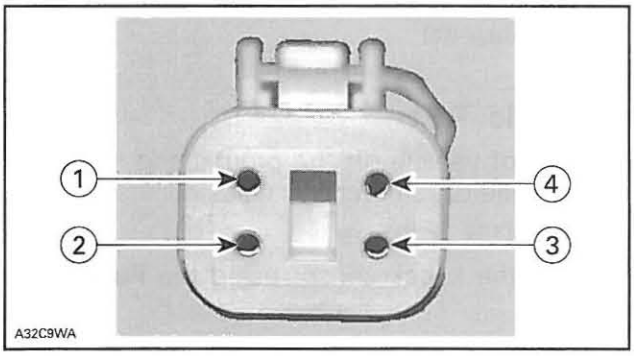
COOLANT TEMPERATURE SENSOR (CTS)



1. Coolant temperature sensor (CTS)

Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.



The resistance between terminal 1 and 2 is used for temperature gauge.

Refer to *ELECTRICAL SYSTEM* at the beginning of this section to find the corresponding resistance value for this sensor temperature.

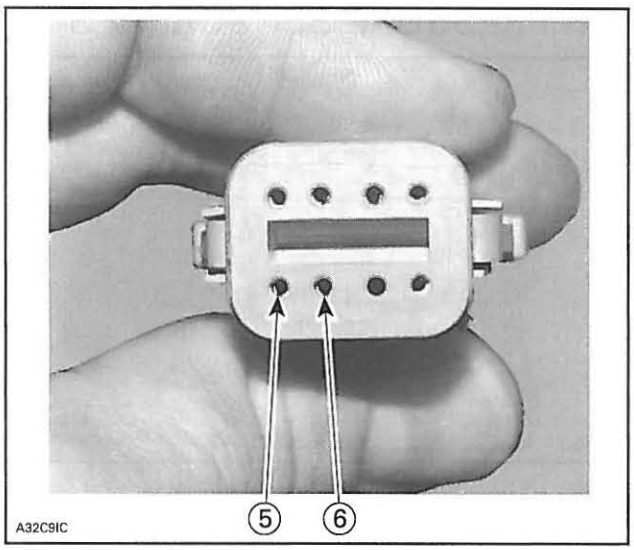
If out of specification, replace the sensor.

The resistance between terminal 3 and 4 is used for the ECM.

Refer to *ELECTRICAL SYSTEM* at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the CTS and disconnect the connector "A" on the ECM as well as the engine/vehicle connector.



ENGINE/VEHICLE CONNECTOR

Using a multimeter, recheck resistance value between terminals 5 and 6 on engine/vehicle connector. This resistance is used for temperature gauge.

Refer to *ELECTRICAL SYSTEM* at the beginning of this section to find the corresponding resistance value for this sensor temperature.

Recheck also resistance value between terminals 11 and 27 on ECM connector "A". This resistance is used for ECM.

Refer to *ELECTRICAL SYSTEM* at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If resistance value is correct, try a new 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 CTS.

Replacement

Drain cooling system.

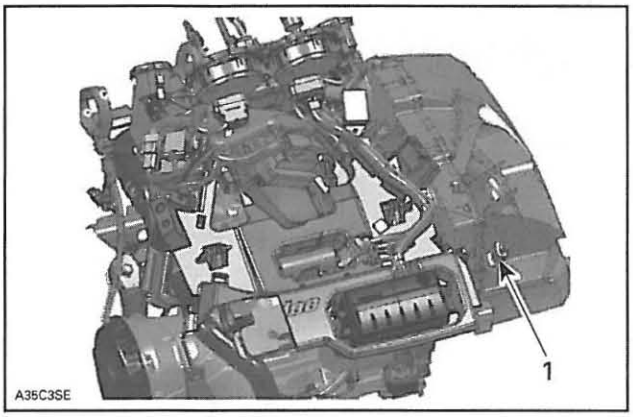
Disconnect CTS connector and remove CTS.

Apply Loctite 5910 on the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant and bleed cooling system. Refer to *COOLING SYSTEM* section.

AIR PRESSURE SENSOR (APS)



INSIDE LH SIDE PANEL
1. Air pressure sensor (APS)

Ensure sensor is correctly installed on air intake silencer. Otherwise, the APS could generate a fault code. Remove sensor and check for oil or dirt on its end and if problem persists, check the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the APS.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Disconnect plug connector from APS and connect a voltmeter between terminal 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between terminal 3 on APS connector and terminal 18 on ECM connector.

If tests are good, replace the APS.

If tests are not good, continue to check the continuity of the rest of the APS circuit on the harness.

Disconnect the connector "A" from the ECM.

Using a multimeter, check continuity of circuits as per following table.

CIRCUIT NUMBER (ECM CONNECTOR "A")	APS CONNECTOR
A-3	Terminal 1
A-4	Terminal 2
A-18	Terminal 3

If wiring harness is good, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

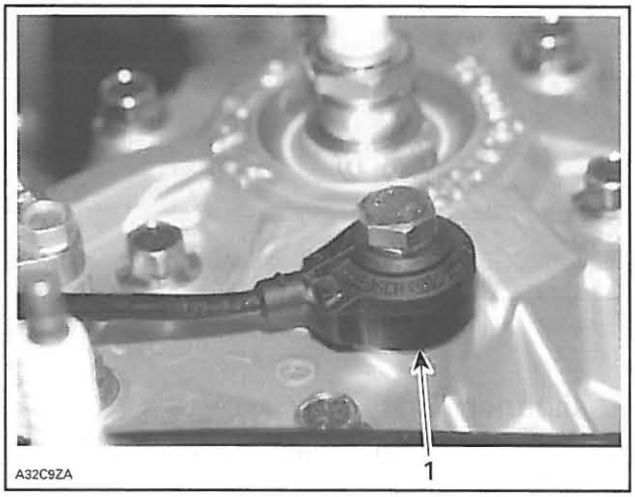
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The ATS is retained with a screw.

Install the new APS.

KNOCK SENSOR (KS)



TYPICAL
1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Use B.U.D.S. software.

Monitor the knock sensor using the **Faults** section.

Start the engine and bring engine RPM above 6000 RPM. If no fault code occurs, the knock sensor is good.

Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector "A" form the ECM and check continuity of circuit as per following table.

CIRCUIT NUMBER (ECM CONNECTOR "A")	KS CONNECTOR
A-22	Terminal 1
A-8	Terminal 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

Replacement

Unscrew and remove knock sensor from cylinder head.

Clean contact surface, apply Loctite 5910 (P/N 293 800 081) on both contact surfaces on the knock sensor then install the new sensor.

CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

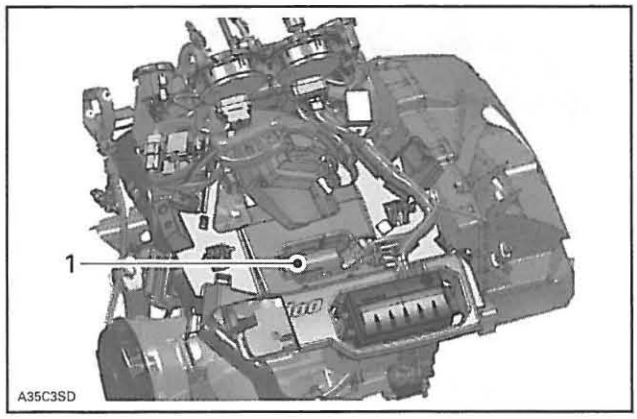
Torque screw to 20 N•m (15 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

CAPACITOR

Manual Start Models



1. Capacitor

⚠ WARNING

Capacitor may be charged. Once discharged, a transient recovery voltage may be generated in the capacitor after a while. Always discharge capacitor before servicing.

Removal

Remove the main fuse.

Connect a test light to capacitor terminals during a complete minute to discharge capacitor.

⚠ WARNING

Do not short-circuit both capacitor terminals.

Disconnect capacitor terminals and unfasten capacitor.

Inspection

Visual Inspection

Check for pin holes in the pressure relief valve on top of capacitor. If any pin hole is present, discard capacitor.

Charge Hold Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery.

Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Wait 5 minutes, then measure capacitor voltage. It must be within 1 V maximum of battery voltage.

If in doubt, proceed with the following residual voltage test.

Residual Voltage Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery. Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Connect a switch (in OFF position) and a 300 Ω 5 W resistor to the capacitor. Turn on the switch for 12 seconds ± 1 second of discharge.

Residual voltage after 12 seconds ± 1 second of discharge must be above 5 volts.

Installation

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Make sure main fuse is removed.

Install the capacitor.

Make sure to connect BLACK wire to negative terminal and RED/WHITE to positive terminal.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Install the main fuse.

CAPACITOR RELAY (R4)

Manual Start Models

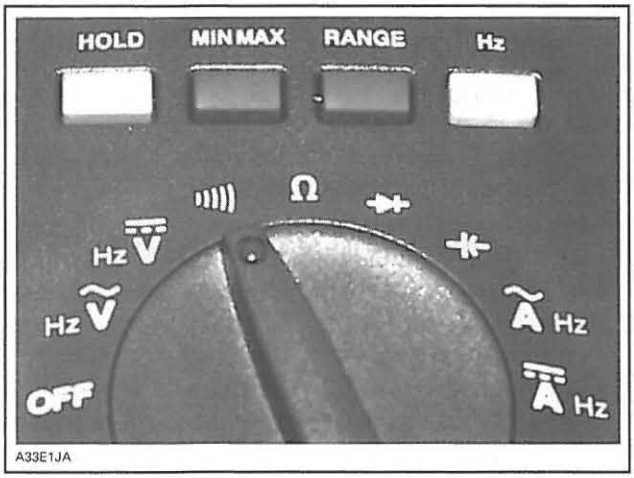
Voltage Test

RELAY 4		
TEST	COIL	CONTACT
WIRE COLOR	ORANGE/BLUE and RED/BROWN	RED/WHITE and RED/VIOLET
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

Continuity Test

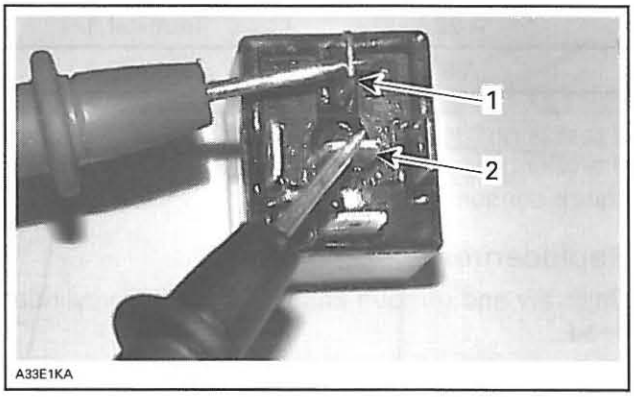
Remove the relay from vehicle.

Using the Fluke 111 multimeter (P/N 529 035 868), select the beeper position.



A33E1JA

Position the RED probe on the terminal 30 and the BLACK probe on the terminal 87a.

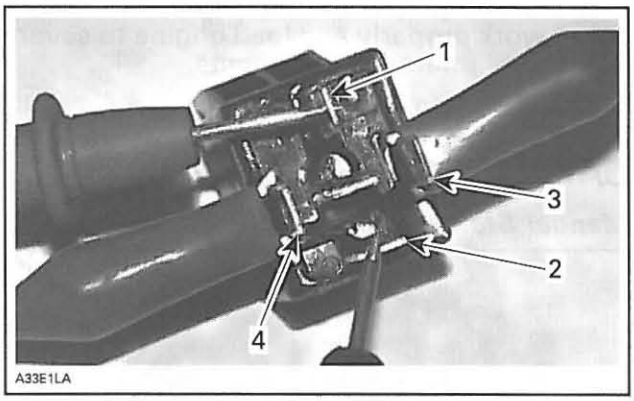


A33E1KA

1. *Terminal 30*
2. *Terminal 87a*

A continuous signal should be audible. If not, replace the relay.

If a signal is audible, apply 12 volts on terminals 85 and 86 then place the RED probe on terminal 30 and the BLACK on the terminal 87.



A33E1LA

1. *Terminal 30*
2. *Terminal 87*
3. *Terminal 85*
4. *Terminal 86*

The continuous signal should be audible. If not, replace the relay.

RELAY R1

Voltage Test

RELAY 1		
TEST	COIL	CONTACT
WIRE COLOR	ORANGE/BLUE and RED/BROWN	RED/WHITE and RED/GREEN
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

Continuity Test

Refer to *CAPACITOR RELAY (R4)* for the continuity test procedure.

IGNITION COIL

Refer to *IGNITION SYSTEM*.

E-RAVE ACTUATOR

Refer to *E-RAVE SYSTEM*.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
digital/inductive type tachometer	529 014 500	171
multimeter Fluke 111	529 035 868	167

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	168

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Ignition System Testing Sequence

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1. Spark plugs.
2. Fault codes.
3. Ignition coil.
4. DESS post.
5. Engine cut-out switch.
6. Crankshaft Position Sensor (CPS).

Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

Using the latest B.U.D.S. software version available on BOSSWeb, verify which fault codes occurred. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for complete list of codes.

Analysis of Readings

Resistance Readings

For best results, use the multimeter Fluke 111 (P/N 529 035 868).

529 035 868

Place multimeter selector switch to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

PROCEDURES

SPARK PLUG

Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

Spark Testing

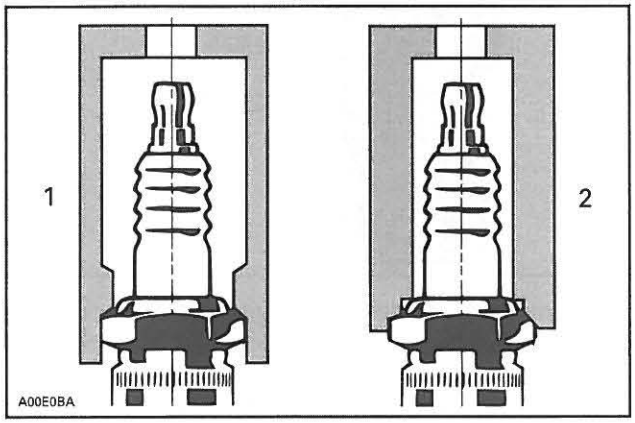
During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

CAUTION: Do not adjust electrode gap of ECS type spark plug.

1. Apply antiseize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
2. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



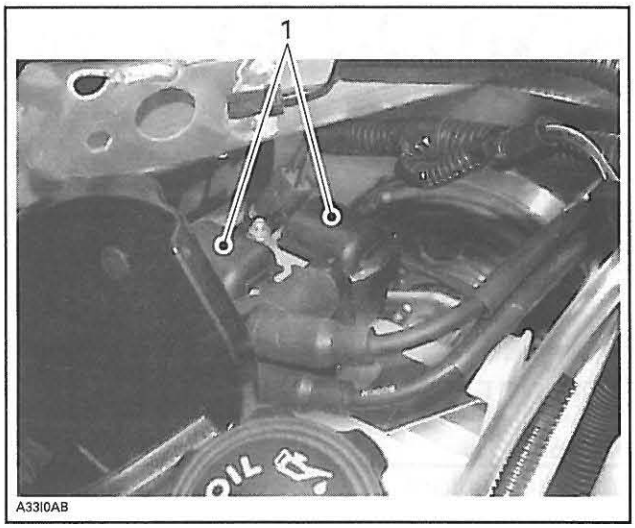
TYPICAL
1. Proper socket
2. Improper socket

Use the following table to torque the spark plugs.

ENGINE	SPARKPLUG	TORQUE N•m (lbf•ft)
995 SDI	NGK	27 (20)

IGNITION COIL

NOTE: The ECM energizes the primary side of each ignition coil individually. It can detect if the double ignition coil is connected. Otherwise a trouble code will appear upon starting.



1. Ignition coil

Test with B.U.D.S.

Use the B.U.D.S. software.

Energize the ignition coil from the **Activation** section.

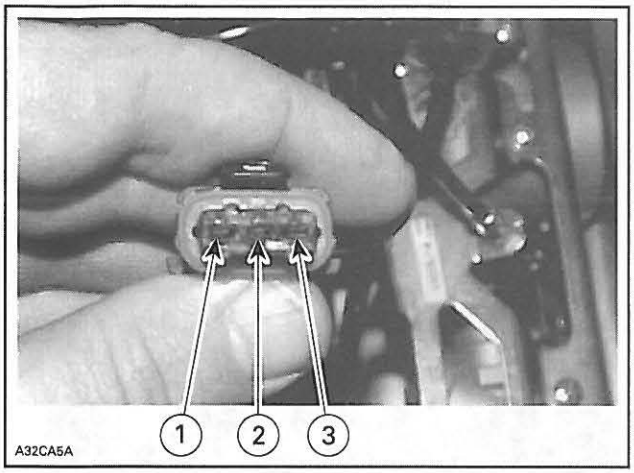
You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester – available from after-market tool/equipment suppliers – to prevent spark occurring in the engine compartment.

Voltage Test

⚠ 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.

Disconnect the plug connector from the ignition coil and check the voltage supplied by the battery.



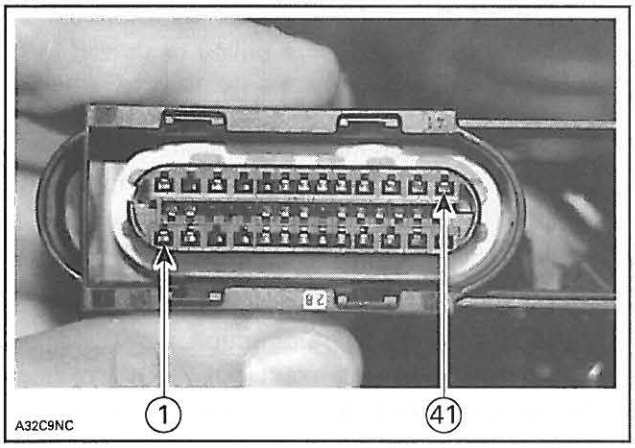
Install **tether cord cap** on the DESS post and push the START/RER button momentarily to activate the ECM.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

Battery voltage should be present (approx. 12 V).

If 12 V is NOT read, check continuity between terminal 2 of ignition coil and the corresponding fuse. Otherwise repair wiring harness.

If 12 V is read, disconnect the connector A from the ECM and check the continuity of appropriate circuit 41 (cylinder 1) or 1 (cylinder 2) and of ignition coil connector, pin 3 and pin 1 respectively.



ECM CONNECTOR

If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

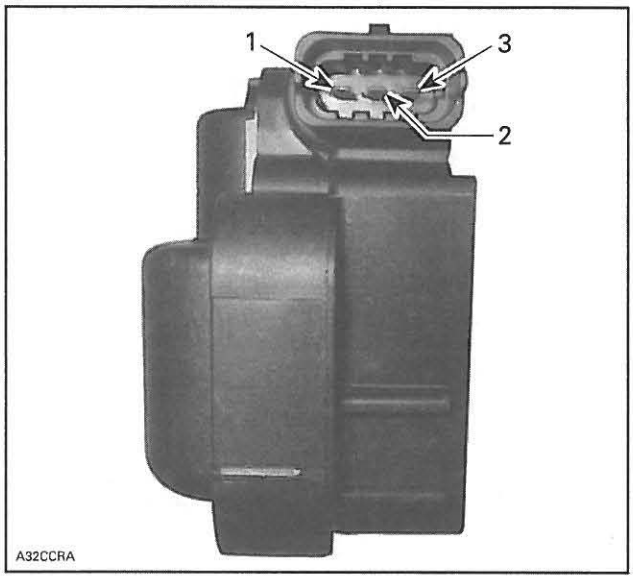
If wiring harness is good, test resistance of primary winding of ignition coil.

Resistance Test

Remove spark plug cables from ignition coil.

Using a multimeter, check the resistance of primary winding.

NOTE: The secondary winding can not be measured with an ohmmeter. Try a new double ignition coil if necessary.



1. *Terminal 1a*
2. *Terminal 15*
3. *Terminal 1b*

For primary winding, check the resistance between terminal 15 and terminal 1a (cylinder 1) of the ignition coil and between terminal 15 and terminal 1b (cylinder 2) respectively.

The resistance should be between 0.40 and 1.15 Ω at 20°C (68°F).

NOTE: An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

If the resistance of one of both windings is not good, replace the ignition coil.

⚠ WARNING

Always reconnect ignition coil cables at the same spark plugs where they come from. Otherwise, severe backfire may occur with possible damage to exhaust system components.

DESS POST

Refer to *DESS SYSTEM*.

ENGINE CUT-OUT SWITCH

Check the condition of engine cut-out switch as follows.

TEST	OPEN CIRCUIT	CONTINUITY
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	0L.	0 to 0.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in RUN position	Engine cut-out switch must be in STOP position

CRANKSHAFT POSITION SENSOR (CPS)

Refer to *ENGINE MANAGEMENT.*

ENGINE CONTROL MODULE (ECM)

Before replacing an ECM, refer to *ENGINE MANAGEMENT* section.

ADJUSTMENT

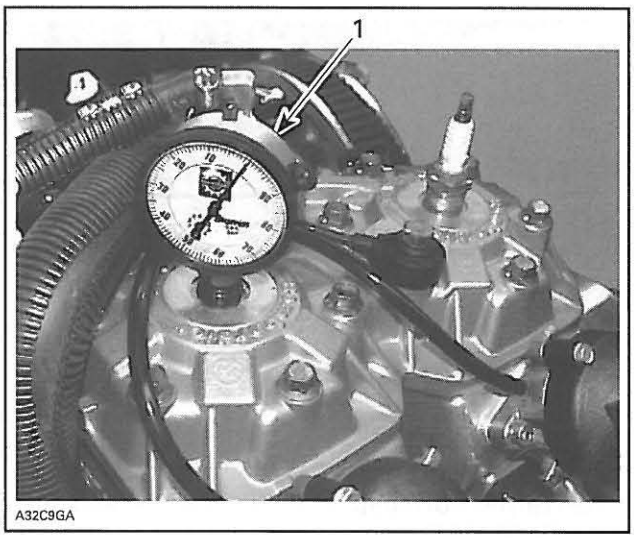
IGNITION TIMING

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the CPS or the ECM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to *LEAK TEST AND ENGINE DIMENSION MEASUREMENT.*

The ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 4000 RPM with a timing light.

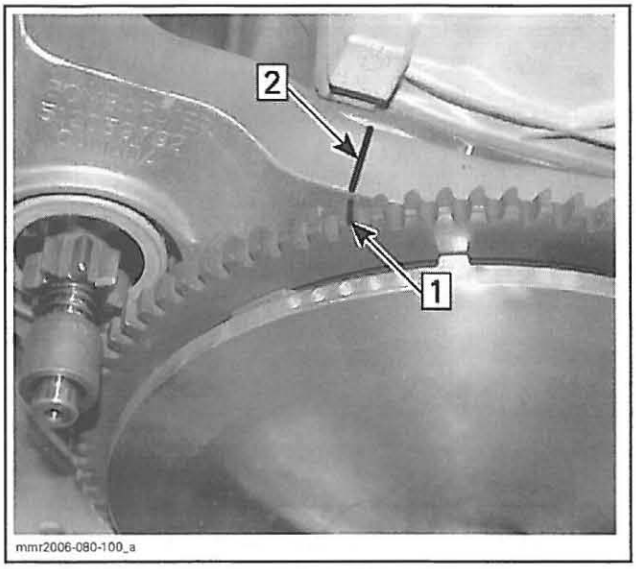
Scribing a Timing Mark

- Clean the area around the MAG spark plug, and remove it.
- Install the TDC gauge in the spark plug hole, (magneto side) and adjust as follows:
  - Position the MAG piston at approximately TDC.



TYPICAL
1. TDC gauge on MAG side

  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
  - Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
  - Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.
- Locate the piston TDC position as follows:
  - Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
  - Rotate the dial face so that «0» is in line with the needle when it stops moving.
  - Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to «0», until the needle always stops exactly at «0» before changing direction.
  - «0» now indicates exact TDC.
- Rotate the drive pulley counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement, indicated in *TECHNICAL SPECIFICATIONS.*
- With the TDC gauge indicating specified timing, trace reference marks as follows.
  - Choose a tooth on ring gear that is the closest to engine support.
  - Trace a line on this tooth.
  - Trace a line on engine support and align it with the previous tooth.



Step 1: Trace a line on tooth closest to engine support
Step 2: Trace a line aligned with tooth

Remove TDC gauge.

Checking Ignition Timing

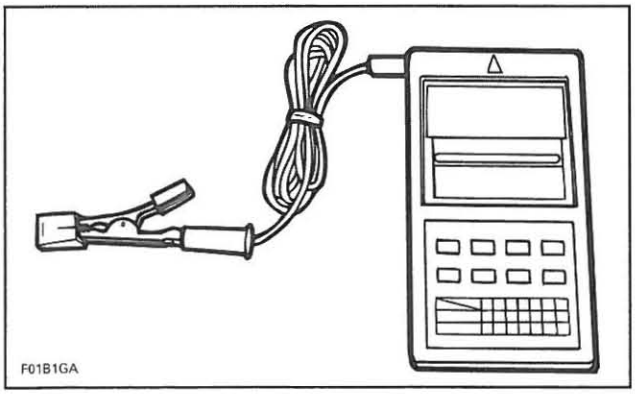
To check the ignition timing proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

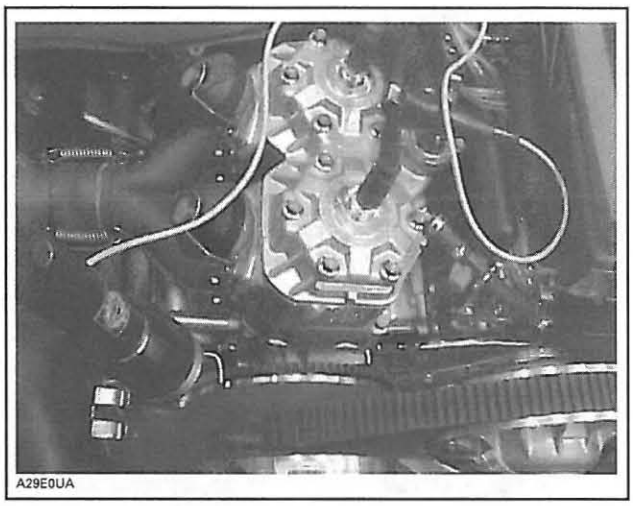
Connect the timing light pick-up to a spark plug cable on MAG side.

Connect the digital/inductive type tachometer (P/N 529 014 500) on same spark plug cable.



TACHOMETER

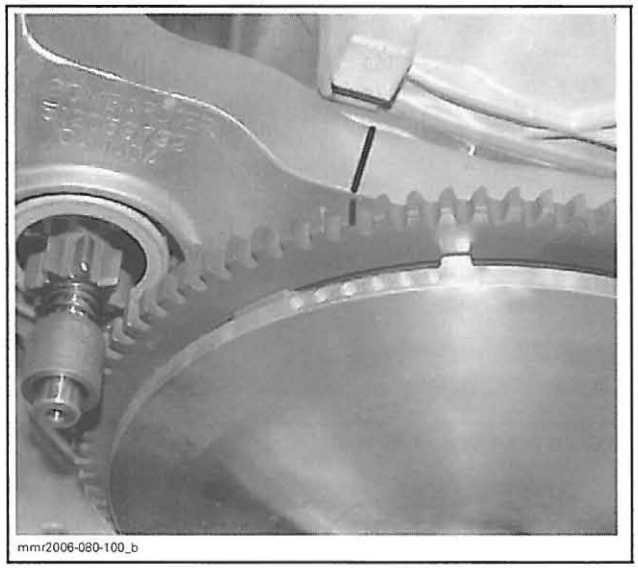
Start the engine and point timing light on timing mark. Bring engine to 4000 RPM for a brief instant.



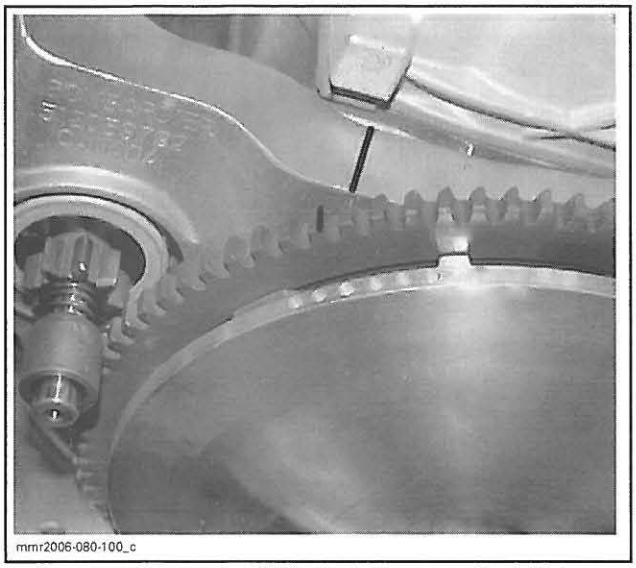
TYPICAL

The timing marks must be aligned. If such is not the case, note if timing is retarded or advanced.

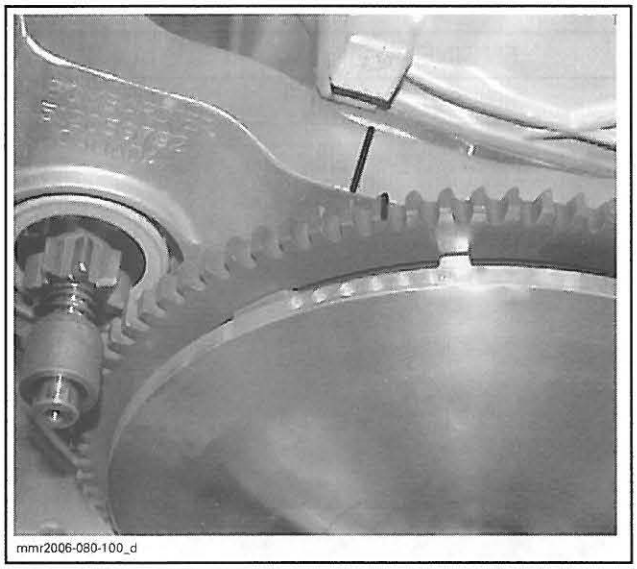
ENGINE	TOLERANCE
995 SDI	± 0.5°



NOTE: To give you an idea to what a degree represents in relation to the mark position, see the following illustrations.


mmr2006-080-100_c

TIMING RETARDED BY ABOUT 1°

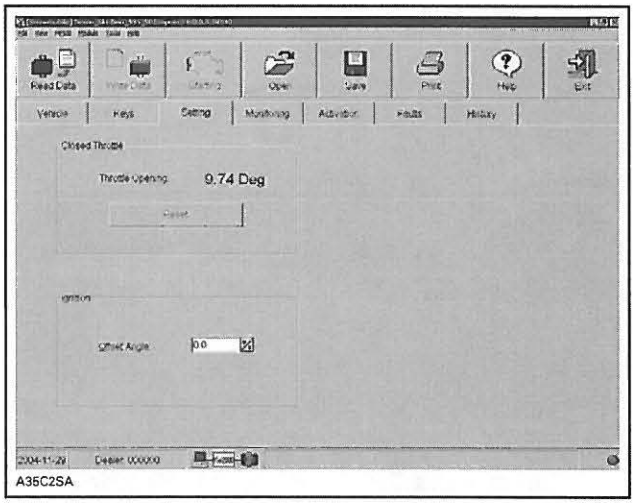

mmr2006-080-100_d

TIMING ADVANCED BY ABOUT 1°

Changing Timing

Use the B.U.D.S. software.

Uses the **Setting** tab to change the ignition timing.



Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	179
multimeter Fluke 111	529 035 868	173

SERVICE PRODUCTS

Description	Part Number	Page
silicone dielectric grease	293 550 004	178–179

GENERAL

NOTE: On applicable models, it is a good practice to check for fault codes using B.U.D.S. software as a first troubleshooting step. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

Voltage measurements are always taken upon engine cranking. Readings when the engine is running would be higher than specified range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise readings could be distorted.

CAUTION: When taking measurements, it is useless to try to run the engine since readings would then be distorted.

When testing the different magneto components, it is important to take into consideration that reading vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

For best results, use the multimeter Fluke 111 (P/N 529 035 868).

529 035 868

Place the selector switch of the multimeter to the appropriate position for the tests. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

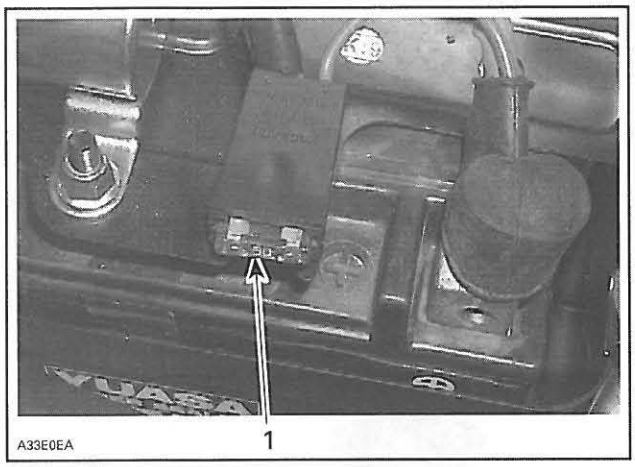
In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

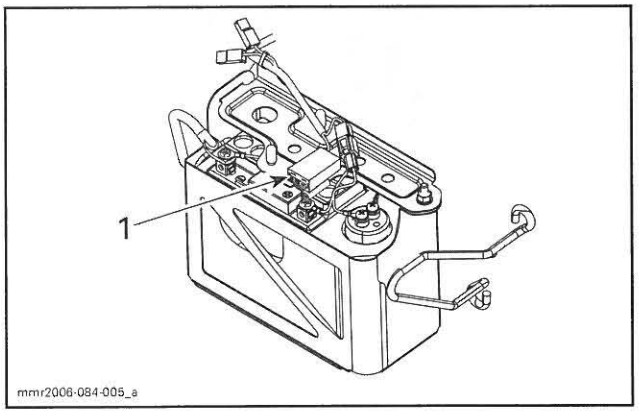
PROCEDURES

CHARGING FUSE

The 30 A fuse is located on the battery.



ELECTRIC START MODELS
1. Charging system fuse



MANUAL START MODELS
1. Charging system fuse

VOLTAGE REGULATOR/ RECTIFIER

NOTE: The regulator/rectifier could be the culprit of a blown charging system fuse. To check, simply disconnect the regulator/rectifier from the circuit. If the fuse still burns, check for a defective wire.

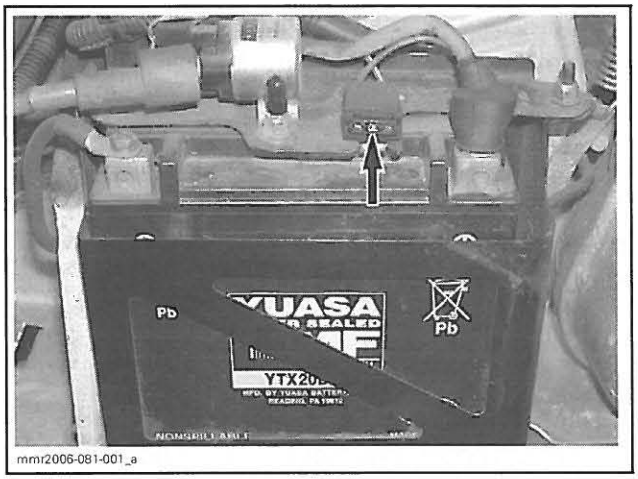
Continuity Test

Due to internal circuitry, there is no static test available to check continuity.

DC Current Test

Proceed as follows:

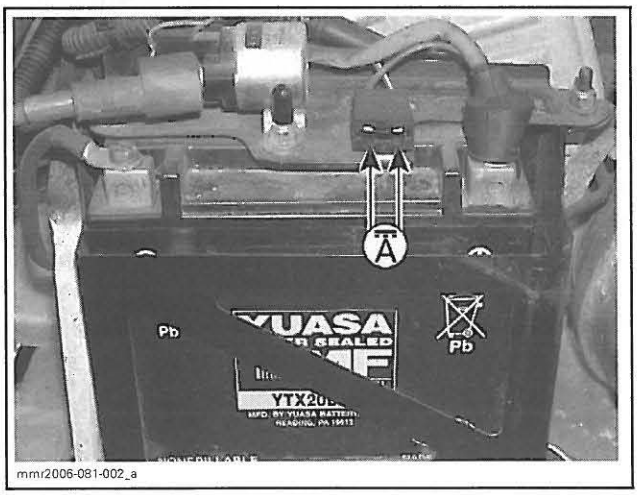
- Ensure to turn OFF heated grips and heated throttle lever.
- Remove charging system fuse on battery.



TYPICAL

- Set multimeter to Adc.
- Start engine.
- Connect multimeter probes between fuse holder terminals.

TEST ENGINE SPEED	CURRENT
5000 RPM	approx. 1 - 4 A



TYPICAL

- Read current.
- If current is below specification, check magneto (stator) output prior to concluding that rectifier is faulty.
- Reinstall fuse.

DC Voltage Test

Proceed as follows:

- Set multimeter to Vdc scale.
- Connect multimeter to battery posts.
- Start engine.

MODELS	TEST ENGINE SPEED	VOLTAGE
All	5000 RPM	15.1 Vdc ± 0.5

- Read voltage.

mmr2006-081-001_b

TYPICAL

- If voltage is above specification, replace voltage regulator/rectifier.
- If voltage is below specification, check charging generator coil and wiring/connections.

NOTE: If the battery will not stay charged, the problem can be any of the charging system components. If these all check good, try a new voltage regulator/rectifier.

Removal

MODEL	LOCATION
All models	Under engine and behind muffler

Disconnect battery.

Remove muffler.

Unplug all connectors located on connector support.

Remove nuts that attach the voltage regulator/rectifier to the frame.

Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

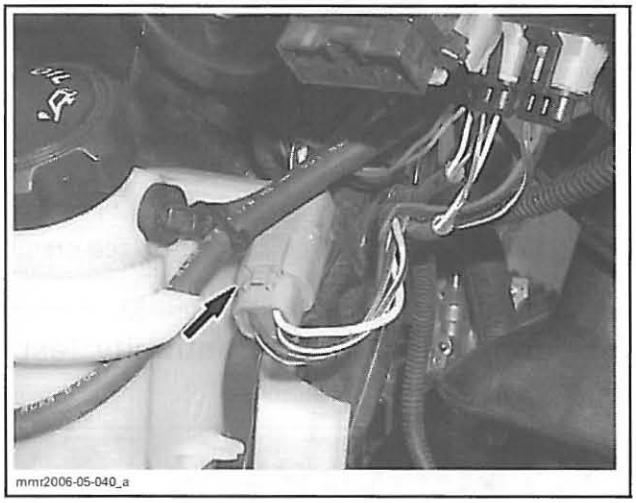
Remove the rubber plug under frame to gain access to install the nut on PTO side. Install this nut first.

Torque voltage regulator/rectifier nuts to 10 N•m (89 lbf•**in**).

CHARGING COIL (stator)

Continuity Test

Disconnect engine connector.



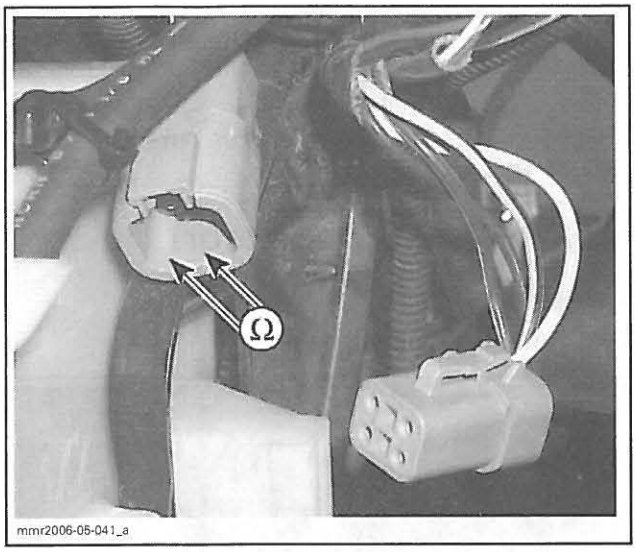
mmr2006-05-040_a

TYPICAL

Set multimeter to Ω.

Read the resistance between wires as follows.

TERMINAL	RESISTANCE @ 20°C (69°F)
1 and 2	0 - 0.5 Ω
1 and 3	
2 and 3	



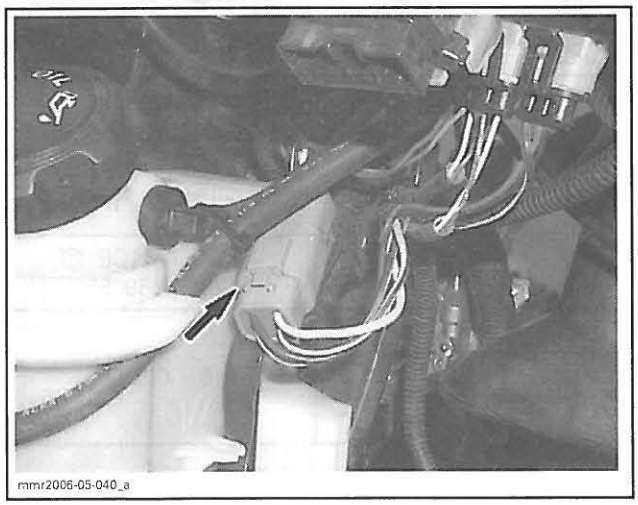
TYPICAL

If resistance is out of specification, replace stator.

Replug connector properly.

Insulation and Ground Continuity Test

Disconnect engine connector.

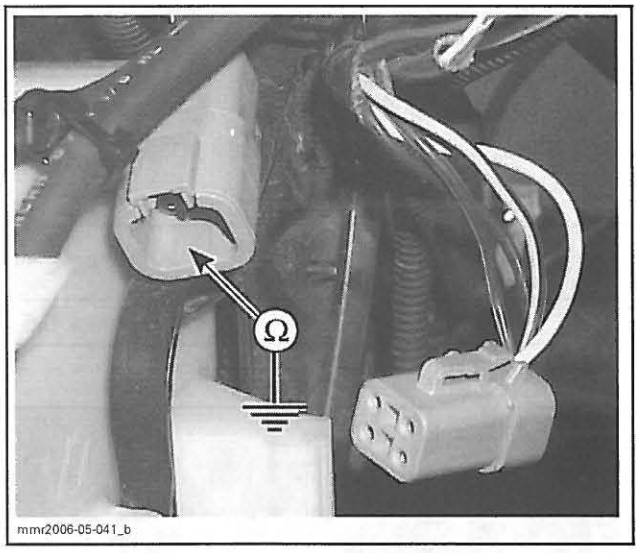


TYPICAL

Set multimeter to Ω.

Read resistance between wires as follows.

MODELS	TERMINAL		RESISTANCE @ 20°C (69°F)
All	Any YELLOW wire	Engine ground	0L. (open circuit)

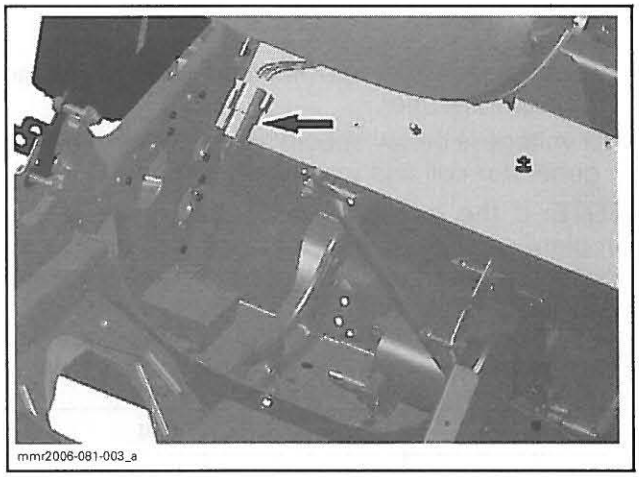


TYPICAL

- If results are out of specification, the generator coil and/or the wiring need to be repaired/replaced.
- Replug connector properly.

AC Voltage Test

- Disconnect the voltage regulator/rectifier connector.



TYPICAL

- Set multimeter to Vac scale.
- Manually crank engine and read the voltage as follows. Repeat the test 3 times.

MODELS	TERMINAL		VOLTAGE
All	Any YELLOW	Any other YELLOW	3.5 - 7.5 Vac

- If voltage is lower than specification, replace generator coil.
- Replug connector properly.

BATTERY

Manual Start Models

General

These models are equipped with a YT4L-BS type battery that requires a specific charging procedure at predelivery.

Battery Charge Testing

⚠ WARNING

Always wear safety glasses and charge in a ventilated area.
Never charge or boost battery while installed on vehicle.
Do not open the sealed caps during charging.
Do not place battery near open flame.

These sealed batteries have to be tested with a voltmeter.

Batteries with a voltage of 12.8 volts and above, no charge is required.

Batteries with a voltage of 12.7 volts and below must be charged as follows:

BATTERY TYPE	STANDARD CHARGE	QUICK CHARGE
YT4L-BS	0.3 amps/hour for 5 to 10 hours	3.0 amps/hour for 30 min.

Electric Start Models

General

Sealed valve regulated lead acid (VRLA) battery are used. They are non-spillable and maintenance reduced — no electrolyte level to be checked and readjusted. No ventilation tube is attached to the battery.

SUPPLIER P/N	BRP P/N
YTX20L-BS	515 175 642

Removal

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Open right side panel of vehicle.

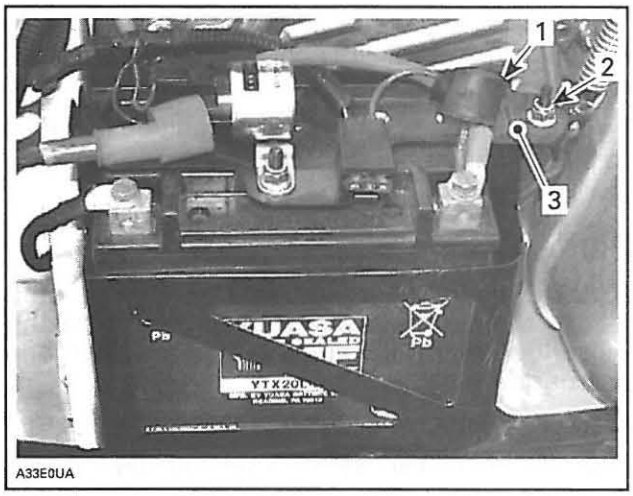
Disconnect BLACK (–) cable end from the terminal.

Slide off rubber boot from RED (+) cable and disconnect it.

Unscrew the bracket retaining nut and lift bracket to remove it.

Put bracket aside.

Remove battery.



1. Rubber boot of RED (+) cable terminal
2. Bracket retaining nut
3. Battery bracket

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

Cleaning

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Inspection

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Battery Charge Testing

Voltmeter Test

NOTE: To determine the battery state of charge, these sealed batteries have to be tested with a voltmeter. They also need to be tested when their voltage is stabilized. Disconnect battery to have open connectors and wait 1 - 2 hours prior to reading the voltage. The same condition is required after a battery has been charged.

Batteries with a voltage above 12.8 V do not need to be charged.

Batteries with a voltage of 12.8 V and below need to be charged. Refer to *BATTERY CHARGING* below.

Battery Storage

CAUTION: A discharged battery will freeze and it may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at temperature **below** 15°C (60°F).

Charge the battery every two week if stored at temperature **above** 15°C (60°F).

Activation of New Battery

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

CAUTION: If battery becomes hot, stop charging and allow it to cool before continuing.

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Perform *BATTERY CHARGE TESTING* above then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4 - 9 hours	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 minutes	10 A

Battery Voltage Below 11.5 V

Batteries with voltage below 11.5 V requires special procedures to recharge. In charging an over discharged battery, its internal resistance may be too high to charge at a normal charging voltage. Therefore, it may be necessary to raise the voltage of the battery initially to 25 V as a maximum, and charge for approximately 5 minutes.

If the charger ammeter shows no change in current after 5 minutes, you need a new battery. Current flowing into the battery at high voltage can become excessive. Monitor amperage and adjust voltage as necessary to keep current at the battery's standard amp rating. Charge for approximately 20 hours.

Installation

Reinstall battery and secure bracket properly.

Connect RED (+) cable it to positive battery terminal. Connect RED wire (coming from 30 A fuse).

Connect BLACK (–) cable LAST.

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

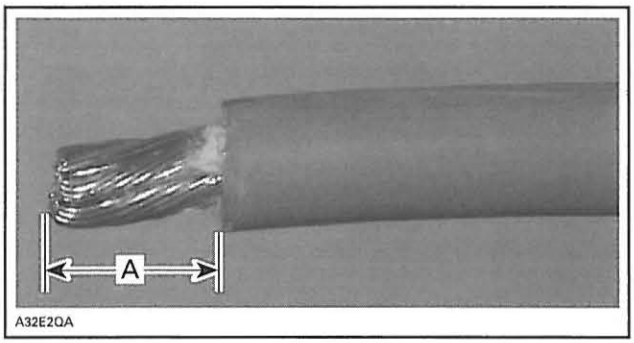
Cover the RED (+) terminal with rubber boot.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

BATTERY CABLE

Terminal Installation

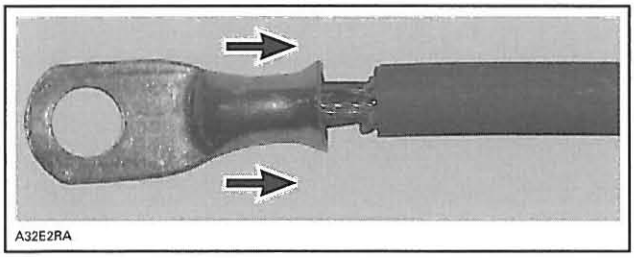
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

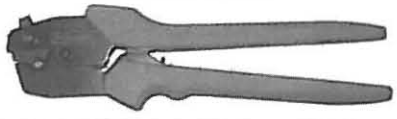
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.



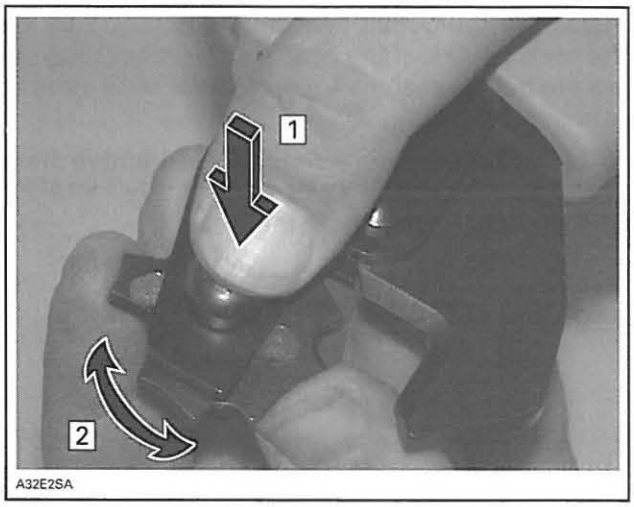
INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.

529 035 730

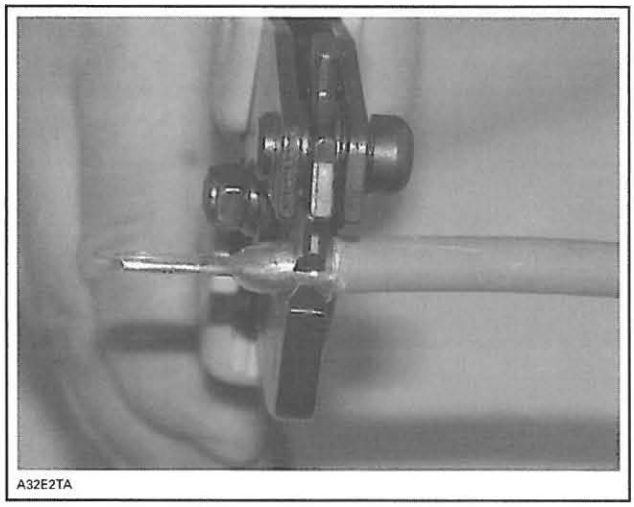


NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.

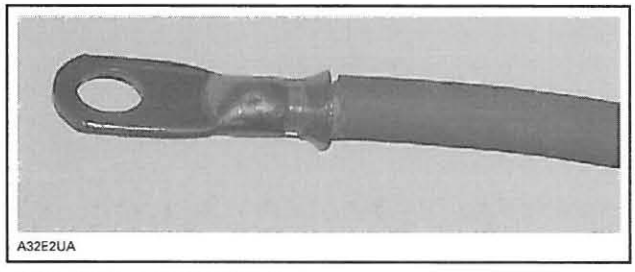


POSITIONING THE CRIMP PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimp 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 solder the wire to the terminal. Soldering can change the property of the wire and it can become brittle and break.

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.

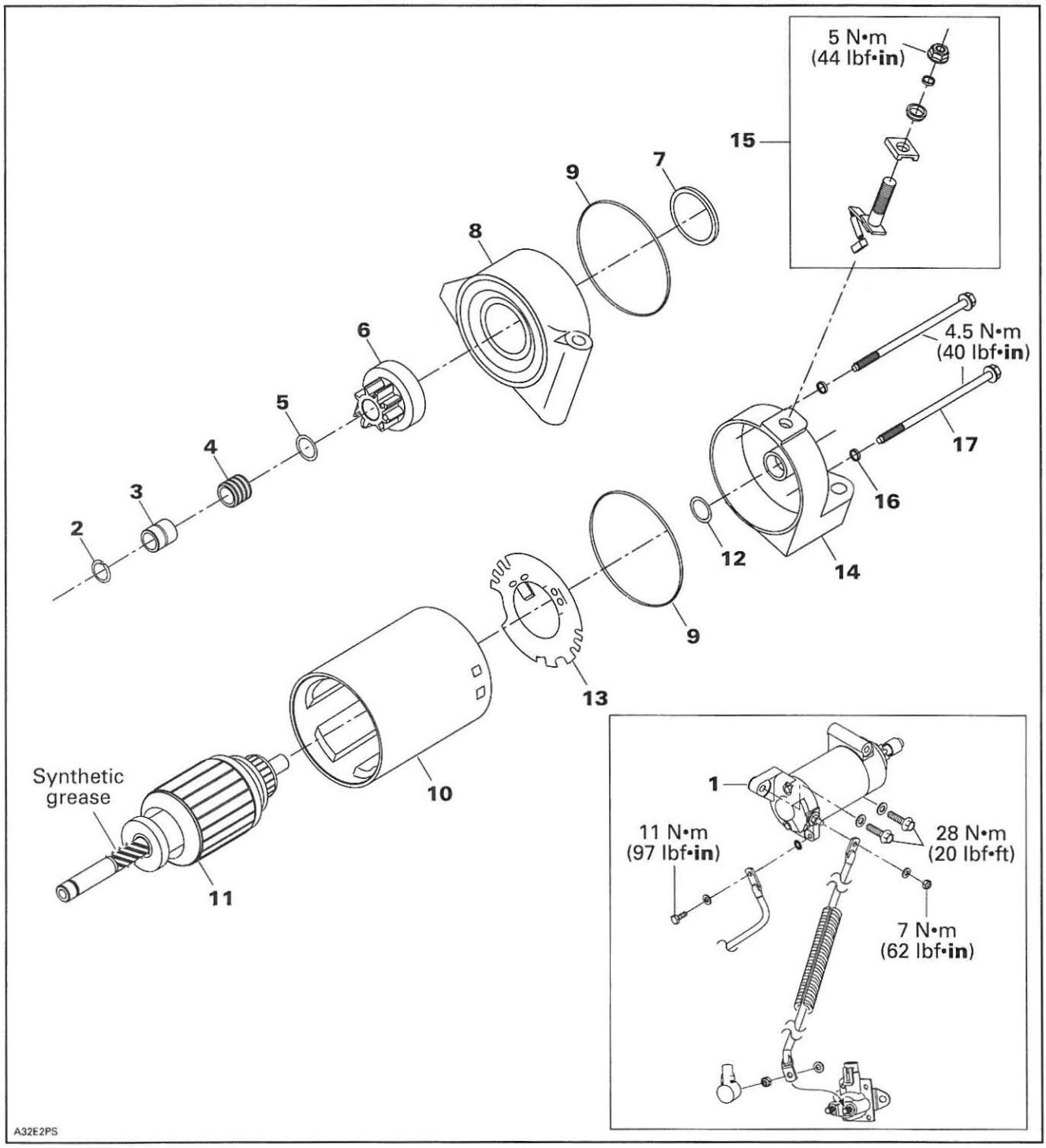
STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
multimeter Fluke 111	529 035 868	183

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	189, 191


5 N•m
(44 lbf•in)
15
7
9
8
6
5
4
3
2
4.5 N•m
(40 lbf•in)
17
16
12
14
9
13
10
Synthetic
grease
11
1
11 N•m
(97 lbf•in)
28 N•m
(20 lbf•ft)
7 N•m
(62 lbf•in)
A32E2PS

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 *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

For best results, use the multimeter Fluke 111 (P/N 529 035 868).

529 035 868

When the start button is pressed, a signal is sent to the starting solenoid. The battery then supplies current to the starter through the starting solenoid to crank the engine.

In case of problems, first ensure the problem is not related to engine mechanical components. If not, test the starting system.

Causes of problems are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start button, engine cut-out switch, starting solenoid, electrical cables and connections or the electronic module.

Check these components before removing starter.

PROCEDURES

FUSES

Make sure the charging fuse on battery and the ECM fuse on electrical harness are in good condition. If the fuses test good, continue with the next tests.

BATTERY

Refer to *CHARGING SYSTEM* to check battery condition. If the test is good, continue with the next tests.

ENGINE CUT-OUT SWITCH

Refer to *IGNITION SYSTEM*.

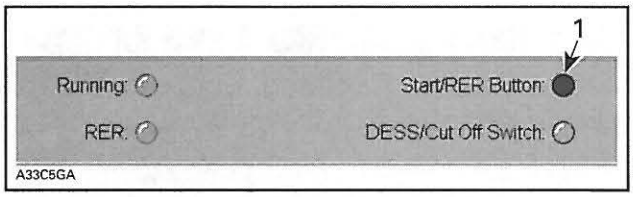
START/RER SWITCH

Test with B.U.D.S.

Use the B.U.D.S. software.

Set engine cut-off to ON and install tether cap on DESS post.

A quick operation test can be done using the **Monitoring** section. Press the START/RER button and look at the START/RER button LED.



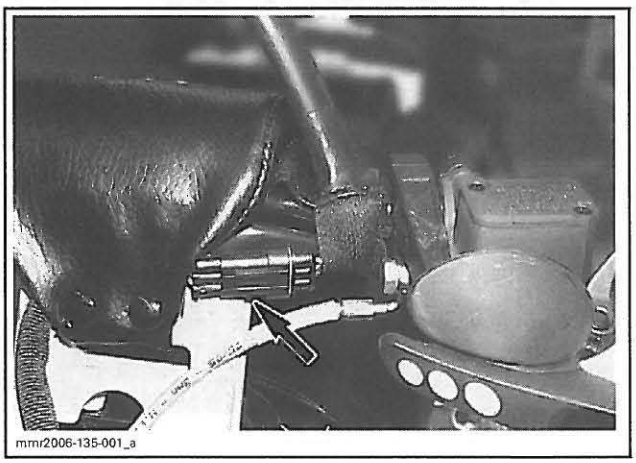
1. Activated here

- If LED turns on, the starting system is working on the input side of the starting system (START/RER button, ECM and wiring). You know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid, solenoid and starter motor. Refer to *STARTING SOLENOID* below.
- If LED does not turn on, check the input side (signal). Test corresponding fuse, relay and wiring.

Switch Static Test

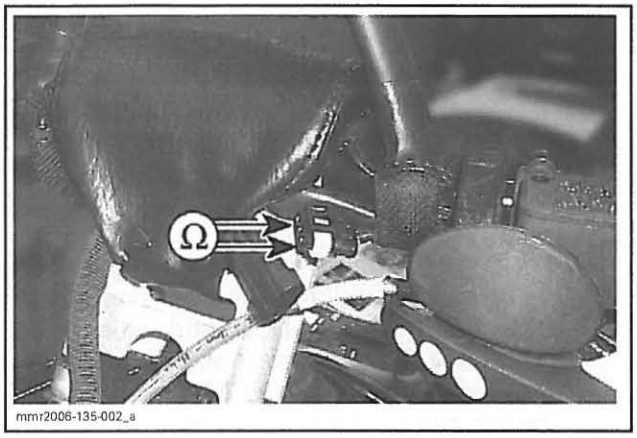
Remove dashboard. Refer to *BODY*.

Disconnect the 3-pin connector of switch harness.



Measure resistance of switch as follows.

SWITCH POSITION	WIRES		RESISTANCE
Released	BLACK	RED	0.2 Ω (closed)
	BLACK	WHITE	High value or infinite (0L.)
Pressed and held	BLACK	RED	High value or infinite (0L.)
	BLACK	WHITE	0.2 Ω (closed)

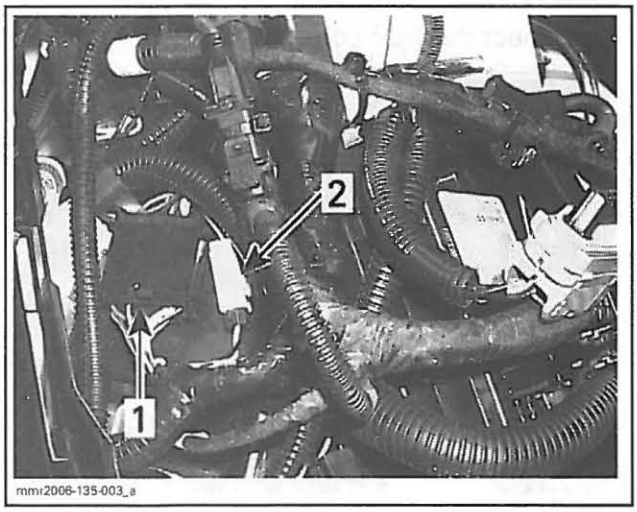


If resistance test fails, replace switch.

If resistance was good, reconnect 3-pin connector and proceed with test below.

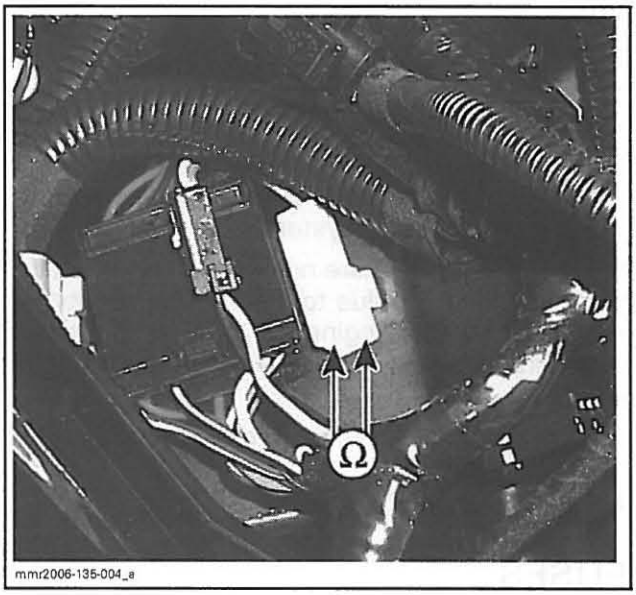
Switch and Wiring Harness Test

Disconnect steering connector and the 2-pin connector.

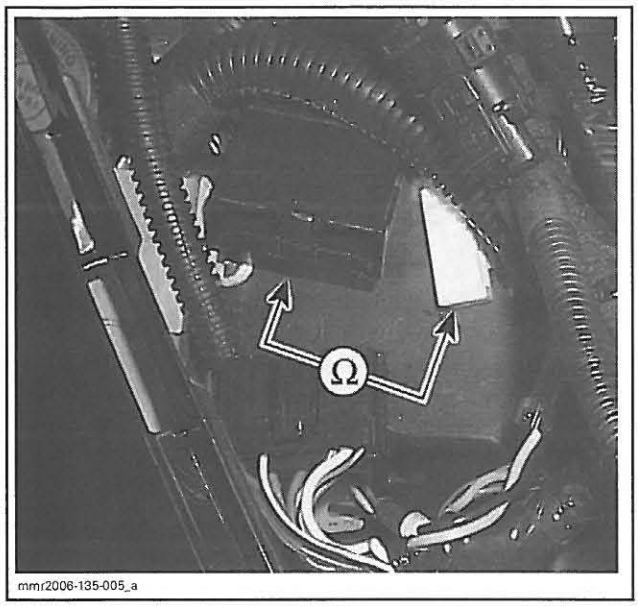


1. Steering connector (8-pin)
2. 2-pin connector

SWITCH POSITION	WIRES		RESISTANCE
Released	BLACK 2-pin connector **(see view 1)**	BEIGE 2-pin connector	0.2 Ω (closed)
	BEIGE 2-pin connector **(see view 2)**	RED/ BROWN 8-pin connector	High value or infinite (0L.)
Pressed and held	BLACK 2-pin connector **(see view 1)**	BEIGE 2-pin connector	High value or infinite (0L.)
	BEIGE 2-pin connector **(see view 2)**	RED/ BROWN 8-pin connector	0.2 Ω (closed)



VIEW 1

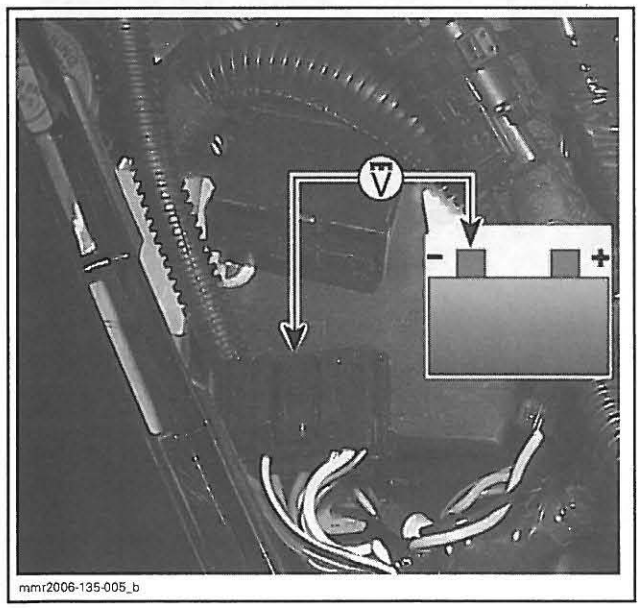


VIEW 2

If resistance was not good, replace steering harness.

If resistance was good, measure voltage on harness side of connector as follows.

WIRE		VOLTAGE
RED/BROWN	Battery ground	12 Vdc



If voltage is not appropriate, check fuse and RED/BROWN supply wire coming from voltage regulator.

If voltage is good, check continuity of BLACK/BLUE wire from 3-pin connector to RH side connector then from RH side connector to engine ground. Repair/replace connector/wiring if test fails.

Also, if voltage is good, disconnect ECM connector and check wire between 2-pin connector and ECM. If it tests good, try a new ECM.

STEERING CONNECTOR WIRE	ECM CONNECTOR WIRE	RESISTANCE
BEIGE	BEIGE	Continuity (0.2 Ω max.)

Reconnect all connectors and reinstall dashboard.

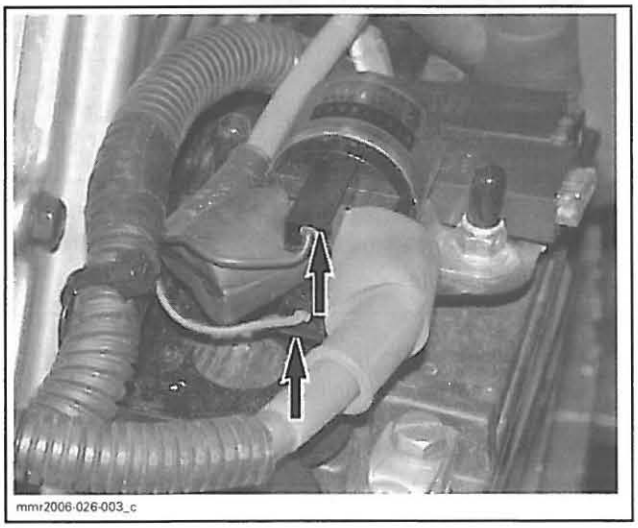
STARTING SOLENOID

General

Inspect connections and clean as necessary.

Solenoid Static Test

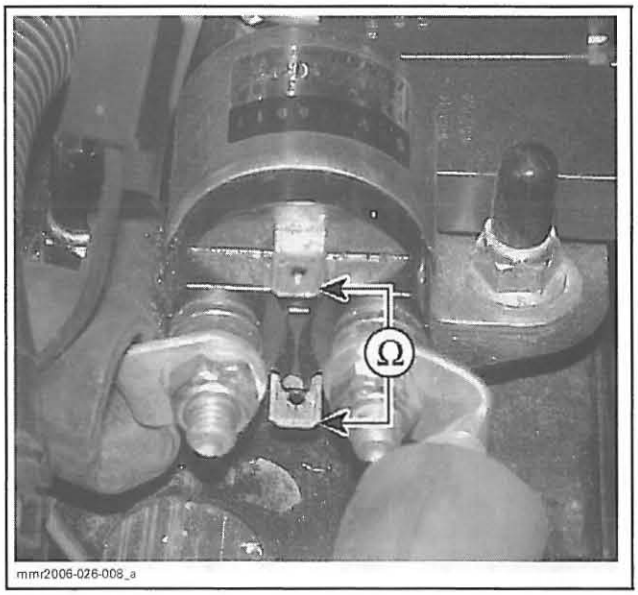
Disconnect terminals from solenoid.



TYPICAL

With a multimeter, check primary winding resistance as follows.

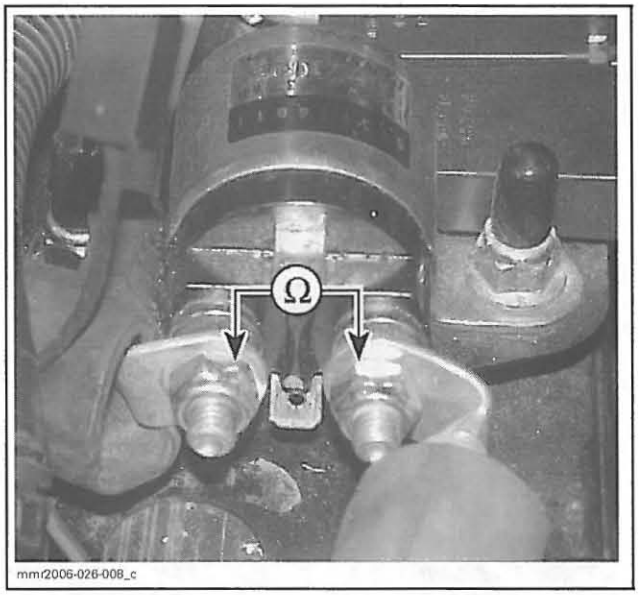
SOLENOID		RESISTANCE MEASUREMENT @ 20°C (68°F)
Terminal A	Terminal B	Approximately 7.5 Ω



TYPICAL

Check for stuck solenoid plunger. Disconnect battery ground cable and measure resistance as follows.

SOLENOID		MEASUREMENT
Battery post	Starter post	Open circuit



TYPICAL

If any measurement is out of specification, replace solenoid.

Solenoid Dynamic Test

Reconnect battery ground cable and solenoid connectors.

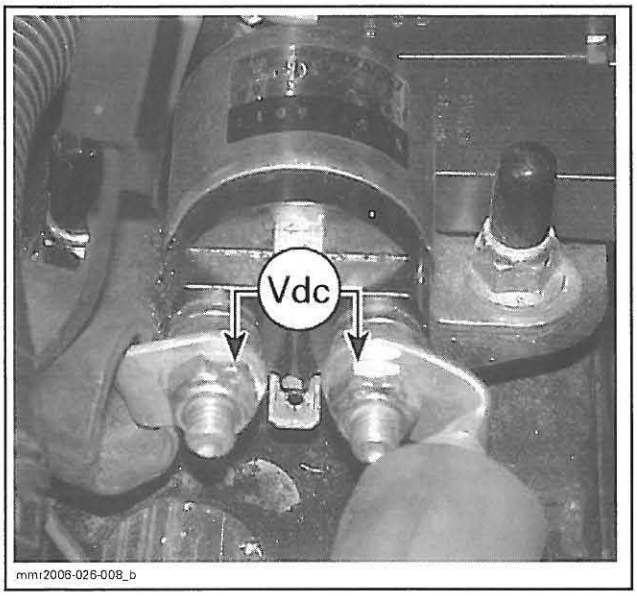
Remove spark plug cables to prevent engine starting for the test.

⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

While engine is cranking, measure the voltage drop as follows.

SOLENOID		VOLTAGE
Post coming from battery	Post going to starter	0.2 Vdc max.



TYPICAL

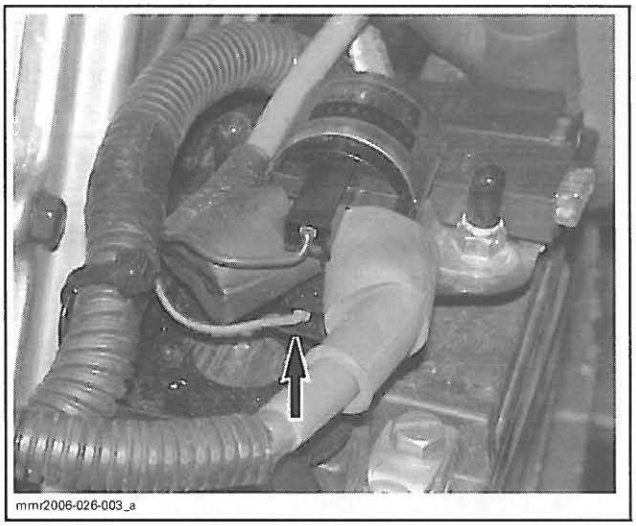
Reconnect spark plug cables.

If voltage is out of specification, replace solenoid.

If solenoid tests good, check the electric starter.

Solenoid Signal Verification

Disconnect connector with RED/GREY wire from solenoid.



TYPICAL

Check voltage as follows.

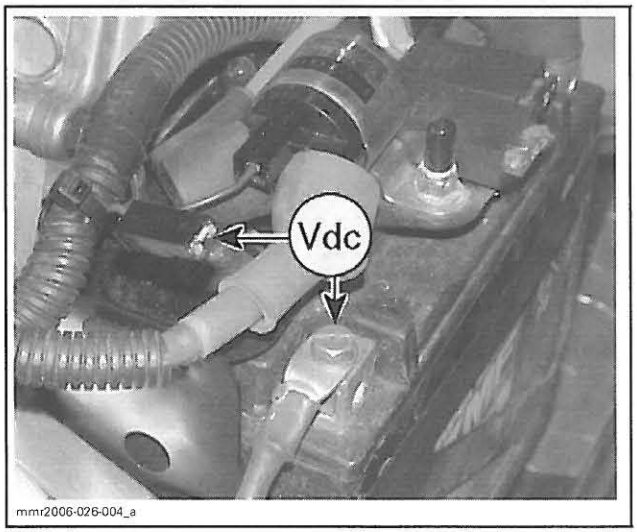
Remove spark plug cables to prevent engine starting for the test.

⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Read voltage.

SOLENOID SIGNAL	VOLTAGE
RED/GREY wire with battery ground	12 Vdc



TYPICAL

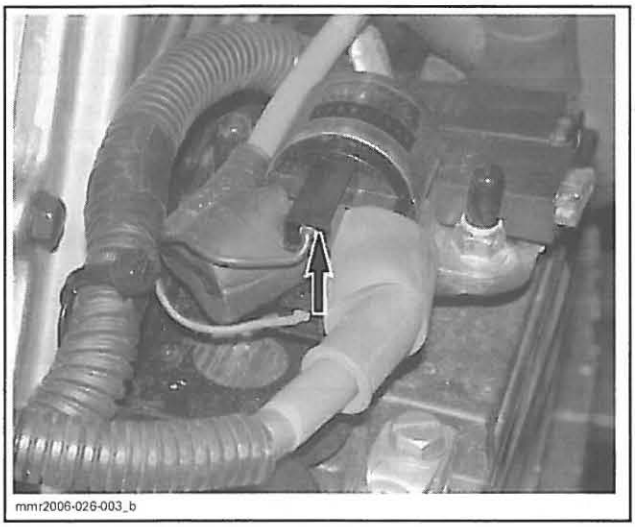
Reconnect spark plug cables.

If voltage is not adequate, check continuity of wiring from START/RER switch.

If wiring is good, do the following test.

Reconnect RED/GREY terminal to solenoid.

Disconnect ORANGE/BLACK terminal from solenoid.



TYPICAL

Connect a jumper wire between solenoid terminal and battery ground.

TYPICAL

Press Start/RER button.

If solenoid works, check wiring/connectors for continuity of ORANGE/BLACK wire.

Reconnect ORANGE/BLACK wire to solenoid.

If solenoid does not work, test solenoid.

ELECTRICAL CABLES AND CONNECTIONS

Check all connections, harnesses and wires.

Tighten any loose connections.

Replace any chafed wires.

If wires, harnesses and connections are good, check the electric starter.

ELECTRIC STARTER

Test

Either set engine cut-out switch to STOP or remove tether cord to prevent engine to run.

Remove the tuned pipe and disconnect spark plug cables.

⚠ WARNING

Do not touch spark plug or cables when cranking engine. High voltage would cause a powerful electrical shock if you touch them.

Using booster cable, carefully supply current from the battery directly to the starter. Connect the BLACK cable first. Connect the remaining booster cable from the battery then to the starter.

If the starter does not turn, check for mechanical problem in the starter.

If the starter turns, ensure wiring harness and connectors between battery and starter are in good condition. If they test good, the ECM can be suspected.

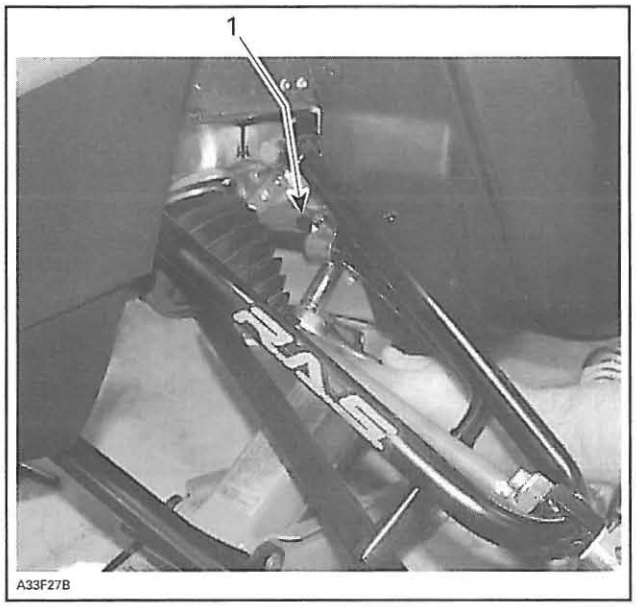
Removal

- Remove tuned pipe.
- Disconnect BLACK (-) cable from battery.
- Disconnect RED (+) cable from battery.
- Unbolt and remove starter from engine.

⚠ WARNING

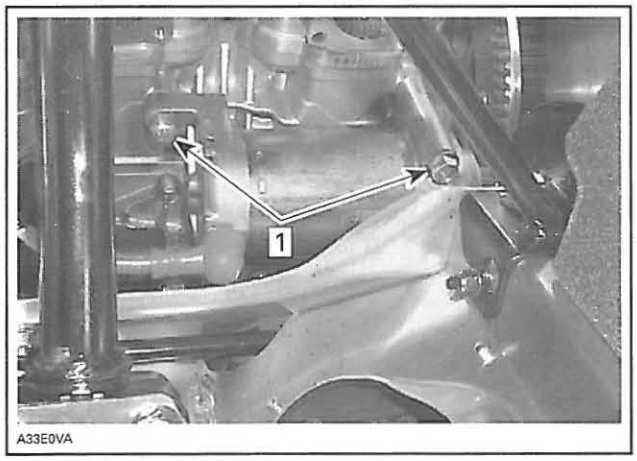
Always disconnect BLACK (-) cable first and connect last.

- Remove tuned pipe.
- Disconnect RED cable from starter.
- Disconnect ground cable from starter.
- Remove stabilizer bar clamp to access the lower starter retaining bolt.



1. Clamp

– Unbolt and remove starter from engine.



1. Bolts to be removed

Disassembly

Before disassembling, trace index marks on starter housing **no. 10** and starter housing assembly **no. 8** to ease further assembly.

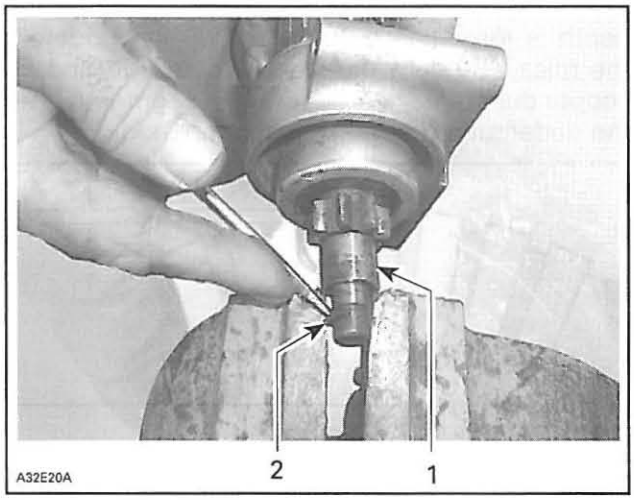
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

Brush holder **no. 13** can be removed from end frame housing **no. 14** by disconnecting the end frame attached brush from brush holder **no. 13**.

Check the radial play between the armature shaft and end frame bearing. Replace the end frame bearing or replace starter. If parts are in good condition then coat with synthetic grease (P/N 413 711 500) before reinstalling them.

Push back the collar **no. 3** using a screwdriver.

Remove snap ring **no. 2**. Remove collar **no. 3** and spring **no. 4**.



1. Collar
2. Snap ring

Turn starter clutch **no. 6** clockwise to remove it from armature assembly **no. 11**.

Pull housing from armature.

Cleaning

CAUTION: Yoke assembly and drive unit assembly must not be immersed in cleaning solvent.

Clean brushes and holders with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holders clean using compressed air.

⚠ WARNING

Always wear safety glasses when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings or bearings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

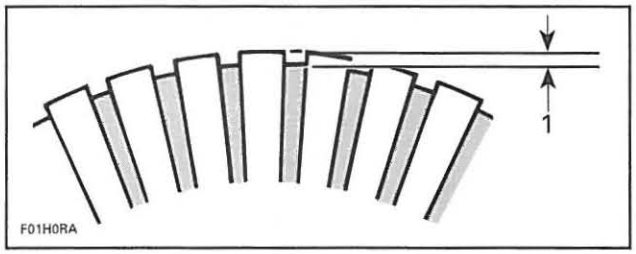
Inspection

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning the shorted windings in the armature.

Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, enough to remove grime only.

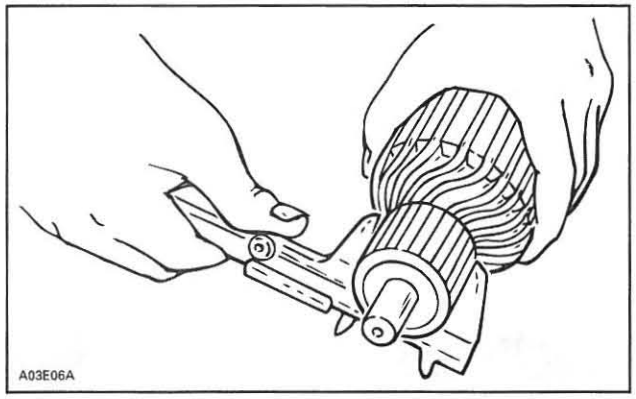
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



1. Commutator undercut 0.20 mm (.008 in)

Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

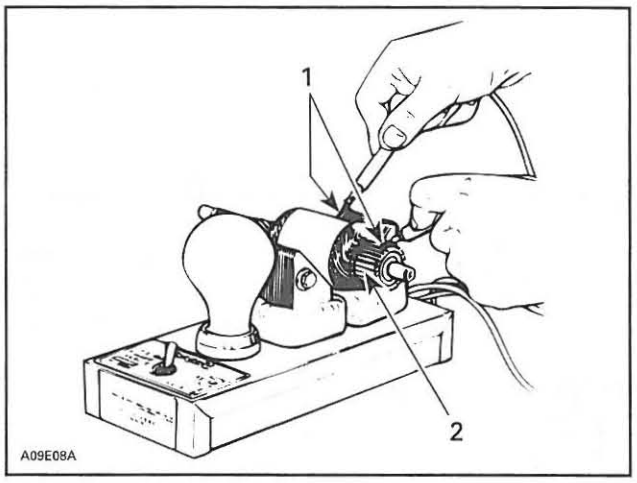
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
All models	27 mm (1.063 in)

Test for Ground Circuit in the Armature

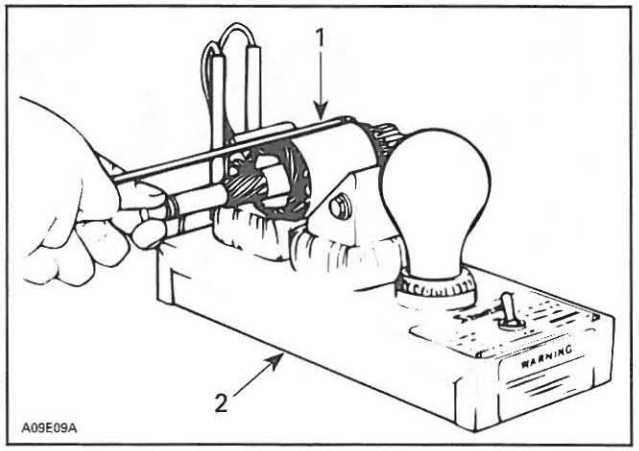
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has short circuit. Replace armature if so.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced or repaired; open circuits most often occur at the commutator riser where coils are soldered. (Burnt commutator bars are usually an indication of an open-circuit armature coil).

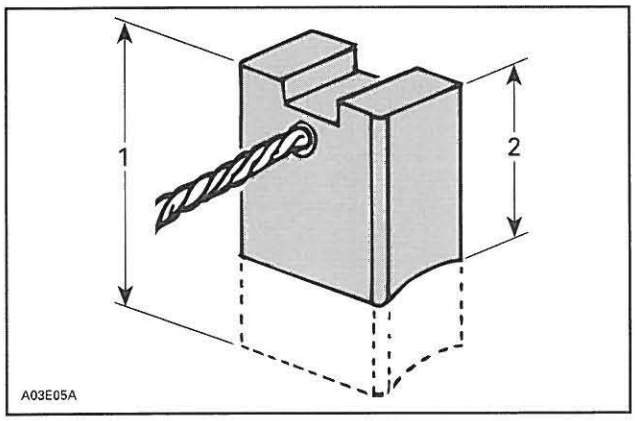
Brush Holder

Check the brush holder for insulation using growler test probes. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate. If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than the specified value, replace them.

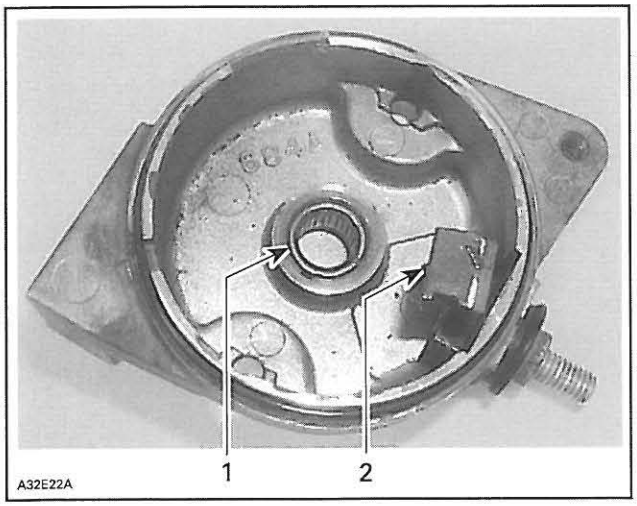
MODEL	LENGTH	
	NEW	WEAR LIMIT
All	10 mm (.400 in)	6 mm (.236 in)



TYPICAL
1. *New*
2. *Wear limit*

End Housing

Check the mica insulation of the positive brush and also the roller bearing condition. Replace, if necessary.



1. *Roller bearing*
2. *Positive brush*

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check the pinion teeth for wear and damage. If defective, replace.

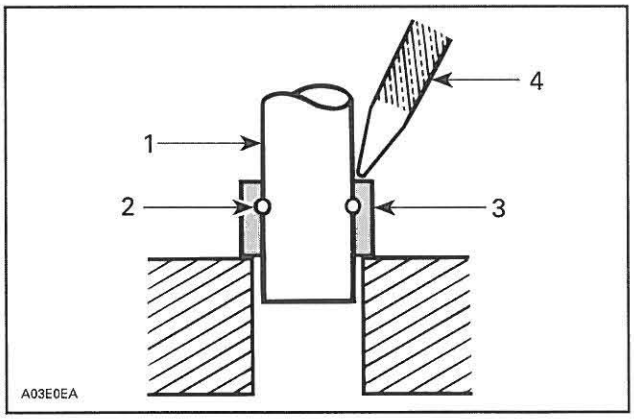
Assembly

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing with synthetic grease (P/N 413 711 500).

After placing collar **no. 3** on armature shaft **no. 11**, fit new snap ring **no. 2** on armature shaft, then make sure that it is properly secured.

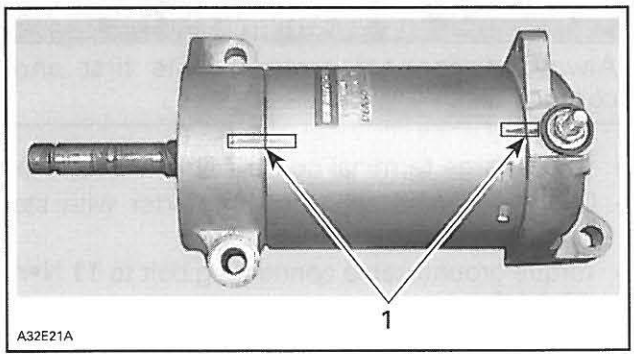
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it at two or three places.



1. *Armature shaft*
2. *Snap ring*
3. *Collar*
4. *Punch*

Starter Housing Assembly and Starter Housing

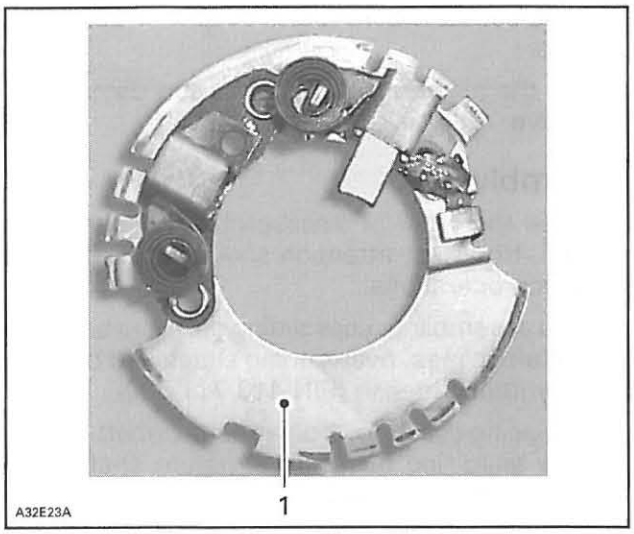
Align previously traced indexing marks.



TYPICAL
1. *Aligned indexing marks*

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder **no. 13** into housing **no. 14**.



1. Brush holder

To ease end frame installation, retain brush holder with a small screwdriver while installing armature assembly.

CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

Installation

- Use new teflon washers on the 3 bolts retaining starter to engine.
- Torque the bolts to 28 N•m (20 lbf•ft).
- Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
- Connect the RED battery cable and the RED wire to the large terminal of the starter.

⚠ WARNING

Always disconnect ground cable first and connect last.

- Torque large terminal nut to 7 N•m (62 lbf•**in**).
- Connect ground cable to the starter with star washer in between.
- Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	194

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 *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

The following components are specially designed for this system: ECM, DESS key and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed DESS key is installed on DESS post.

The DESS key contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the DESS key. This is achieved with B.U.D.S. software.

The system is quite flexible. Up to 8 DESS keys may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a DESS key can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When starting the engine with a DESS key on the post, the DESS is activated and will emit audible signals:

- 2 short beeps indicate a working DESS key. Vehicle can be driven.
- 1 short beep indicates a wrong DESS key is being used or that something is defective. Vehicle can not be driven.

Engine Starting

If the ECM recognizes a valid DESS key, it allows engine to rev above 3000 RPM.

The ECM will shut down immediately after stopping the engine.

KEY PROGRAMMING

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

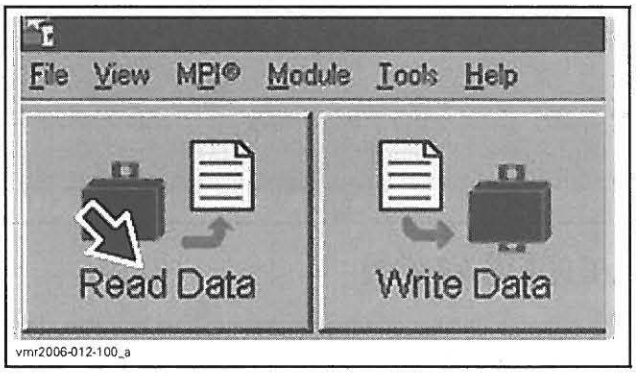
The B.U.D.S. software is designed to allow, among other things, the programming of DESS key(s) and entering customer information.

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

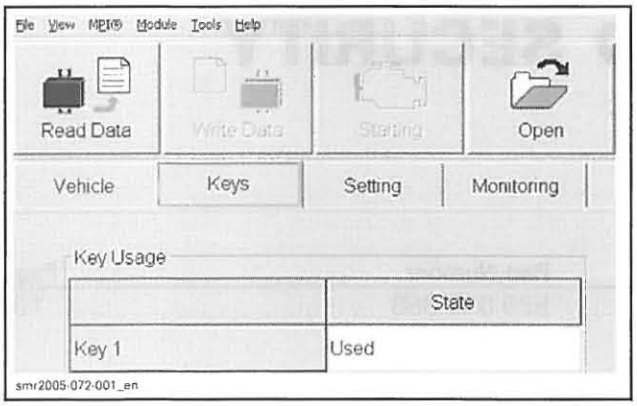
If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

Read ECM using READ DATA button.

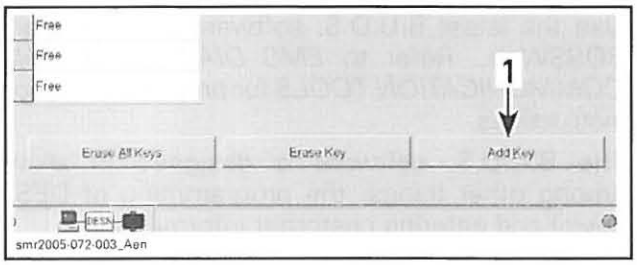


Install the new key to be programmed on DESS post interface tool.

Click on KEYS tab.



Click on ADD KEY button on bottom of screen.

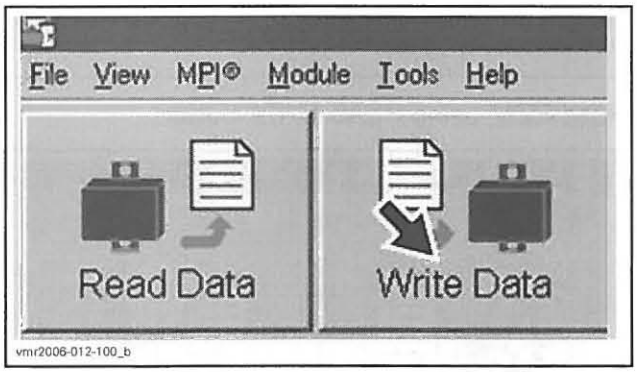


1. Click on this tab

A new key is now saved in the computer.

NOTE: To program other key(s), install a new key and click again on ADD KEY tab.

Ensure to save new data in ECM using WRITE DATA button.

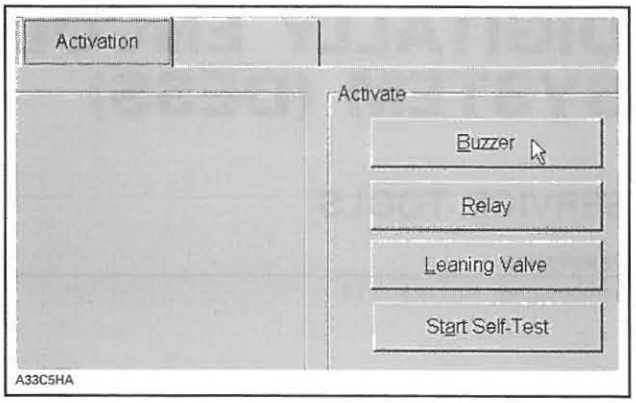


VERIFICATION

If no beep is heard when starting the engine, test beeper operation.

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

Energize **Buzzer** from **Activation** tab.



If beeper properly works, refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* and check for fault codes.

DESS Post

The following continuity tests can be performed using an ohmmeter.

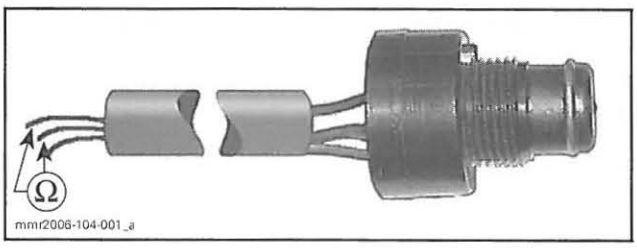
For best results, use the multimeter FLUKE 111 (P/N 529 035 868).

Disconnect DESS post wires.

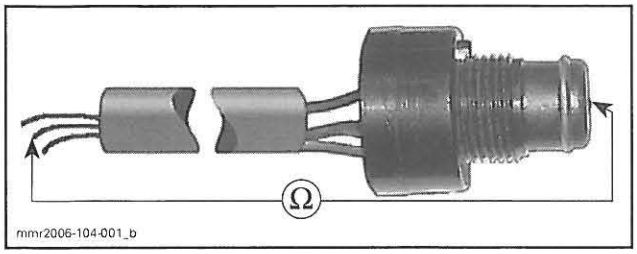
DESS Key Removed from Post

Connect test probes to DESS post as per tables and measure resistance.

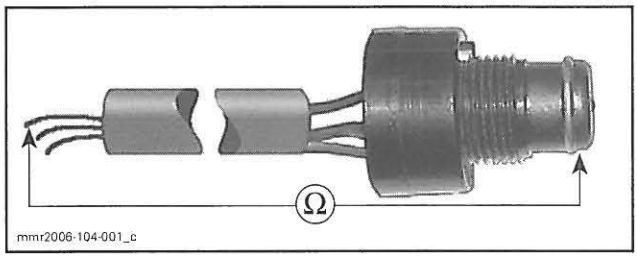
DESS POST		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BLACK/ GREEN	BLACK/ WHITE	Open circuit



DESS POST		RESISTANCE Ω @ 20°C (68°F)
WIRE		
WHITE/ GRAY	Post terminal	Close to 0 Ω



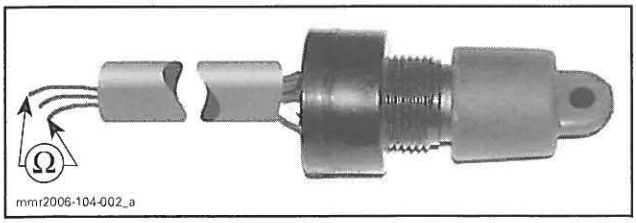
DESS POST		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BLACK/ GREEN	Post ring	Close to 0 Ω



DESS Key on Post

Connect test probes to DESS post as per table and measure resistance.

DESS POST		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BLACK/ GREEN	BLACK/ WHITE	Close to 0 Ω



If any resistance test fails, replace DESS post.

ROTAX ELECTRONIC REVERSE (RER)

SERVICE TOOLS

Description	Part Number	Page
multimeter Fluke 111	529 035 868	197
supply cable	529 035 997	199
supply harness	529 035 869	199

GENERAL

For best results, use the multimeter Fluke 111 (P/N 529 035 868).

There are 3 main components used for the RER system: the RER switch, the ECM and the CPS (crankshaft position sensor).

The ECM receives signals from the CPS for the forward and reverse engine rotation.

The ECM recognizes a signal sent by the START/RER switch.

When switch is activated and engine is not running, engine starting occurs if tether cap is on DESS post AND engine cut-out switch is on RUN position.

When switch is activated and engine is running, ECM cuts off ignition. Therefore, engine RPM gradually drops. When engine reaches a low threshold RPM, ECM sends an ignition spark at a great advance creating a thrust which reverses engine rotation.

Under a threshold low RPM or above drive pulley engagement speed, the RER function is disabled. Nothing takes place when pressing RER button.

TESTING

START/RER SWITCH

Testing Signal with B.U.D.S.

Use the latest B.U.D.S. software available from BOSSWeb. Refer to *EMS DIAGNOSTIC AND COMMUNICATION TOOLS* for proper connection instructions.

A quick operation test can be done using the **Monitoring** section in B.U.D.S.

Set engine cut-out to OFF.

Press vehicle START/RER button and look at the START/RER button LED. It should turn on, indicating START/RER switch, ECM and wiring are working.

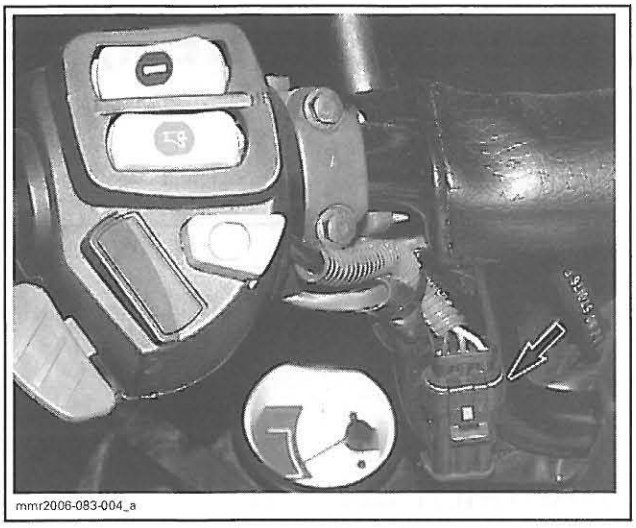
1. Should turn on

If light does not turn on, check Start/RER switch. See below.

Resistance Test

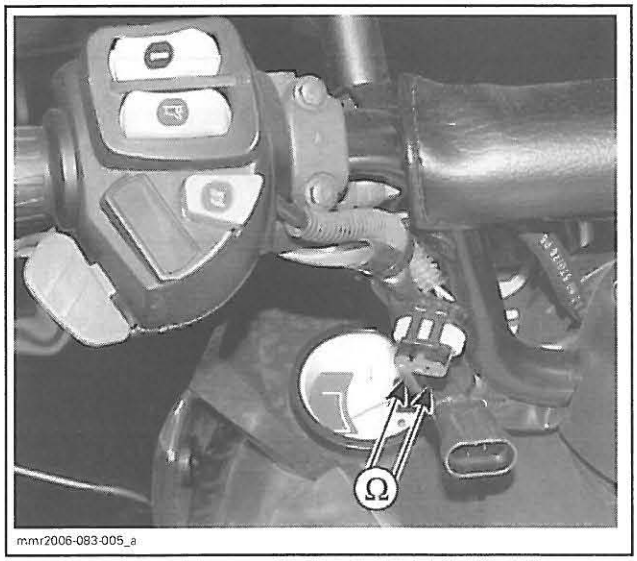
Remove dashboard. Refer to *BODY*.

Disconnect the 3-pin connector of switch harness.


mmr2006-083-004_a

Measure resistance of switch as follows.

SWITCH POSITION	WIRES		RESISTANCE
Released	BLACK	RED	0.2 Ω (closed)
	BLACK	WHITE	High value or infinite (0L.)
Pressed and held	BLACK	RED	High value or infinite (0L.)
	BLACK	WHITE	0.2 Ω (closed)



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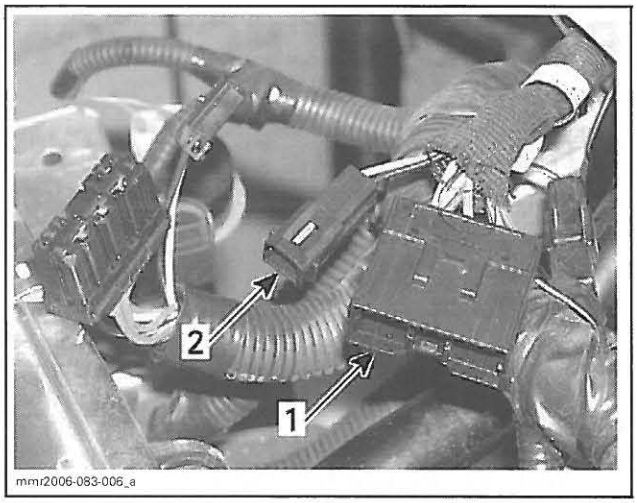
If resistance test fails, replace switch.

If resistance was good, reconnect 3-pin connector and recheck resistance as follows.

Disconnect steering connector and the 2-pin connector.



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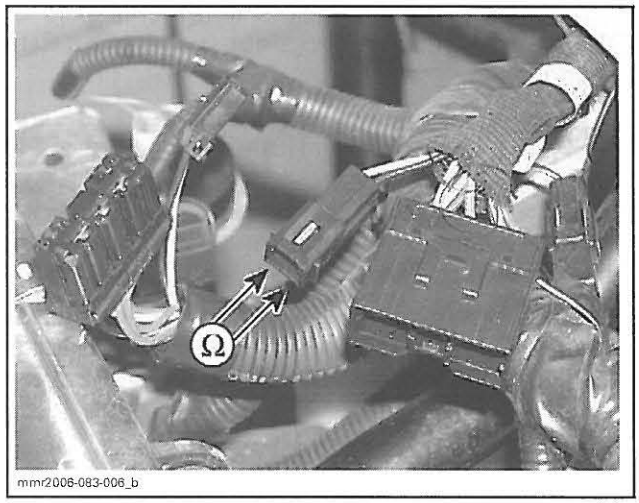
1. Steering connector (8-pin)
2. 2-pin connector

SWITCH POSITION	WIRES		RESISTANCE
Released	BLACK 2-pin connector **(see view 1)**	BEIGE 2-pin connector	0.2 Ω (closed)
	BEIGE 2-pin connector **(see view 2)**	RED/ BROWN 8-pin connector	High value or infinite (0L.)
Pressed and held	BLACK 2-pin connector **(see view 1)**	BEIGE 2-pin connector	High value or infinite (0L.)
	BEIGE 2-pin connector **(see view 2)**	RED/ BROWN 8-pin connector	0.2 Ω (closed)



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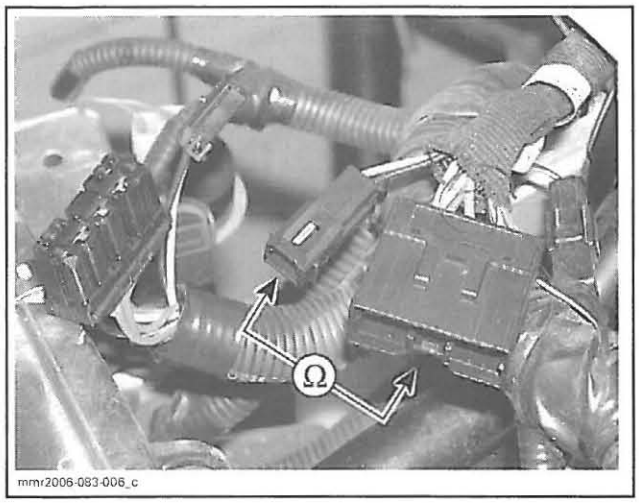
VIEW 1



VIEW 2

If resistance was not good, replace steering harness.

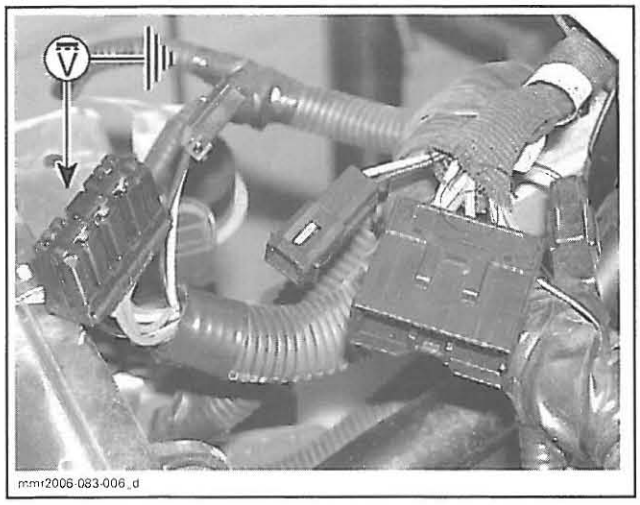
If resistance was good, measure voltage on harness side of connector as per procedure below.

Voltage Test

On manual start models, use supply harness (P/N 529 035 869) and connect supply cable (P/N 529 035 997) to T-harness and vehicle battery to supply the ECM for the following test. Refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES* for proper connections.

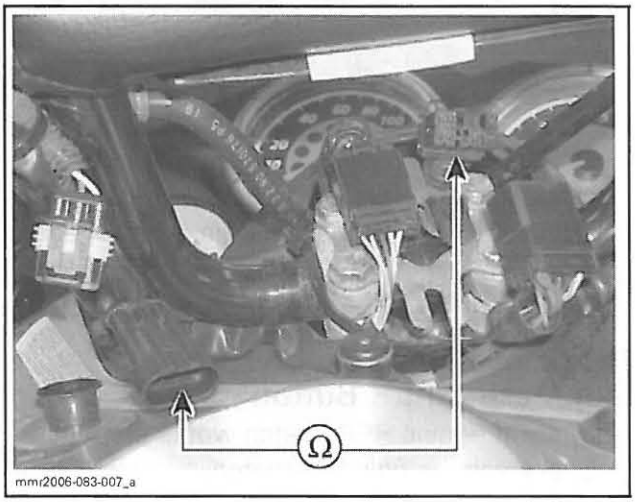
On electric start models, install tether cap on DESS post.

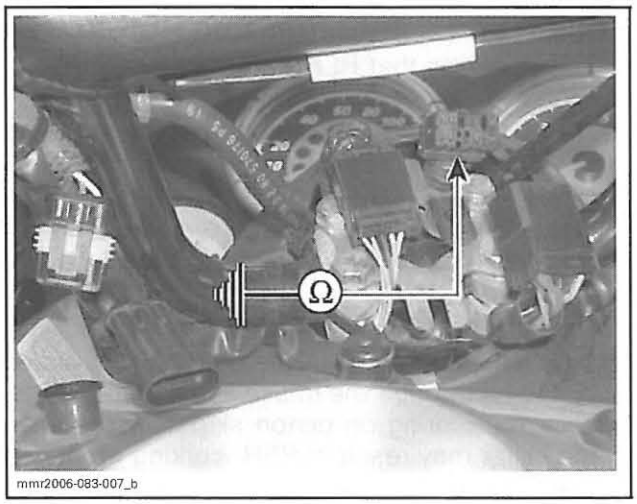
WIRE		VOLTAGE
RED/BROWN	Manual start: engine ground Electric start: battery ground	12 Vdc



If voltage is not appropriate, check fuse and RED/BROWN supply wire coming from voltage regulator.

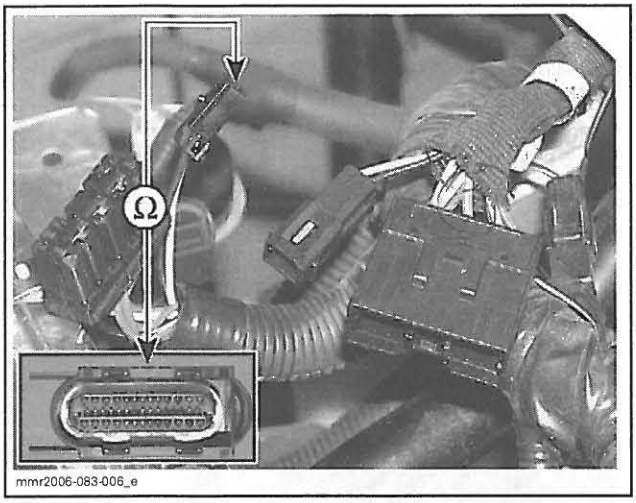
If voltage is good, check continuity of BLACK/BLUE wire from 3-pin connector to RH side connector then from RH side connector to engine ground. Repair/replace connector/wiring if test fails.





Also, if voltage is good, disconnect ECM connector and check wire between 2-pin connector and ECM. If it tests good, try a new ECM.

STEERING CONNECTOR WIRE	ECM CONNECTOR WIRE	RESISTANCE
BEIGE	BEIGE	Continuity (0.2 Ω max.)



Reconnect all connectors and reinstall dashboard.

TROUBLESHOOTING

RER Does Not Respond when Depressing RER Button

- Check if engine RER switch works properly.
- Check voltage going to switch.

Engine Stops after Pressing RER Button

- This confirms that RER switch works.
- Check crankshaft position sensor (CPS).

RER Works Erratically

- Check engine compression. A low compression engine may result in RER working erratically making you think the problem is an electronic problem.
- Check piston condition. Remove exhaust system and carburetor/throttle body. Verify piston condition through the intake and exhaust ports. Look for scoring on piston skirts. Scored piston skirts may result in RER working erratically making you think the problem is an electronic problem.
- Check RER switch.

LIGHTS, INSTRUMENTS AND ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	201, 204
supply harness	529 035 869	203

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 *EMS DIAGNOSTIC AND COMMUNICATION TOOLS*.

⚠ WARNING

It is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Do not place tools on battery.

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* at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

For best results, use the multimeter FLUKE 111 (P/N 529 035 868).

529 035 868

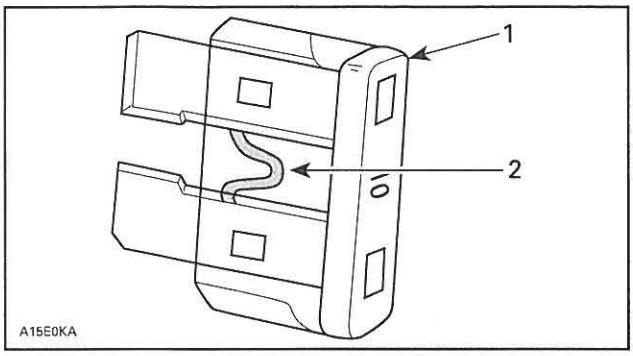
FUSE BLOCK

It contains fuses and relays.

mmr2006-137-001_a

FUSE

Check if filament is melted. Replace as necessary.



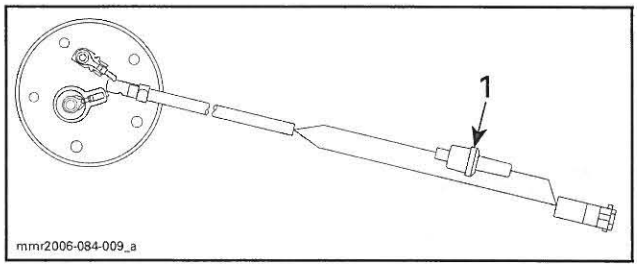
1. Fuse
2. Check if melted

CAUTION: Do not use a higher rated fuse as this can cause severe damage to electric components and/or fire.

⚠ WARNING

If fuse has burnt out, source of malfunction should be determined and corrected before restarting.

Electric Fuel Level Gauge Fuse

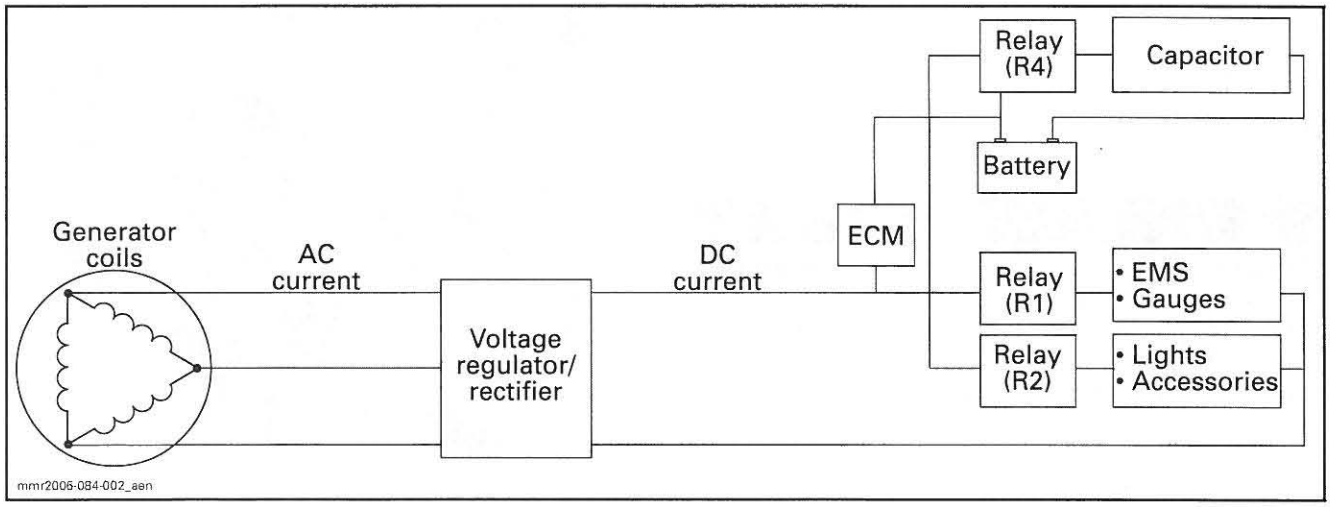


1. In-line fuse

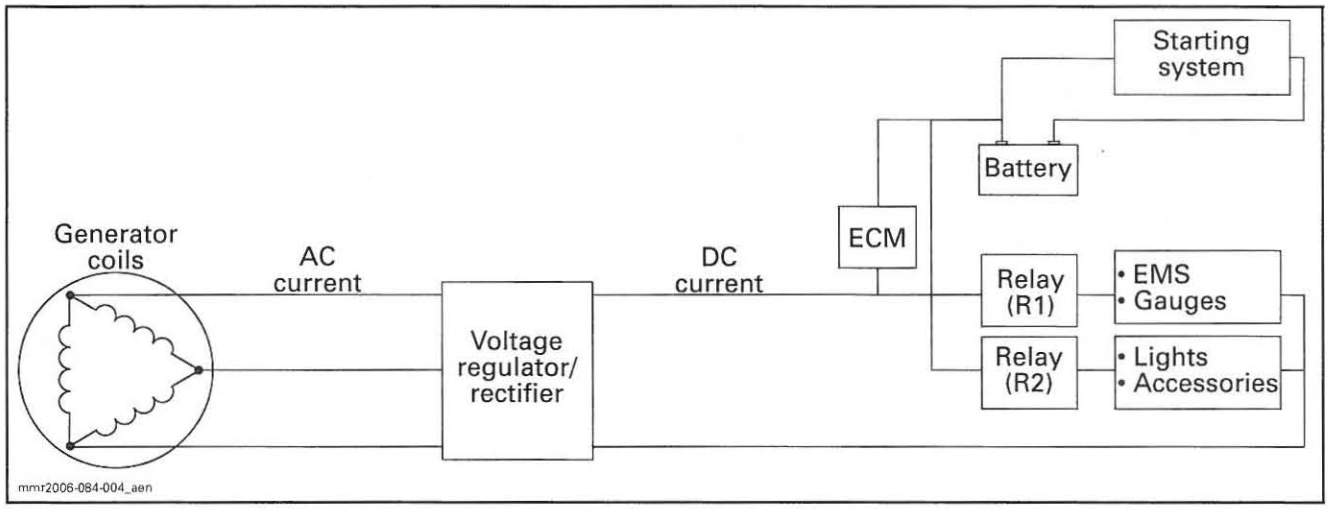
POWER DISTRIBUTION

When there is no power, check fuses, relays, battery, charging coil, voltage regulator/rectifier and wiring harness. Also ensure to check the circuit ground wires. Refer to *CHARGING SYSTEM* and *WIRING DIAGRAMS*.

Manual Start Models



Electric Start Models

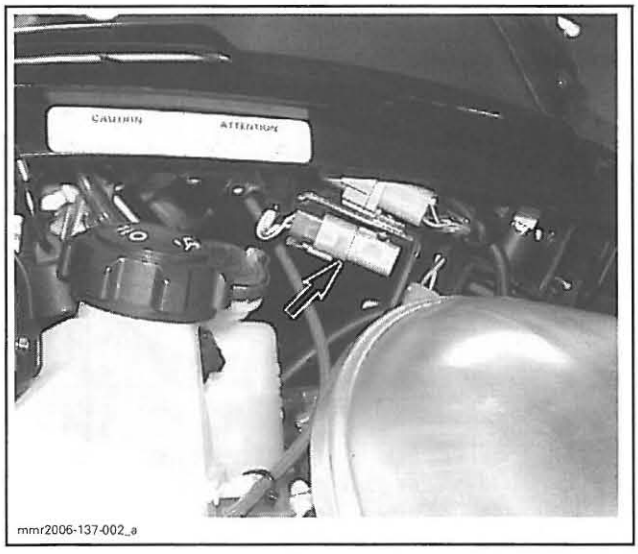


POWER SUPPLY

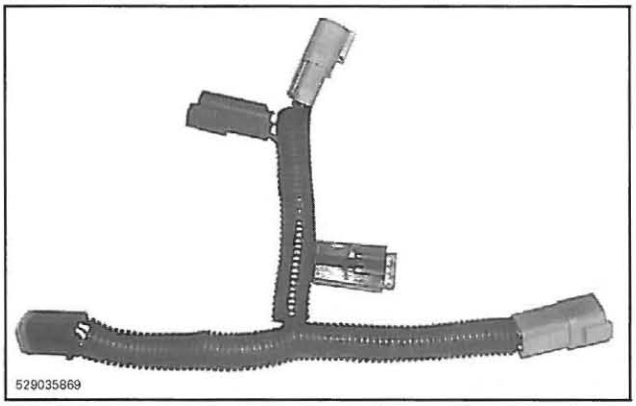
To provide power to lighting and accessories systems without starting engine, proceed as follows.

NOTE: SDI models already have a 12 V battery; they do not need any external battery to allow troubleshooting. The use of the supply harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.

Remove the 6 pin diagnostic connector from protective cap on vehicle.



Connect supply harness (P/N 529 035 869) to the 6-pin connector of vehicle.

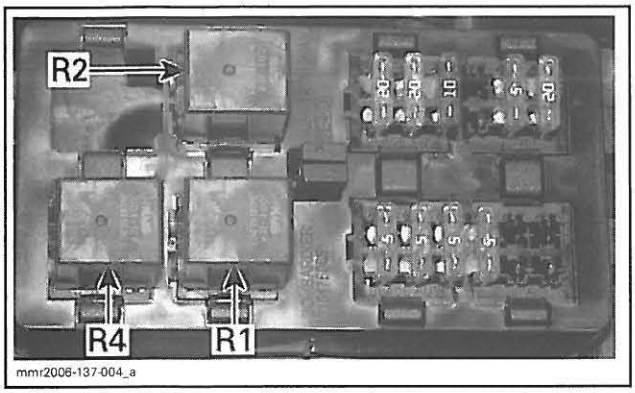


Use the wiring diagram in *WIRING DIAGRAMS* section to troubleshoot lighting and accessories systems.

Once testing is done, disconnect supply harness from vehicle and then from supply cable. Reconnect the 6-pin connector in its cap.

PROCEDURES

RELAY



Relay 1: EMS and gauges
Relay 2: Lights and accessories
Relay 4: Capacitor (manual start only)

NOTE: For testing the relay R4, refer to *ENGINE MANAGEMENT*.

Voltage Test

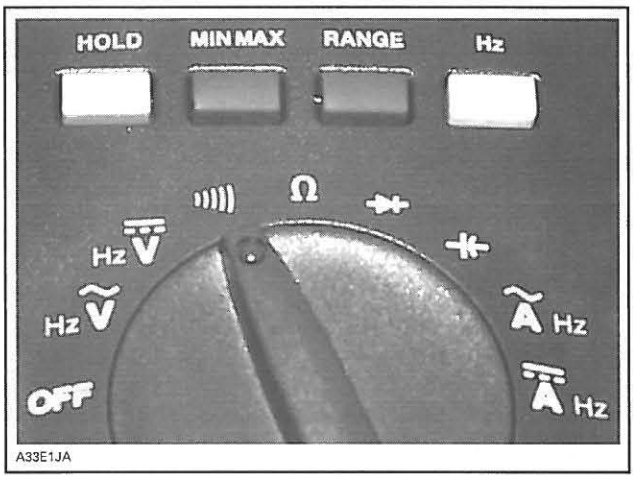
RELAY 1		
TEST	COIL	CONTACT
WIRE COLOR	ORANGE/BLUE and RED/BROWN	RED/WHITE and RED/GREEN
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

RELAY 2		
TEST	COIL	CONTACT
WIRE COLOR	RED/GREY and ORANGE/GREEN	VIOLET/RED and RED/BLUE
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

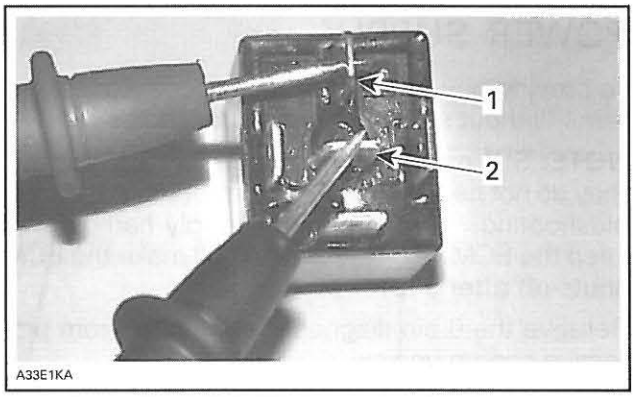
Continuity Test

Remove the relay from vehicle.

Using the multimeter FLUKE 111 (P/N 529 035 868), select the beeper position.



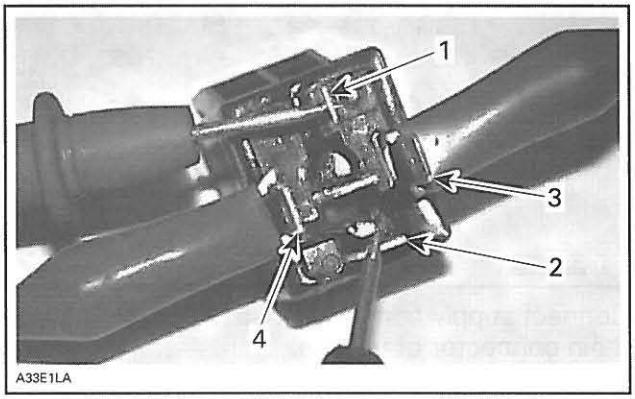
Position the RED probe on the terminal 30 and the BLACK probe on the terminal 87a.



1. Terminal 30
2. Terminal 87a

A continuous signal should be audible. If not, replace the relay.

If a signal is audible, apply 12 volts on terminals 85 and 86 then place the RED probe on terminal 30 and the BLACK on the terminal 87.



1. Terminal 30
2. Terminal 87
3. Terminal 85
4. Terminal 86

The continuous signal should be audible. If not, replace the relay.

Test with B.U.D.S.

Relay R2

Use B.U.D.S. software.

Energize **relay 2** from **Activation tab**.

Headlamp should turn on.

If the relay does not work, remove the relay to test the input side.

Connect a voltmeter as indicated in the following table.

TEST PROBE (+)	TEST PROBE (-)
RED/GRAY wire	Battery ground

Battery voltage (12 V) should be read. If so, check relay.

HEADLAMP

Bulb Replacement

If any headlamp bulb is burnt, proceed as follows.

Remove windshield.

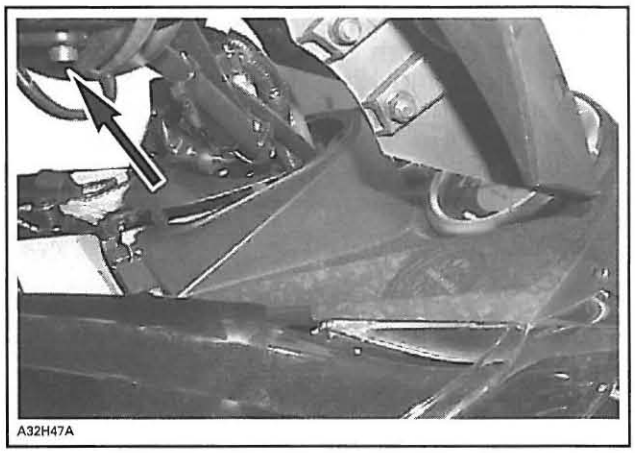
Pull out steering support cap.


A32H45A

TYPICAL

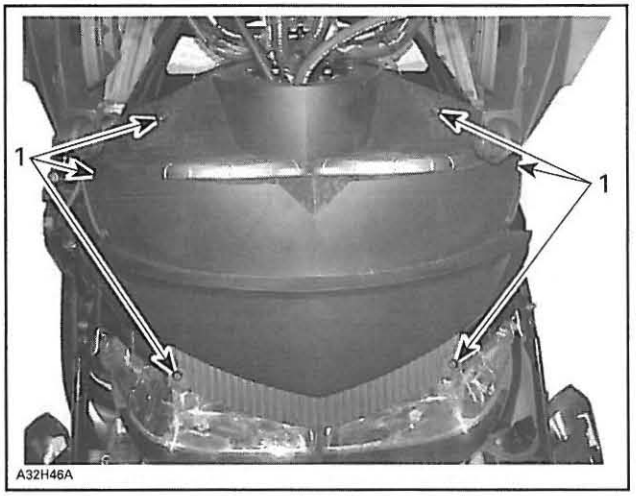
Lift hood.

Pull up front console end cap.


A32H47A

TYPICAL

Remove retaining screws and slightly lift accessories panel.



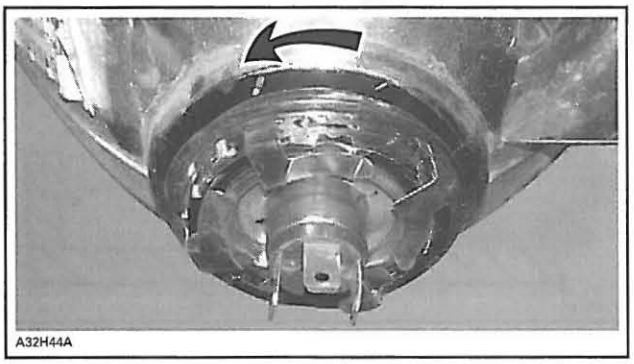
A32H46A

TYPICAL
1. Remove screws

Place the accessories panel out of way.

Unplug burnt bulb connector. Remove the rubber boot.

Turn bulb retainer ring counterclockwise to unlock. Detach the bulb and replace.


A32H44A

TYPICAL

CAUTION: Never touch glass portion of an halogen bulb with bare fingers, as it shortens its operating life. If by mistake glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb. After locking ring installation, ensure bulb is properly secured in place.

Properly reinstall removed parts.

Test

If the new bulb do not work correctly, check connectors, wiring harness or HI-LOW beam switch. Also, refer to *POWER SUPPLY* above.

Removal

Remove the accessories panel.

Disconnect headlamps.

On RH side of vehicle, remove the push nut then remove the headlamp housing.

Installation

Reverse the removal procedure.

Headlamp Beam Aiming

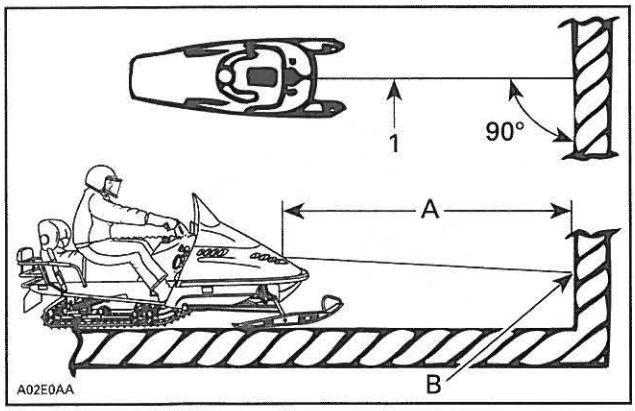
Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

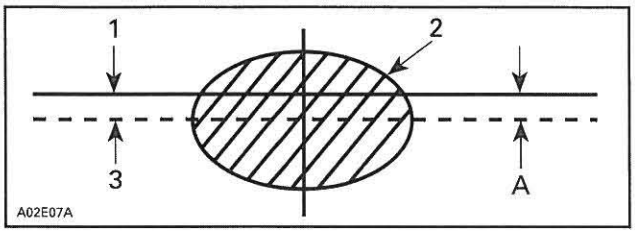
Rider or equivalent weight must be on the vehicle.

Select **high** beam.

Measure headlamp center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



TYPICAL
1. Headlamp center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



1. Headlamp horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

TAILLIGHT

Bulb Replacement

Unscrew lens screws to expose bulb.

Push the bulb in and hold while turning counterclockwise to release.

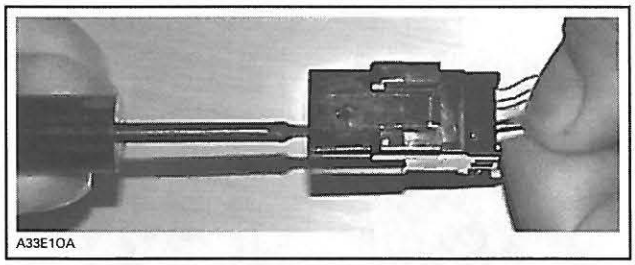
Install the new bulb by first pushing in while turning clockwise.

Removal

Remove the radiator cover by removing the retaining screws.

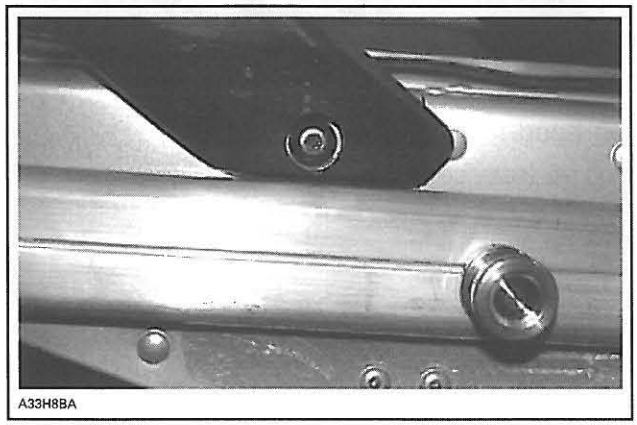
Disconnect taillight connector.

Remove the wires from connector. Open the connector on wire side then with a small tool extract the wires from the connector.



NOTE: Note the location of each wire.

Unscrew the screws retaining the rack to the side of frame.



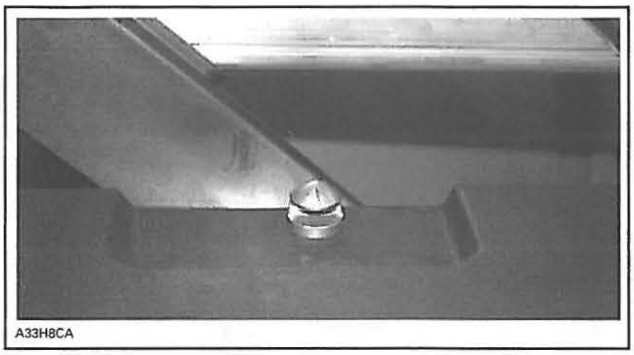
Unscrew the other screws that attach the rack near the radiator.

Unscrew taillight lens and pull the wire.

Installation

The installation is the reverse of the removal procedure.

Install the seat studs with the slot inside.



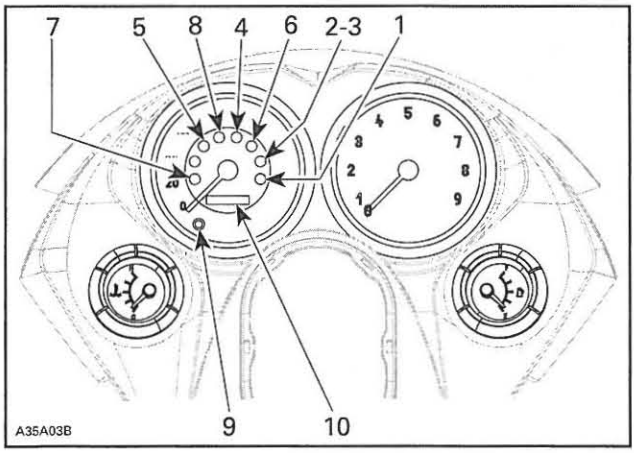
Torque the seat stud screws to 10 N•m (89 lbf•**in**).

SPEEDOMETER

All Models except Summit

These models are equipped with an electronic speedometer. It may show speed in km/h or MPH.

NOTE: At vehicle speed of 90 km/h (55 MPH) and more, the multifunction display will show speed only instead of the selected mode.

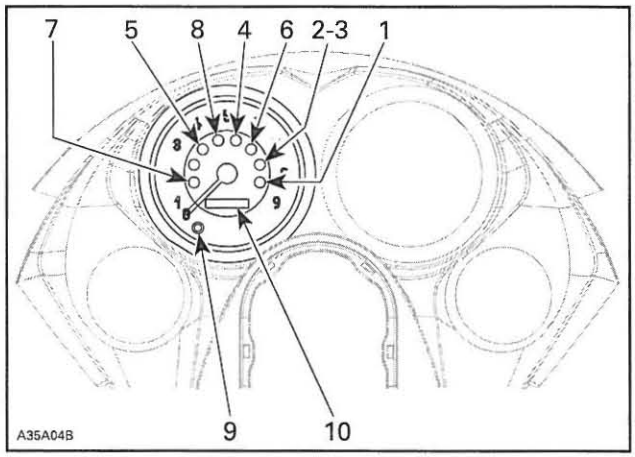


TYPICAL — MODELS WITH A SEPARATE TACHOMETER
1. *Brake/parking brake pilot lamp (red)*
2. *Reverse pilot lamp*
3. *DESS pilot lamp*
4. *High beam pilot lamp (blue)*
5. *Oil pilot lamp*
6. *Low battery voltage pilot lamp*
7. *Engine management system (EMS) pilot lamp*
8. *Engine overheat warning lamp (red)*
9. *Mode button*
10. *Multifunction display*

Summit Models

These models are equipped with a tachometer that includes a multifunction display on which speed is shown in km/h or MPH.

NOTE: As soon as the vehicle is moving, the multifunction display will show speed only instead of the selected mode.



TYPICAL — MODELS WITH A COMBINED SPEEDOMETER/ TACHOMETER
1. *Brake/parking brake pilot lamp (red)*
2. *Reverse pilot lamp*
3. *DESS pilot lamp*
4. *High beam pilot lamp (blue)*
5. *Oil pilot lamp*
6. *Low battery voltage pilot lamp*
7. *Engine management system (EMS) pilot lamp*
8. *Engine overheat warning lamp (red)*
9. *Mode button*
10. *Multifunction display*

All Models

Brake/Parking Brake Pilot Lamp (Red)

Lights when brake or parking brake is applied (with engine running).

Reverse Pilot Lamp

This pilot lamp will light up when reverse is selected.

DESS Pilot Lamp

This lamp will light up to confirm DESS status.

High Beam Pilot Lamp (Blue)

Lights when headlamp is on HIGH beam.

Oil Pilot Lamp

This pilot lamp will glow up when injection oil level is low.

Low Battery Voltage Pilot Lamp

This lamp will light up to indicate a low battery voltage condition (**on so equipped models**).

Engine Management System (EMS) Pilot Lamp

This lamp will light up to indicate a trouble.

Engine Overheat Warning Lamp (Red)

If this lamp glows, reduce snowmobile speed and run snowmobile in loose snow or stop engine immediately.

Mode Button

Depress mode button to change multifunction display. Each time engine is started, display shows odometer. From that point depressing mode button will change display for the trip meter.

Depressing mode button again will change display for the resetable hourmeter. Push mode button again to return to odometer.

Push and hold mode button for 2 seconds to reset the tripmeter or the resetable hourmeter depending on the one displayed.

Multifunction Display

Odometer

Odometer records the total distance travelled and displays it either in miles or kilometers. Refer to *CHANGE FROM ONE UNIT TO THE OTHER* for changing units.

Trip Meter

Records distance travelled since it has been reset. Distance travelled is displayed either in miles or kilometers. Refer to *CHANGE FROM ONE UNIT TO THE OTHER* for changing units.

Resetable Hourmeter

Records engine running time in hours and minutes since it has been reset.

Push and hold mode button for 2 seconds to reset the hourmeter.

Multifunction Display Code

If your speedometer shows **SCALE** in the multifunction display, it means that the display selector button is stuck in the down position or depressed when the electrical system was activated.

Change from One Unit to the Other

NOTE: Speedometer, odometer and trip meter will have their units (kilometer or miles) changed all together.

Stop engine and open LH side panel.

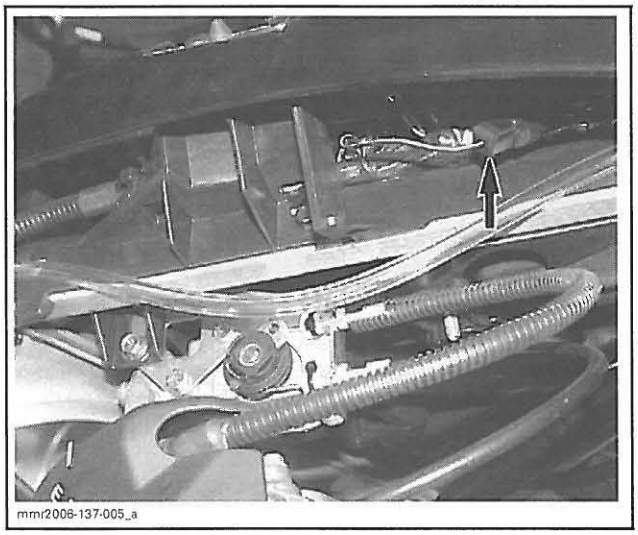
Connectors are located underneath console near steering column.

Underneath console, look for:

- 1 circuit male connector housing with BLACK/GREY wire
- 1 circuit female connector housing with BLACK/BLUE wire.

Cut locking ties. Plug connectors together to change units from miles to kilometers.

Unplug to return to miles reading. Fasten connector to harness with locking ties.



LH SIDE OF VEHICLE

Speedometer Pinout

FUNCTION	PIN
Power 12 Vdc (+)	8
Ground	11
Ground	10
Speed sensor signal	6
MPH/Km/h setting	5
Tachometer RPM signal	7
HI beam signal	15
Low injection oil level signal	14
Park light signal	16
DESS pilot lamp	9
Temperature pilot lamp	2
Engine pilot lamp (EMS)	1

Troubleshooting

SCALE Appears in Multi-Function Display

The display selector button is stuck in the down position or was depressed while the engine was started.

Stop engine and press/release button several times to unstick it.

Start engine to retry.

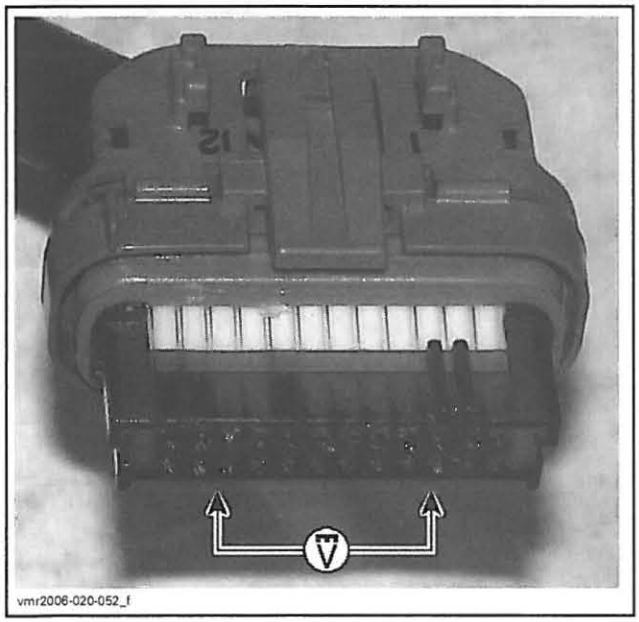
NO LIGHTS in speedometer and needle does not move

QUICK CHECK	
OBSERVATION	POSSIBLE CAUSE
Speedometer does not turn on	Wiring/connectors
	Defective speedometer

Disconnect speedometer connector.

Read voltage from vehicle harness as follows.

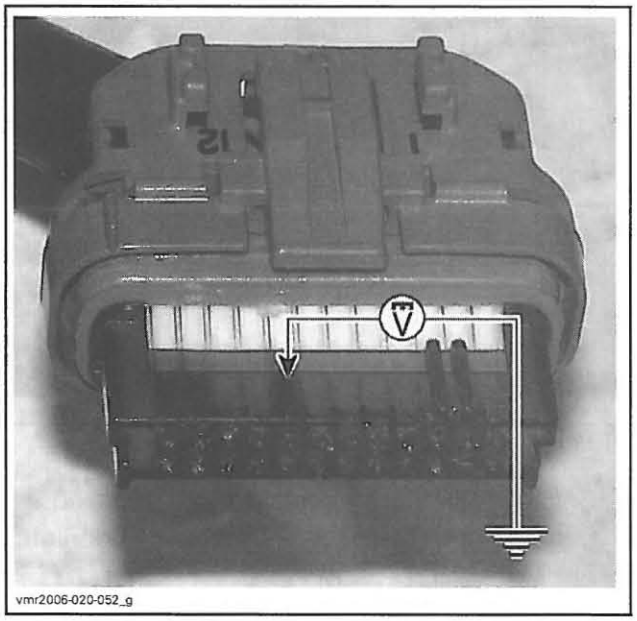
SPEEDOMETER CONNECTOR (harness side)		VOLTAGE
Pin 8	Pin 11	12 Vdc



If there is voltage, replace speedometer.

If there is no voltage, recheck voltage as follows.

SPEEDOMETER CONNECTOR (harness side)		VOLTAGE
Pin 8	Engine ground	12 Vdc



If voltage is not good, check/repair wiring/or connectors from magneto. If good, check generator coil.

If voltage is good, check ground circuit (pin 11) wiring/connectors.

LIGHTS ARE LIT in Speedometer and Needle Does Not Move

Check speed sensor. See below.

If speed sensor tests good, replace speedometer.

Reconnect connector.

Calibration of a New Speedometer

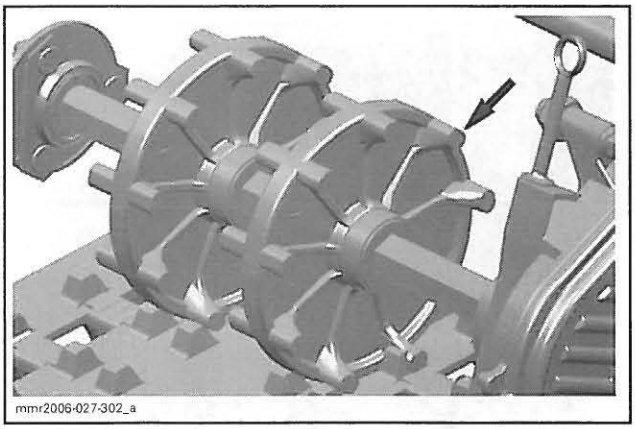
When installing a new speedometer, it is necessary to set it in accordance with the drive axle sprocket used on the vehicle.

CAUTION: If the following operation is not done right the first time, it cannot be repeated. Speedometer calibration can be set only once. Learn the procedure thoroughly before doing it.

Proceed as follows:

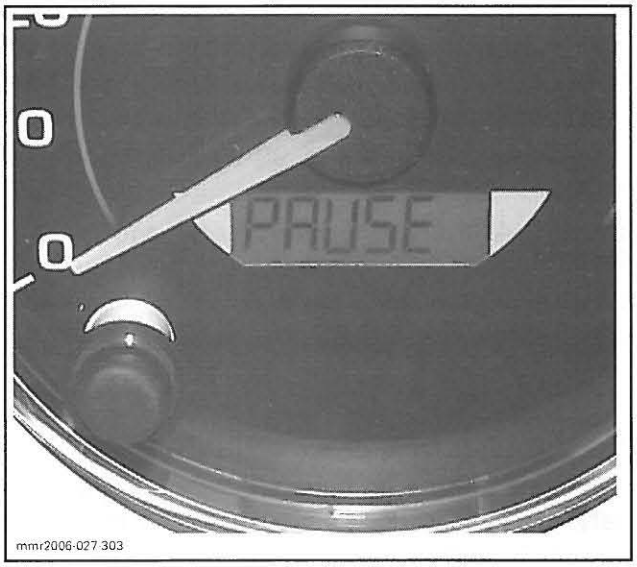
IMPORTANT: The following illustrations are examples only. Enter the exact value required for the specific model you are working on.

– First count number of teeth on sprocket and note it.


mmr2006-027-302_a

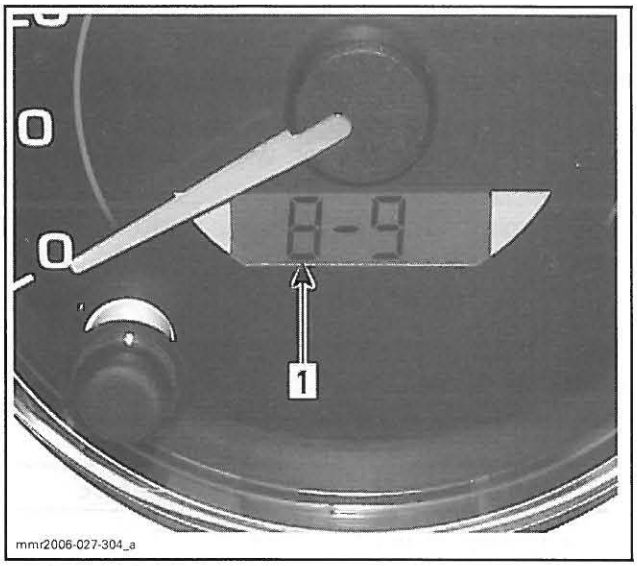
TYPICAL

– Ensure speedometer connector is installed.
– Look at speedometer ▶ Speedometer lights flash and PAUSE appears.



mmr2006-027-303

– Available values will scroll automatically ▶ 1st digit indicates the number of teeth on sprocket.



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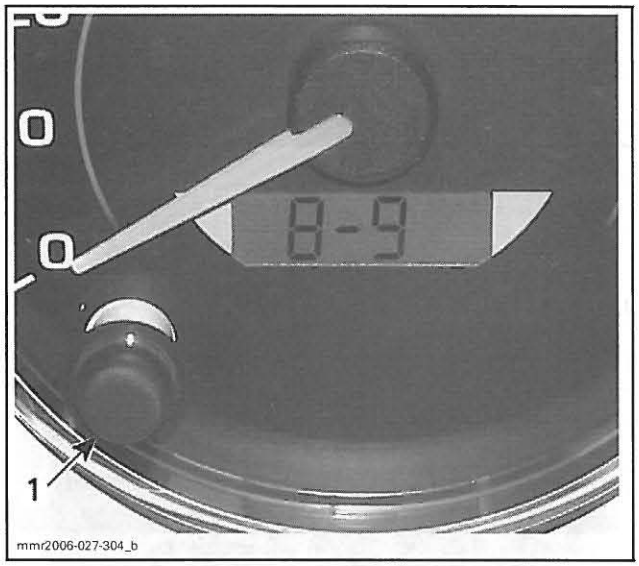
1. Number of teeth on sprocket

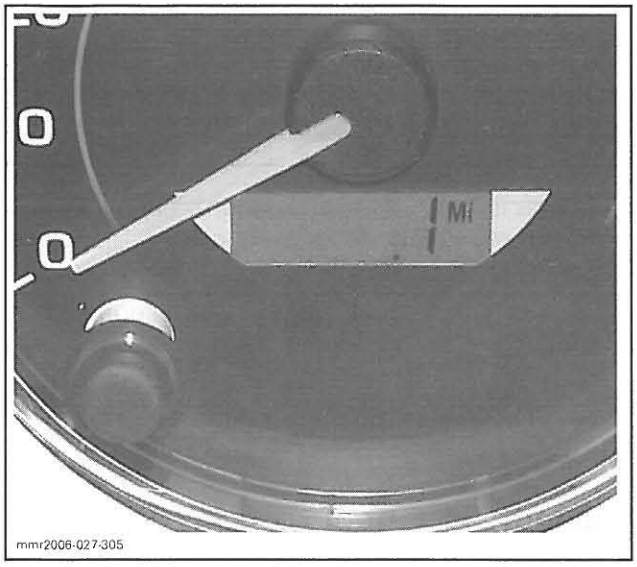
– When the proper number is displayed ▶ Press MODE button and HOLD 5 seconds to set that value.



mmr2006-027-304_b

1. HOLD 5 seconds to set

– Lights flashing will stop. ▶ Speedometer now begins to operate normally.



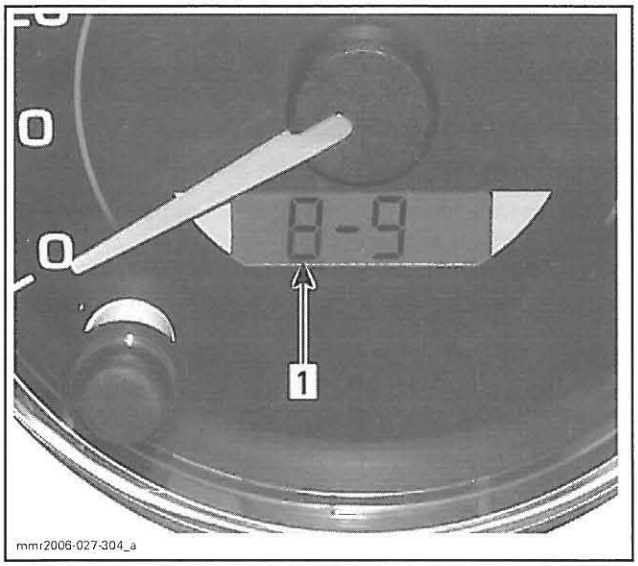
– Procedure is over.

NOTE: At some point, 0-0 will be displayed. Do not use, it is intended for manufacturer only. If inadvertently used, speedometer will exit programming mode without causing problems. Restart procedure.

Speedometer Calibration Information

To know the actual calibration of a speedometer, proceed as follows.

– Ensure speedometer connector is installed.
– Look at speedometer ▶ The calibration will be visible a brief moment.



1. Number of teeth on sprocket

NOTE: Speedometer calibration cannot be set to a different value.

Speedometer Removal

Insert a little flat screwdriver into the slot at the bottom of the speedometer. Slightly, pry the speedometer and turn it clockwise then remove it from accessories panel.

Unplug connector.

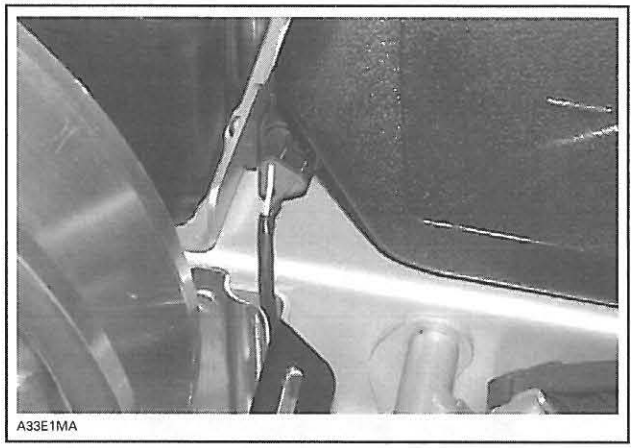
Speedometer Installation

The installation is the reverse of the removal procedure.

SPEED SENSOR

Static Test

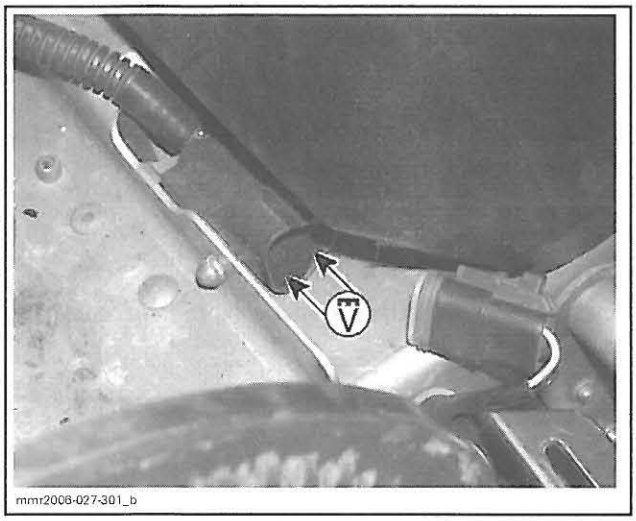
Unplug speed sensor connector.



TYPICAL

Read voltage from vehicle harness as follows.

SPEED SENSOR CONNECTOR (harness side)		VOLTAGE
RED/GREY	BLACK/BLUE	12 Vdc
GREEN/WHITE		Voltage read above ± 1 V



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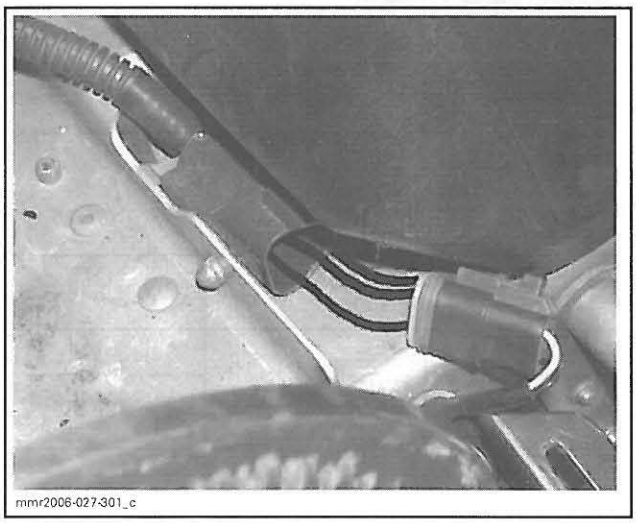
If values are within specifications, continue with *DYNAMIC TEST* below.

If values are out of specifications, check wiring/connectors going to speedometer. If good, replace speedometer.

Dynamic Test

Install 3 pins in speed sensor connector.

Install wire jumpers between pins.


mmr2006-027-301_c

Lift rear of vehicle and safely block.

⚠ WARNING

Before starting engine, ensure track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

Start engine and slightly accelerate engine so that track rotates SLOWLY. Read voltage as follows.

SPEED SENSOR CONNECTOR (harness side)		VOLTAGE
GREEN/WHITE	BLACK/BLUE	Voltage read above ± 1 V

If value is out of specification, check wiring/connectors going to speedometer. If good, change speed sensor.

If value is within specification, speed sensor is operational.

TACHOMETER

Models with a Separate Tachometer

Tachometer Pinout

FUNCTION	PIN
Power 12 Vdc (+)	9
Ground	10
RPM Signal	18, 19, 20, 21

Test

No Light But the Needle Moves

The tachometer is supplied through the main wiring harness. Check the voltage between pins 9 and 10 of tachometer.

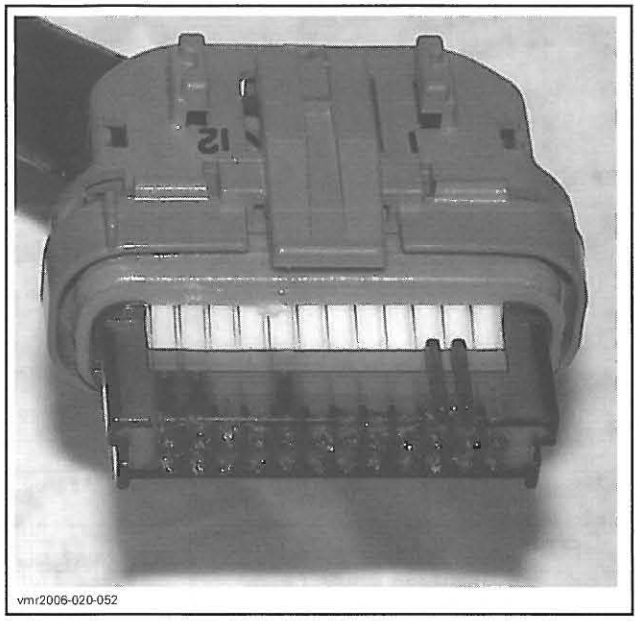
The obtained value should be 12 Vdc. Otherwise, check connections and wiring harness. Also refer to *POWER SUPPLY*.

If the voltage is good, replace the tachometer.

The Needle Does Not Move

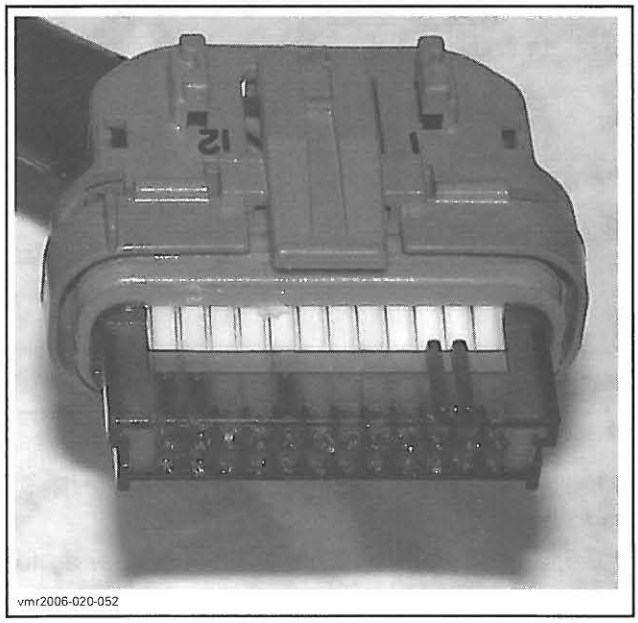
No lights in tachometer: see above

Lights in tachometer: check RPM signal on pin 18, 19, 20 and 21.


vmr2006-020-052

Crazy Needle

Check wire connections on pin 18, 19, 20 and 21.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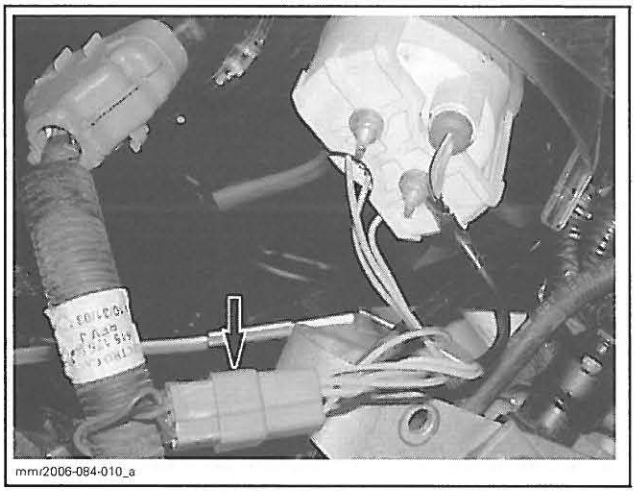
ENGINE TEMPERATURE GAUGE

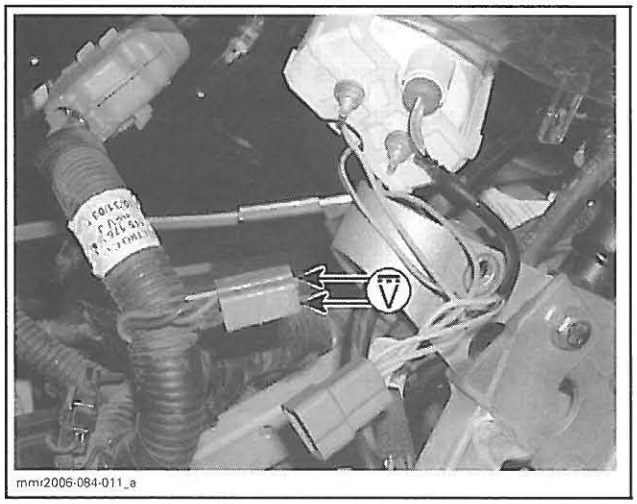
Test

Disconnect gauge connector and measure voltage as follows.


mmr2006-084-010_a

TYPICAL

TEMPERATURE GAUGE CONNECTOR (harness side)		VOLTAGE
RED/GREY	BLACK/BLUE	12 Vdc


mmr2006-084-011_a

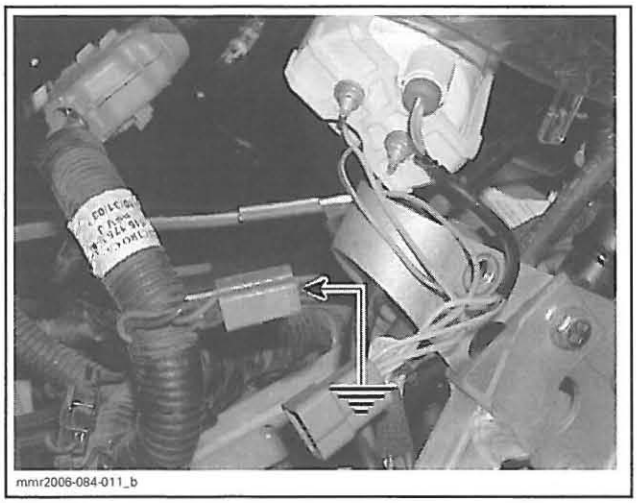
TYPICAL

If voltage is not good, check gauge supply. Refer to *POWER SUPPLY*.

If voltage is good, check temperature sensor on engine as follows.

Reconnect gauge connector.

Jump VIOLET wire on gauge to ground. Pointer should move to "H" zone.


mmr2006-084-011_b

TYPICAL

- If so, ensure wiring/connectors going to sensor are good and if correct, replace sensor.
- Otherwise, replace temperature gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector.

Remove gauge.

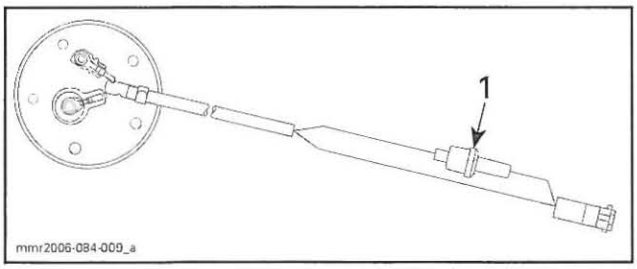
Installation

The installation is the reverse of removal procedure.

ELECTRIC FUEL GAUGE

Test

First check in-line fuse on sender.



mmr2006-084-009_a

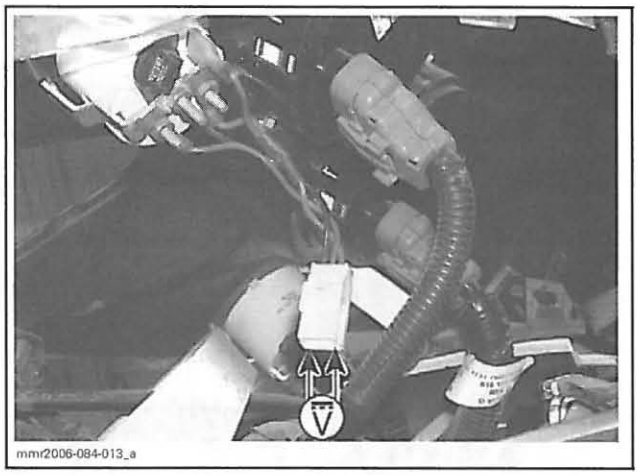
1. In-line fuse

Disconnect gauge connector and measure voltage as follows.


mmr2006-084-012_a

TYPICAL

FUEL GAUGE CONNECTOR (harness side)		VOLTAGE
RED/GREY	BLACK/BLUE	12 Vdc


mmr2006-084-013_a

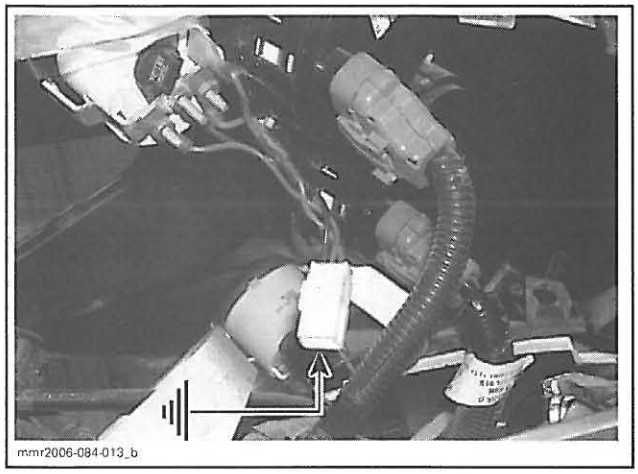
TYPICAL

If voltage is not good, check gauge supply. Refer to *POWER SUPPLY*.

If voltage is good, check fuel level sender as follows.

Reconnect gauge connector.

Jump BLUE wire on gauge to ground. Pointer should increase to "F" zone.



TYPICAL

- If so, ensure wiring/connectors are good and if correct, replace fuel level sender.
- Otherwise, replace fuel gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector and remove gauge.

Installation

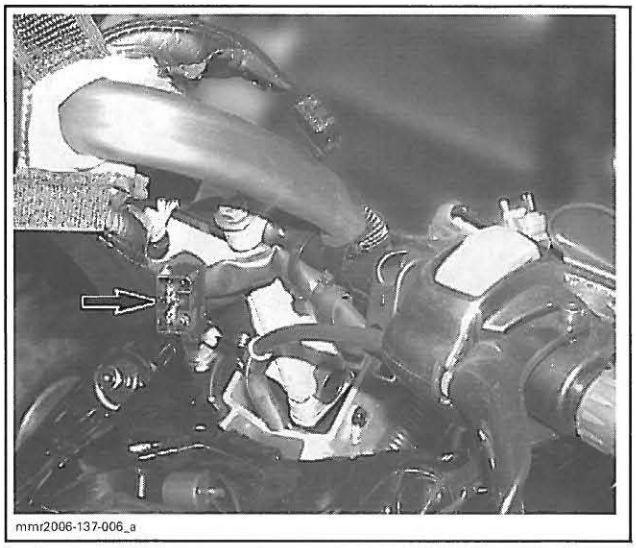
The installation is the reverse of the removal procedure.

HEATING ELEMENTS

NOTE: All measurements must be performed at 21°C (70°F).

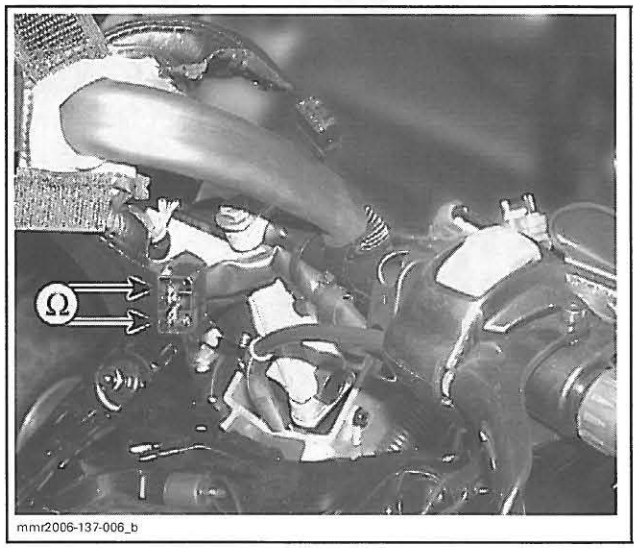
Throttle Lever

Unplug connector under steering cover.



Check heating element as follows.

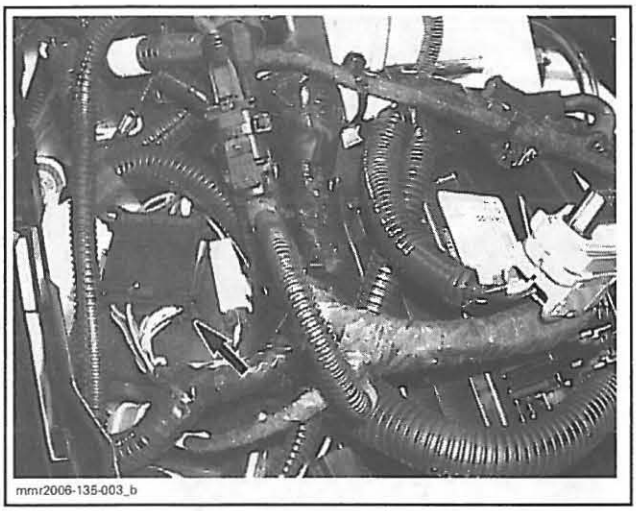
INTENSITY	ELEMENT TERMINAL		RESISTANCE @ 20°C (68°F)
LOW	BROWN/YELLOW	YELLOW	18.5 Ω
HIGH	BROWN		4.2 Ω



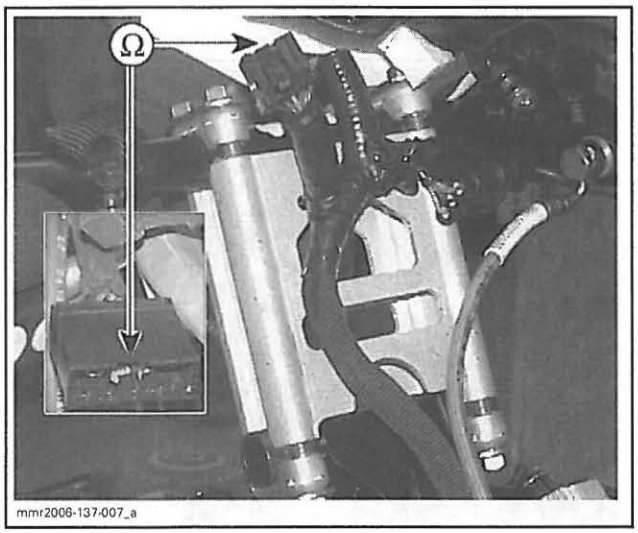
If readings are out of specifications, check/repair wiring and if good, replace throttle lever.

If readings are within specifications, check switch continuity as follows.

Disconnect steering connector.


mmr2006-135-003_b

SWITCH POSITION	LARGE CONNECTOR	SMALL CONNECTOR	RESISTANCE @ 20°C (68°F)
LOW	RED/YELLOW	BROWN/YELLOW	0.5 Ω max.
HIGH		BROWN	



mmr2006-137-007_a

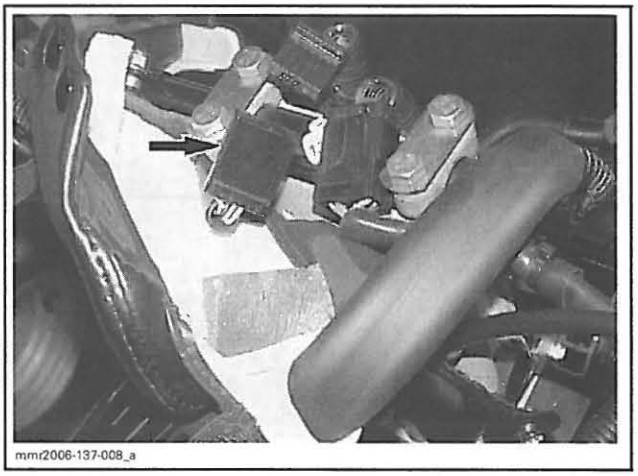
If switch is out of specifications, replace switch.

If switch test good, refer to *POWER SUPPLY.*

Reconnect connectors.

Handlebar Grip

Unplug connector under steering cover.

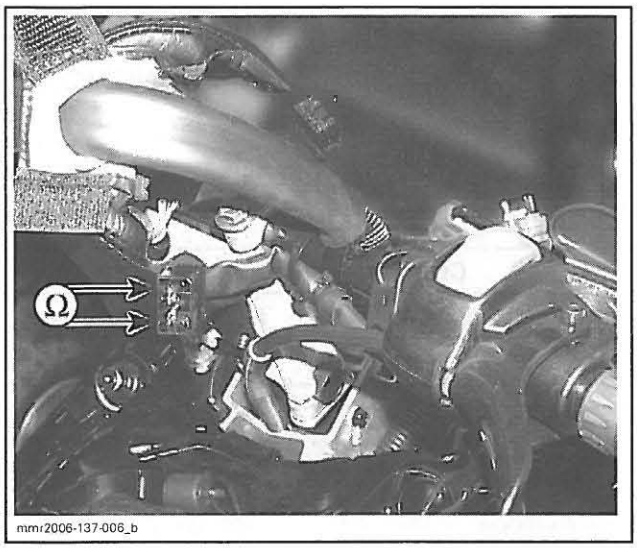

mmr2006-137-008_a

Check heating element on either side as follows.

INTENSITY	WIRE OF ELEMENT CONNECTOR		RESISTANCE @ 20°C (68°F)
LOW	ORANGE/VIOLET	BLACK	15.2 Ω
HIGH	ORANGE	BLACK	7.6 Ω

mmr2006-137-008_b

TYPICAL — LH SIDE GRIP

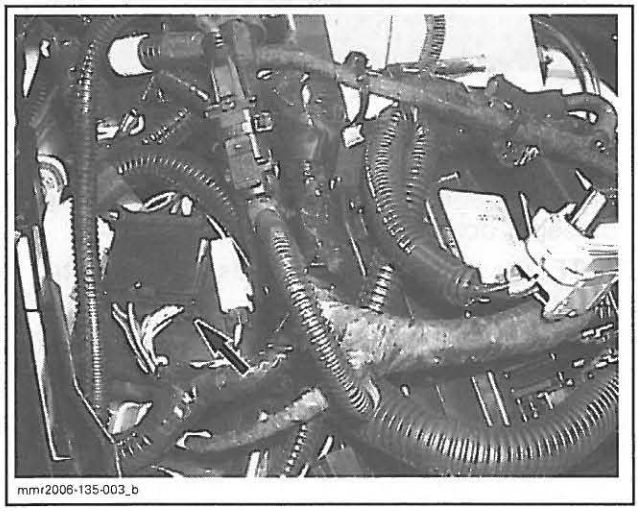


TYPICAL — RH SIDE GRIP

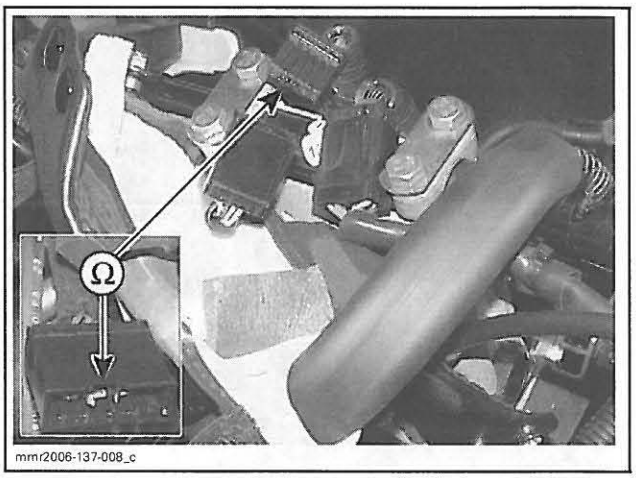
If readings are out of specifications, check/repair wiring going to heating grip and if good, replace handlebar grip.

If readings are within specifications, check switch continuity as follows.

Disconnect steering connector.



SWITCH POSITION	WIRE IN LARGE CONNECTOR	PIN IN SMALL CONNECTOR	RESISTANCE @ 20°C (68°F)
LOW	RED/YELLOW	ORANGE/VIOLET	0.5 Ω max.
HIGH		ORANGE	



If switch is out of specifications, check wiring/ connectors going to switch. If they are good, replace switch.

If switch test good, refer to *POWER SUPPLY* in this section.

Reconnect connectors.

12-VOLT POWER OUTLET

Removal

Remove the console.

Remove connectors from the power outlet housing.

Unscrew the large nut then remove the 12-volt power outlet.

Test

Remove power outlet.

Unplug the power outlet connectors.

Measure the voltage as follows.

WIRES		VOLTAGE
RED/YELLOW	BLACK	12 - 14.5 Vdc

- No voltage:
  - Check accessories fuse (20 A) and relay 1 (if applicable), connectors and wiring harness.
- Voltage is good:
  - After checking the accessories, change the power outlet.

Installation

The installation is the reverse of the removal procedure.

BEEPER (reverse alarm)

Removal

The beeper is located behind RH side of headlamp.

Open the front hood, remove the windshield then remove screws retaining the accessories panel.

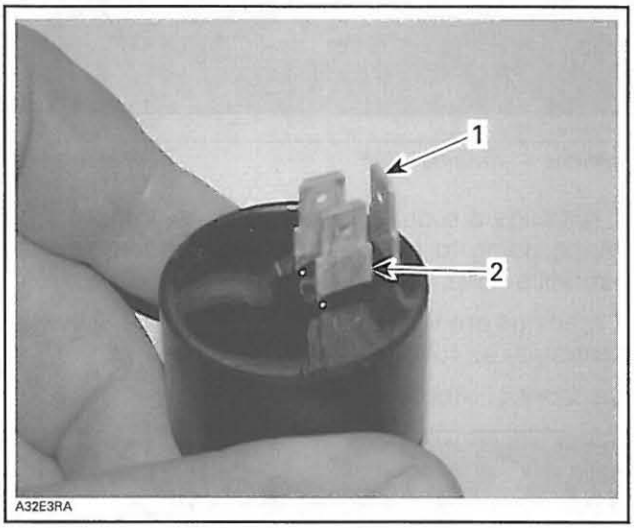
Unplug connector from beeper.

Unscrew retaining ring then remove beeper.

Test

NOTE: Before testing the beeper, make sure the connectors are installed on proper beeper tabs.

CONNECTOR LOCATION	
POSITIVE TAB (+)	NEGATIVE TAB (-)
RED/GREY	BEIGE/BLACK



1. Positive tab
2. Negative tab

Using jumper wires, connect battery positive post to beeper positive tab.

NOTE: On manual start models, use an external 12 V battery.

Connect battery negative post to beeper negative tab.

CAUTION: To avoid beeper damage, ensure that polarity is respected.

A sound should be heard. If not, replace the beeper with a new one.

If the beeper is good, check connectors, fuse, relay 1 (if applicable) and wiring harness.

Installation

To install beeper, reverse the removal procedure. Properly position connectors.

VISOR OUTLET

Removal

Remove the console.

Unplug the visor connector.

Unscrew visor outlet.

Test

First, try another accessory, if it does not work, check visor outlet.

Unplug the visor connector.

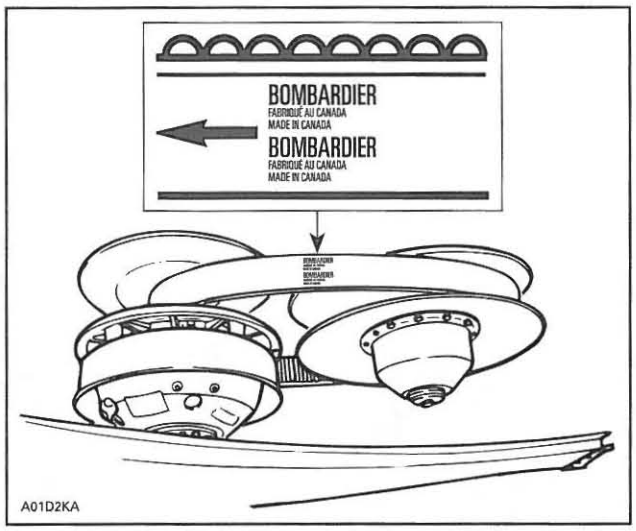
Check voltage as follows

WIRES		VOLTAGE
RED/YELLOW	BLACK	12 - 14.5 Vac

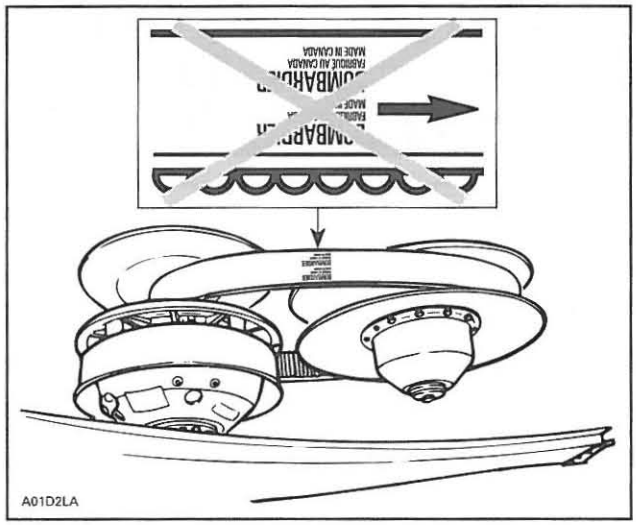
- No voltage:
  - Check fuse and relay 1 (if applicable), connectors and wiring harness.
- Voltage is good:
  - Replace power outlet.

Installation

The installation is the reverse of the removal procedure.



CORRECT



INCORRECT

DRIVE BELT ADJUSTMENT

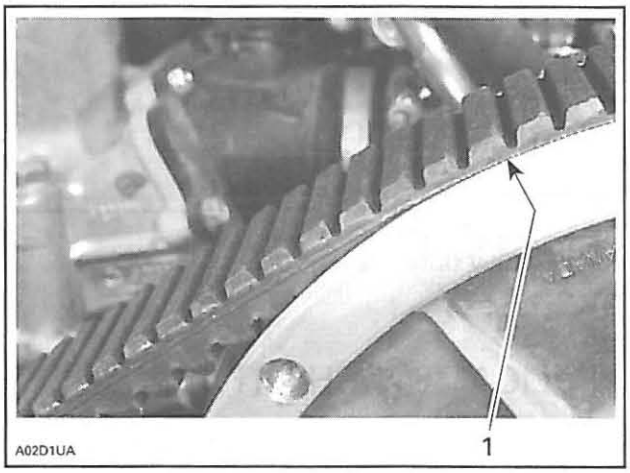
To adjust drive belt correctly, do the following:

1. Make sure proper drive belt is installed and check if it's condition is appropriate (no wear spots, no damages, etc.).
2. Adjust pulley alignment (refer to *PULLEY ALIGNMENT*).
3. Adjust drive belt height (see procedure below).
4. Check drive belt deflection (see procedure below).

NOTE: This measure is done as a reference only.

Drive Belt Height

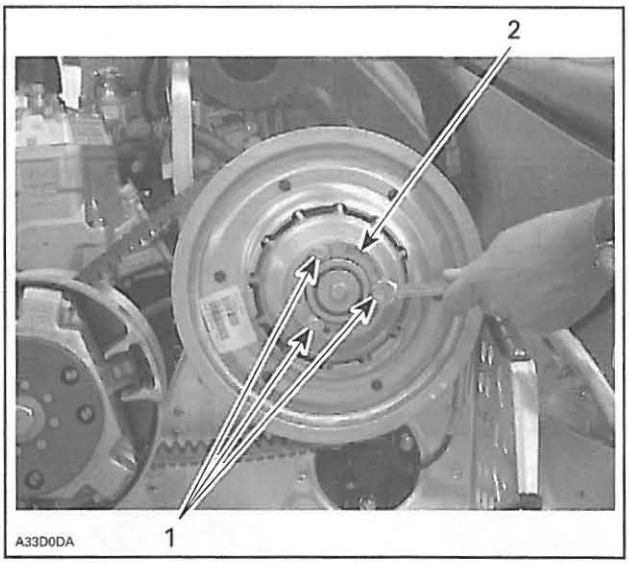
To obtain maximum vehicle performance, the drive belt cord should be flush with driven pulley edge. Adjust as required



TYPICAL
1. Flush

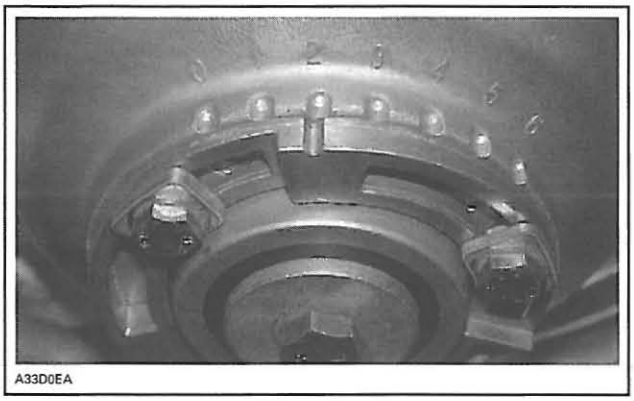
Loosen screws and turn adjustment ring as follows:

- To lower belt in driven pulley: turn adjustment ring counterclockwise and tighten the screws.
- To raise belt in driven pulley: turn adjustment ring clockwise and tighten the screws.



TYPICAL
1. Screws
2. Adjustment ring

Turn the adjustment ring up one notch, tighten the screws, then rotate driven pulley to allow drive belt to settle in pulley. Check height, if required the adjustment ring can be turned up to 1/4 or 1/2 the notch. Check height, repeat as required.



DRIVEN PULLEY NOTCHES

NOTE: Notches are there on the driven pulley for reference purpose only and the desired adjustment can be attained at any point.

Drive Belt Deflection (reference only)

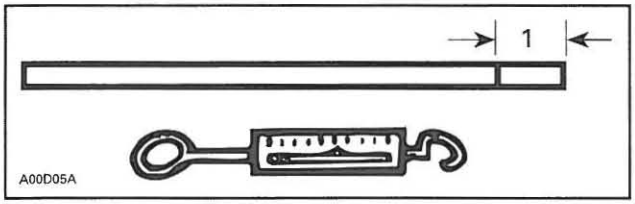
To obtain maximum vehicle performance, the belt tension must be adjusted according to specifications shown in the accompanying chart.

MODEL	DEFLECTION † mm (in)	FORCE kg (lb)
All models	32 ± 5 (1.260 ± .197)	11.3 (25)

† FOR REFERENCE ONLY

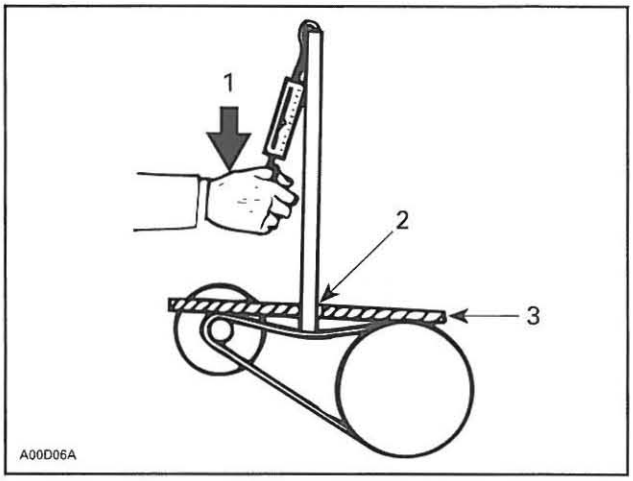
Wooden Stick and Spring Scale Method

Position a reference ruler on drive belt.



1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.

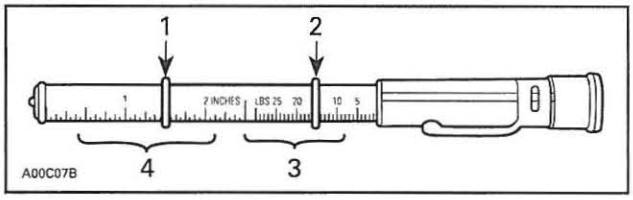


1. Force
2. Read deflection here
3. Reference ruler

Belt Tension Tester Method

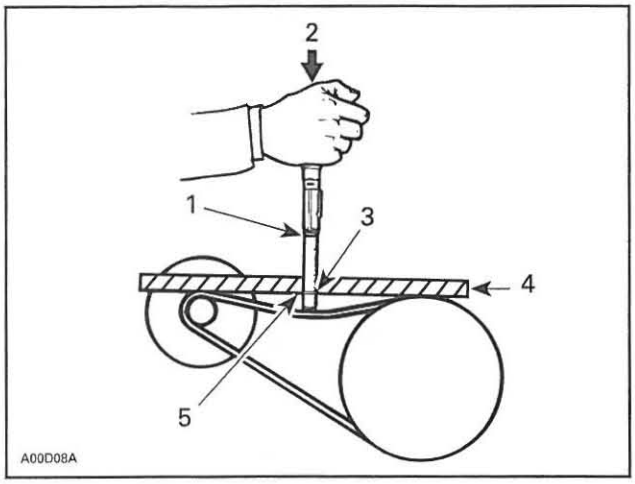
Position a reference ruler on drive belt.

Use the belt tension tester (P/N 414 348 200) as explained below.



1. Lower O-ring
2. Upper O-ring
3. Force (read down)
4. Deflection (read up)

1. Slide lower O-ring of deflection scale to specified measure.
2. Slide upper O-ring to 0 (zero) on the force scale.
3. Apply pressure until lower O-ring is flush with edge of ruler and read force on the upper scale at top edge of O-ring.



1. Upper O-ring — force
2. Force
3. Lower O-ring — deflection
4. Reference ruler
5. Deflection

If the deflection is out of specifications, refer to *PULLEY ALIGNMENT* and check the W and Z measurements.

- If measurements W and Z are within specifications:
  - To compensate a minor inappropriate deflection, a little adjustment can be obtained by placing the belt drive cord slightly above or slightly below the driven sheaves edges. Recheck deflection and replace belt if necessary.
- If measurements W and/or Z are out of specifications, check engine mounting bolts, chaincase or frame alignment.

DRIVE PULLEY

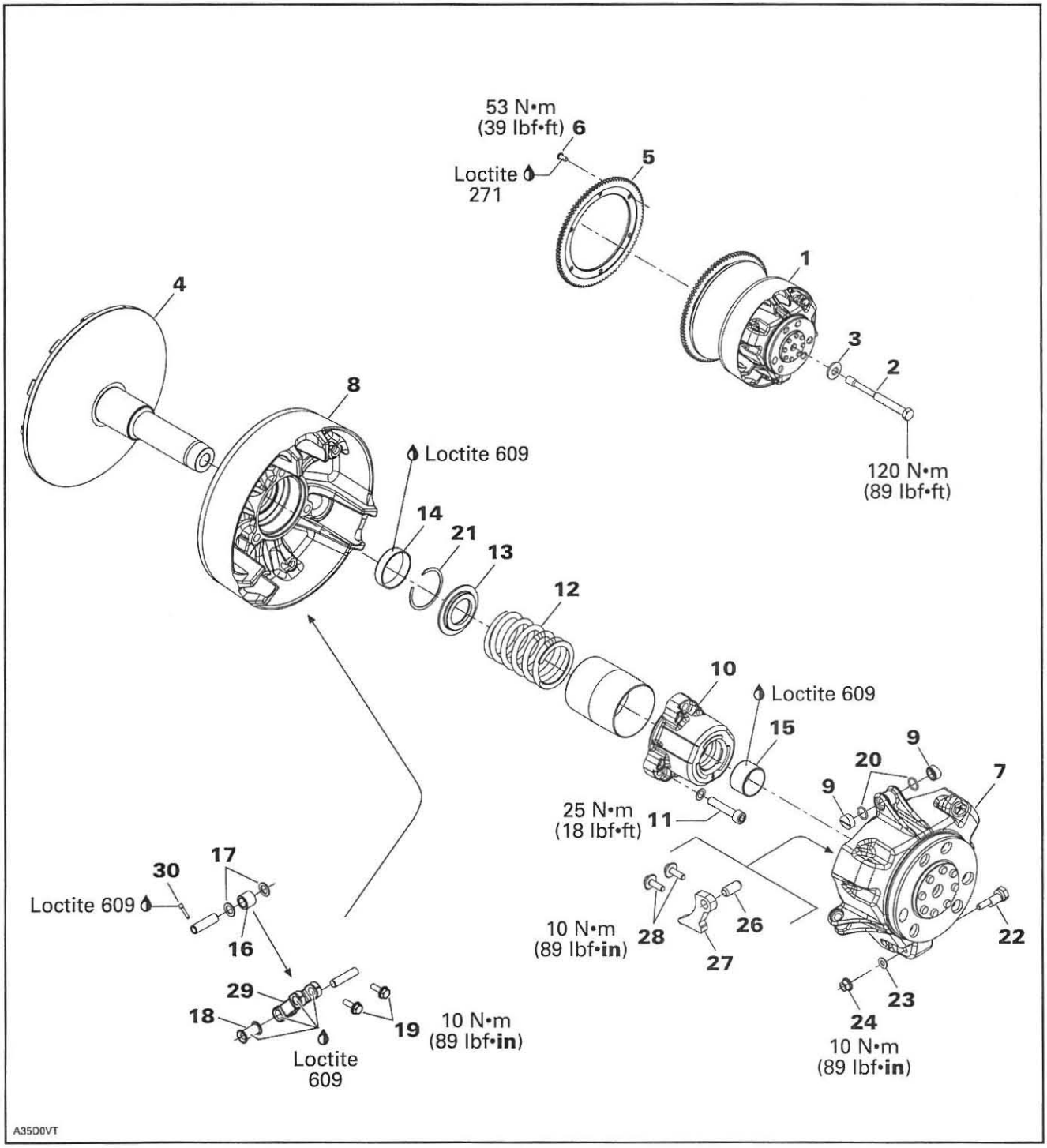
SERVICE TOOLS

Description	Part Number	Page
bushing remover/installer	529 031 200	230
drive pulley holder	529 035 674	227, 234
drive pulley puller	529 022 400	227
slider shoe fork	529 005 500	228, 233
sliding sheave bushing remover/ installer	529 035 931	230
sliding sheave bushing remover/installer	529 035 931	230
spring compressor	529 036 012	228, 230, 232

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	231
Loctite 609	413 703 100	230–232
pulley flange cleaner	413 711 809	229–230

TRA V


53 N•m
(39 lbf•ft) 6
Loctite 271
5
1
4
3
2
8
Loctite 609
120 N•m
(89 lbf•ft)
14
21
13
12
10
Loctite 609
15
9
20
9
7
25 N•m
(18 lbf•ft) 11
30
17
Loctite 609
16
10 N•m
(89 lbf•in)
28
26
27
22
29
18
19
10 N•m
(89 lbf•in)
Loctite
609
23
24
10 N•m
(89 lbf•in)
A35D0VT

GENERAL

TRA drive pulley stands for Total Range Adjustable drive pulley.

NOTE: This is a lubrication free drive pulley. Always refer to appropriate parts catalog for replacement parts. Most parts of TRA V are not interchangeable with other TRA models.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation. The use of impact wrench could damage the drive pulley and modify the calibration.

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A service bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

Ring Gear

Each time the drive pulley is removed from the engine, check the tightening of ring gear screws. Torque them if necessary.

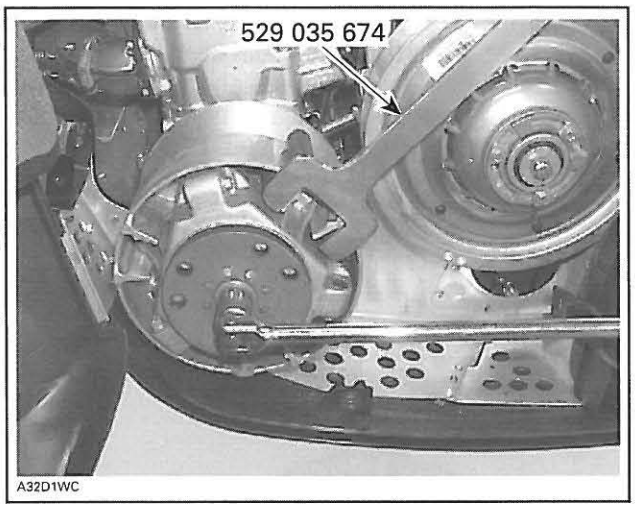
CAUTION: All 995 engines are equipped with a ring gear, even though the vehicle does not have an electric starter. The ring gear is used as a damper. Do not remove it.

PROCEDURES

REMOVAL

Remove drive belt.

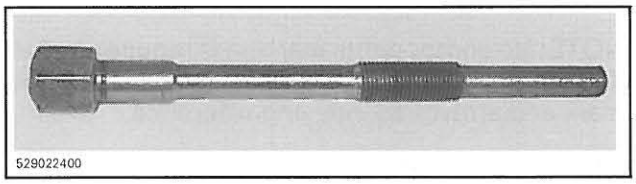
Secure drive pulley **no. 1** with the drive pulley holder (P/N 529 035 674). Install it over a sliding sheave tower.



TYPICAL — INSERT THE TOOL IN SLIDING FLANGE CAVITIES

Remove the drive pulley bolt **no. 2** and its conical spring washer **no. 3**.

To remove drive pulley **no. 1** and/or fixed sheave **no. 4** from engine, use the drive pulley puller (P/N 529 022 400).



Retain drive pulley with the drive pulley holder (P/N 529 035 674), and install the puller in pulley shaft then tighten.

CAUTION: These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.

DISASSEMBLY

Ring Gear

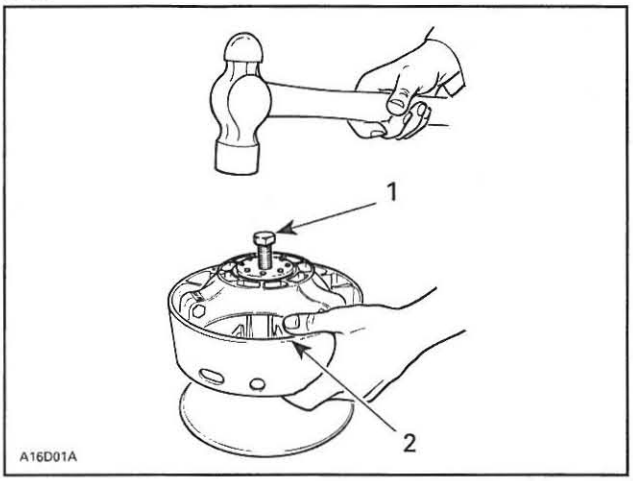
To remove the ring gear **no. 5**, use a heat gun to break the threadlocker on ring gear screws **no. 6** before disassembly.

CAUTION: If a tool other than a heat gun is used, do not exceed 150°C (300°F).

Fixed Sheave

CAUTION: NEVER tap on governor cup no. 7.

To separate fixed sheave **no. 4** from sliding sheave **no. 8**, heat the stop plate with a heat gun then screw puller into fixed sheave shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding sheave while knocking on puller head to disengage fixed sheave.



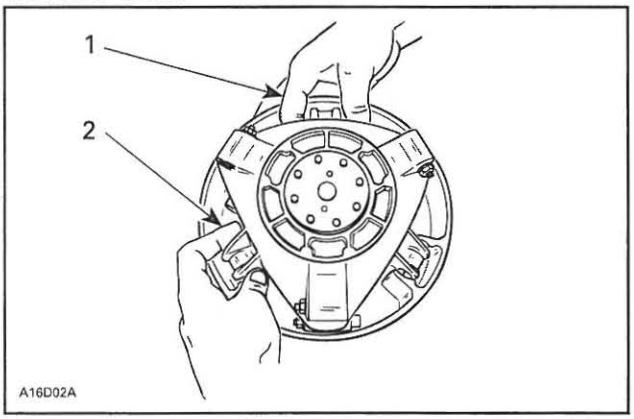
TYPICAL
1. Puller
2. Holding sliding sheave

NOTE: No components marking is required before disassembling this drive pulley since it has factory mark and arrows as indexing reference.

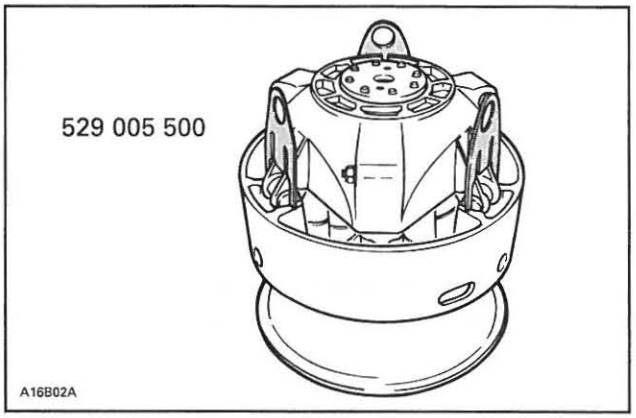
Slider Shoe and Governor Cup

Carefully lift governor cup **no. 7** until slider shoes **no. 9** come at their highest position into guides.

Hold a slider shoe set then carefully lift its housing and install a slider shoe fork (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.



TYPICAL
1. Hold slider shoes
2. Lift one housing at a time



TYPICAL

When all slider shoes are hold with the forks, remove the governor cup.

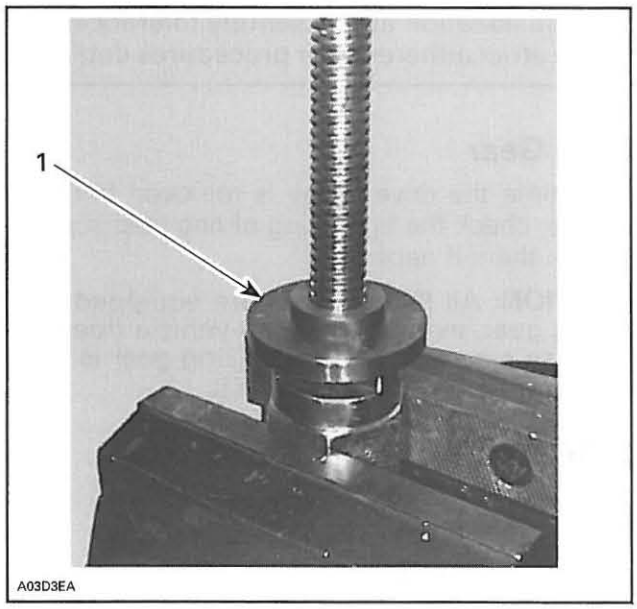
Spring Cover

To remove the spring cover **no. 10**, always use the spring compressor (P/N 529 036 012). The spring cover is pushed by clutch spring pressure.

⚠ WARNING

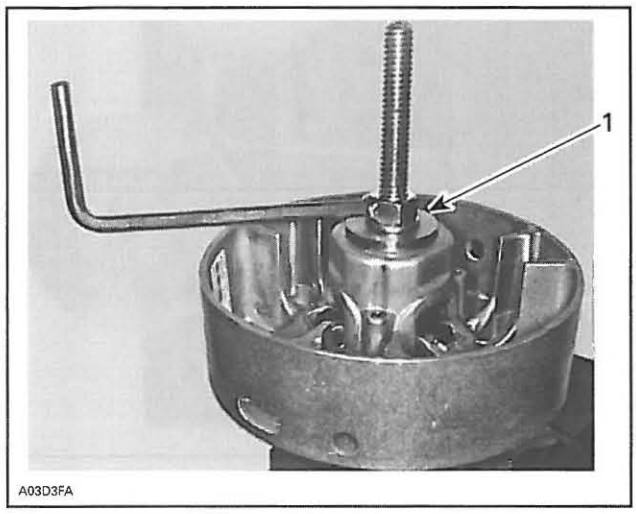
Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

Install support guide of spring compressor in vice.



1. Support guide

Install sliding sheave **no. 8** then a second support guide. These support guides will prevent bushing damages.



TYPICAL
1. Support guide

Remove 3 Allen screws **no. 11** retaining spring cover then unscrew compressor.

Remove spring cover, spring **no. 12** and spring seat **no. 13**.

CLEANING

Fixed and Sliding Sheaves

Parts must be at room temperature before cleaning.

Clean pulley sheaves and shaft with fine steel wool and dry cloth.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed sheave of the drive pulley, crankshaft threads and retaining screw threads.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: Do not use any other type of abrasive.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

Bushings

Clean sliding sheave bushing **no. 14** and spring cover bushing **no. 15** only with a petrol-based cleaner.

CAUTION: Do not use acetone to clean bushing.

INSPECTION

Drive pulley should be inspected annually.

Ring Gear

Check torque of ring gear screws. If a screw turns, verify screw surface and ring gear surface. If surface is worn, replace ring gear and screws. If screw is only loose, refer to *ASSEMBLY* for procedure and torque.

Thrust Washer and Roller

Check rollers **no. 16** for roundness of external diameter. Check thrust washers **no. 17** for thickness wear. Replace as required.

CAUTION: Ensure rollers are in good condition. Replace as required.

Lever Bolt and Flanged Bushing

Check the flanged bushing **no. 18** for wear. Replace if necessary.

Check lever bolts **no. 19** for wear, replace as required.

O-ring and Slider Shoe

Check if O-rings **no. 20** are cracked, cut or crushed. Replace as required.

Check slider shoes **no. 9** for wear. Replace if groove is not apparent on top.

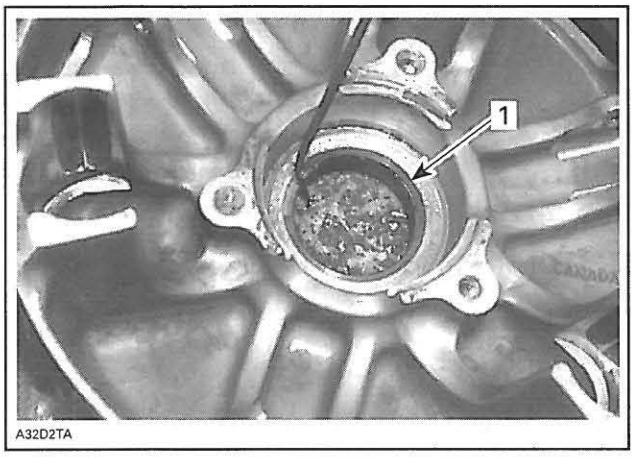
Sliding Sheave and Spring Cover Bushings

Visually inspect coating of bushings **no. 14** and **no. 15**. Replace if worn.

Sliding Sheave Bushing Replacement

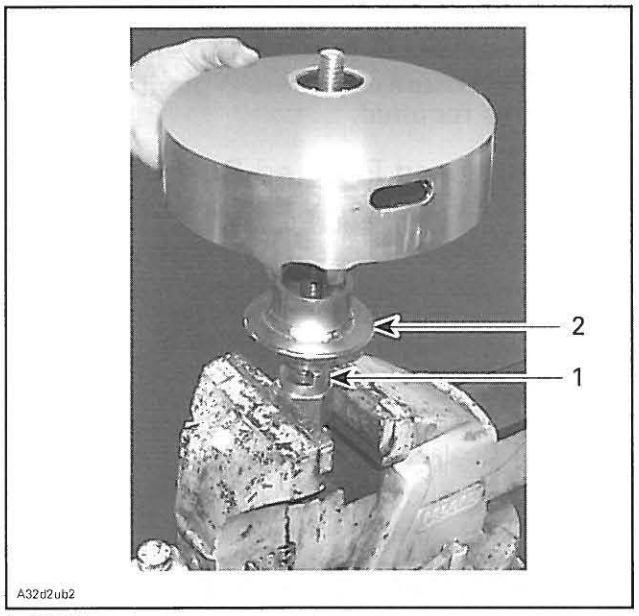
NOTE: In case of worn out bushing, it is advisable to replace whole sliding sheave assembly as replacing just the bushing may reduce the drive pulley performance.

Remove circlip **no. 21** from the sliding sheave.



TYPICAL
1. Circlip

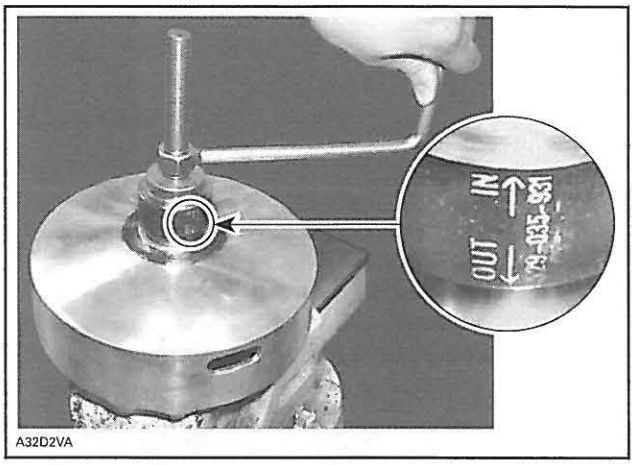
Secure the spring compressor (P/N 529 036 012) in a vice. Mount the bushing remover/installer (P/N 529 031 200) and the sliding sheave assembly on it.



TYPICAL
1. Spring compressor
2. Bushing remover/installer

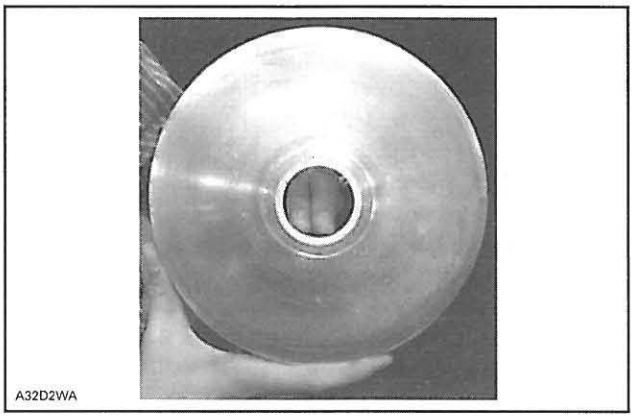
Use the sliding sheave bushing remover/installer (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the tool as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.



TYPICAL

Use a soft sand paper to clean sliding sheave bushing mounting surface.

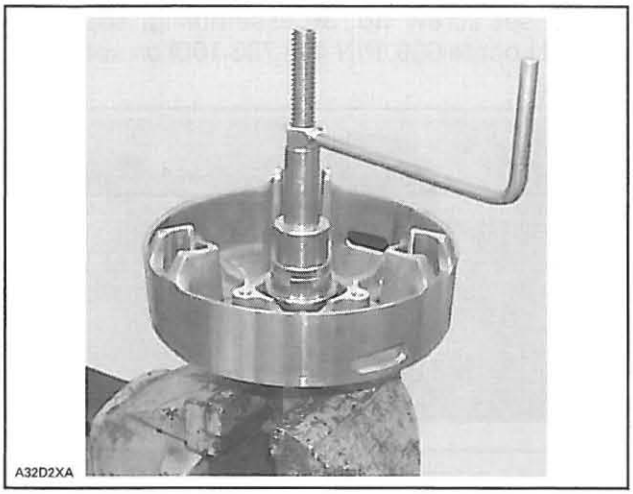


Clean sliding sheave bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

To install a new bushing, secure the spring compressor (P/N 529 036 012) in a vice and mount the sliding sheave.

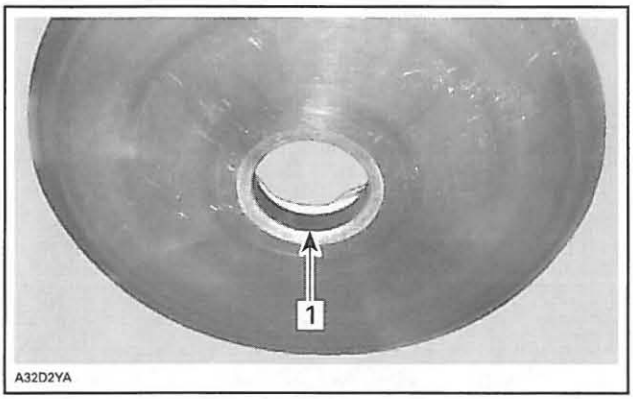
Apply Loctite 609 (P/N 413 703 100) on the outside of bushing face then insert the bushing from inner side of sliding sheave.

Mount the sliding sheave bushing remover/installer (P/N 529 035 931) with side marked "IN" to press in a new bushing.



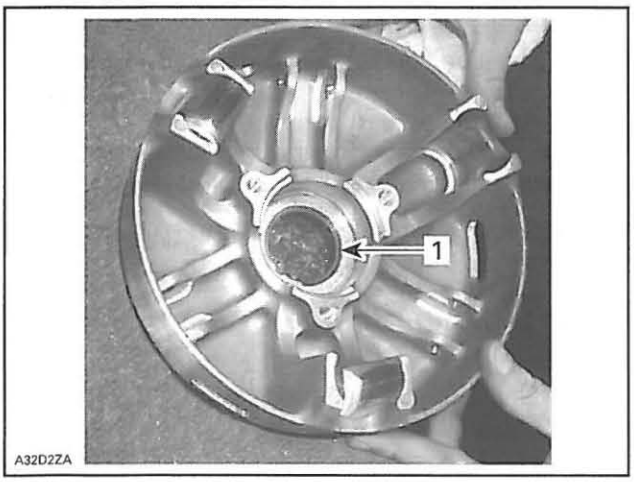
TYPICAL

NOTE: Make sure that the bushing is well seated on the sliding sheave.



1. Bushing

Install the circlip.



TYPICAL
1. Circlip

Spring Cover Bushing Replacement

Under normal use there is no need to replace this bushing **no. 15**.

In case of replacement, it's recommended to replace spring cover assembly.

ASSEMBLY

NOTE: This drive pulley is lubrication free. Do not lubricate any component.

Ring Gear

Clean ring gear **no. 5** and the inner threads of fixed sheave **no. 4**.

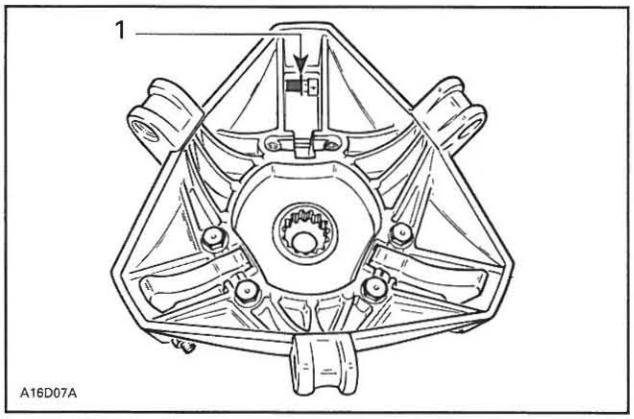
Apply few drop of Loctite 271 (red) (P/N 293 800 005) along the ring gear screw threads and at the bottom of the fixed sheave holes.

Torque ring gear screws to 53 N•m (39 lbf•ft).

CAUTION: Do not use other screws than recommended ones in the parts catalog. Never use bolts coming from another type of pulley.

Calibration Screw, Washer and Locking Nut

When installing calibration screw **no. 22**, make sure to install washer **no. 23** as shown.



TYPICAL
1. Washer

Refer to *ADJUSTMENT*, further in this section, to install the calibration screws in original setting.

Torque locking nut **no. 24** to 10 N•m (89 lbf•**in**).

Pin

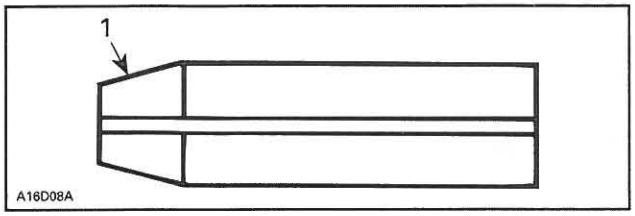
Always use the same type of pin **no. 25** as originally installed when servicing. Different types have different weights for calibration purpose. Refer to *TECHNICAL SPECIFICATIONS*.

Use a heat gun for pin removal.

Apply Loctite 609 (P/N 413 703 100) between pin and lever when assembling.

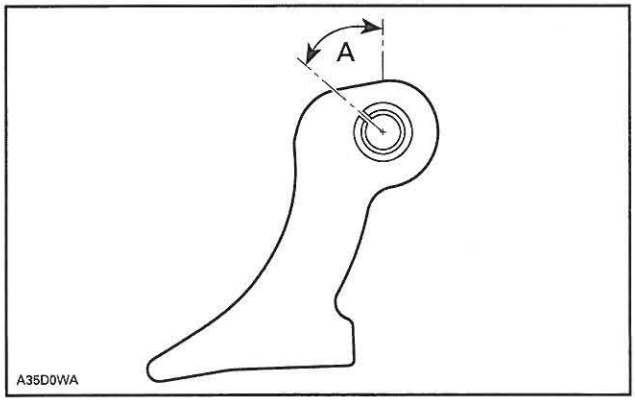
Dowel Tube and Ramp

Insert dowel tube **no. 26** from chamfered side. Make sure ramp **no. 27** is centered on dowel tube.

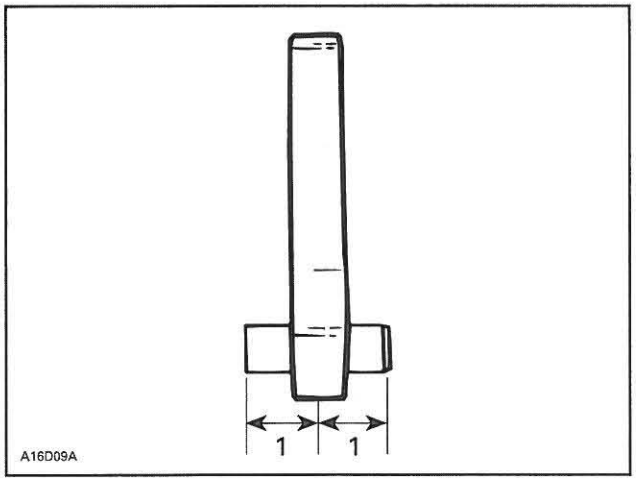


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA V	45 ± 3°



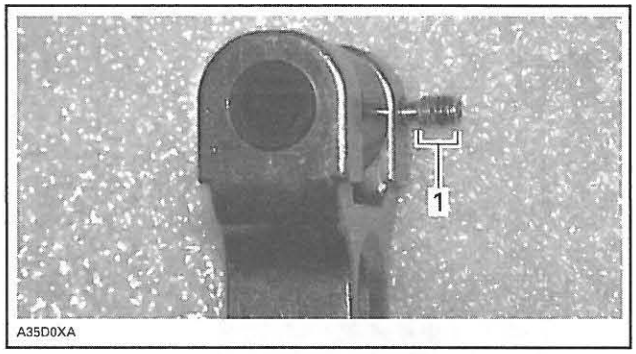
1. Equal distance

Torque screws **no. 28** to 10 N•m (89 lbf•**in**).

Lever, Roller and Set Screw

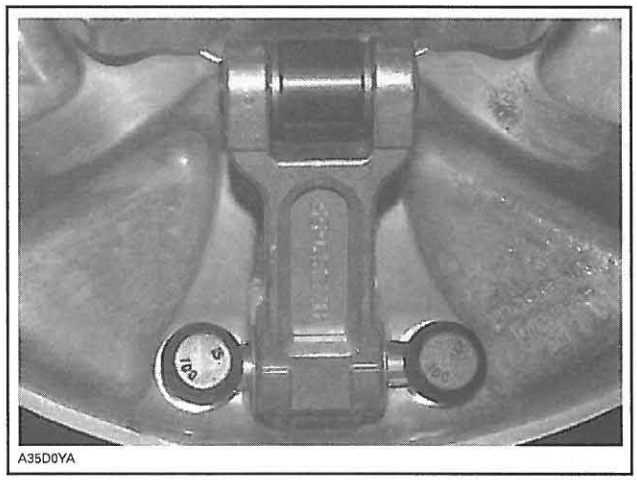
CAUTION: Although rollers of TRA V drive pulley can be replaced by other rollers from other TRA drive pulleys, such modifications should not be performed. The time life of the parts can be greatly affected. Use only recommended rollers specific for the TRA V drive pulley.

During set screw **no. 30** assembling, apply one drop of Loctite 609 (P/N 413 703 100) on set screw threads.



1. Set screw threads

While installing levers **no. 29** make sure that the BRP part number is visible.



⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley misbalancing will occur because of levers difference.

Torque lever bolts **no. 19** as per the exploded view.

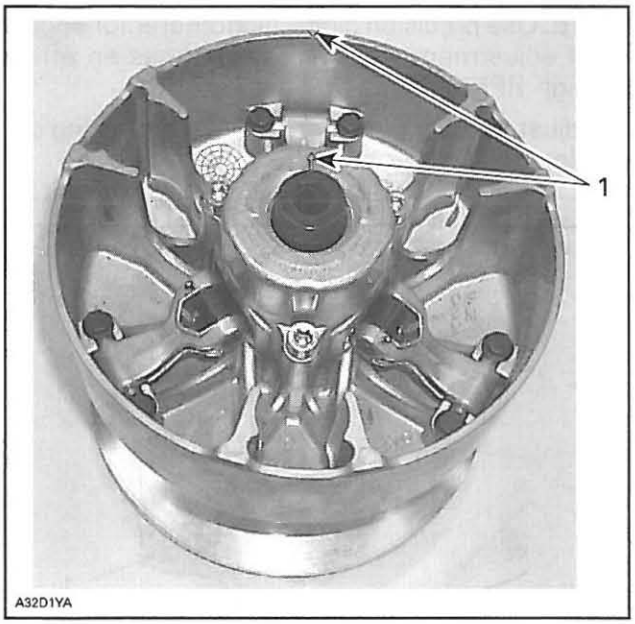
CAUTION: Lever assembly and rollers must move easily after installation.

Fixed Sheave, Sliding Sheave, Spring and Spring Cover

To install spring cover, use spring compressor (P/N 529 036 012).

Assemble fixed and sliding sheaves. Note that fixed sheaves have different taper angle. Match taper angle with crankshaft.

Lift sliding sheave against spring cover and align spring cover arrow with sliding sheave mark.

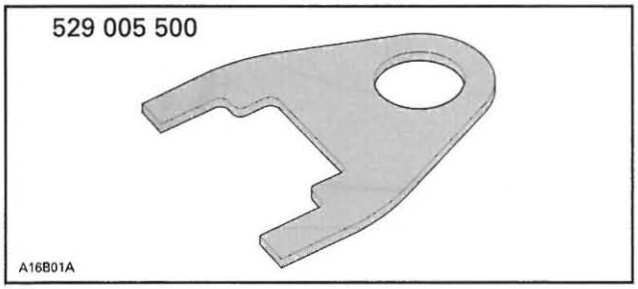


TYPICAL
1. Align

Tighten screws **no. 11** to proper torque as mentioned in exploded view.

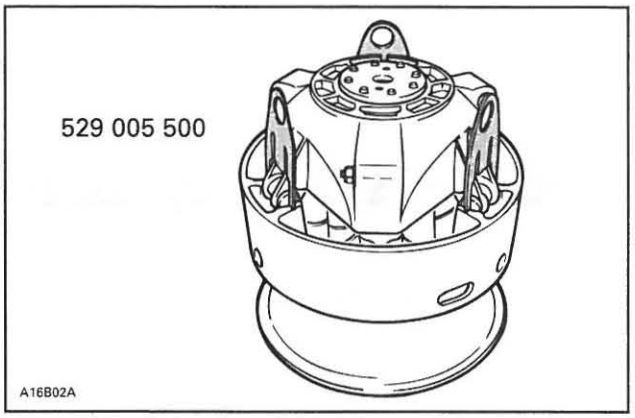
Sliding Sheave, Slider Shoe and Governor Cup

To install governor cup, use the slider shoe fork (P/N 529 005 500) following tool:



Insert O-rings **no. 20** and slider shoes **no. 9** into governor cup **no. 7** so that groove in each slider shoe is vertical to properly slide in guides.

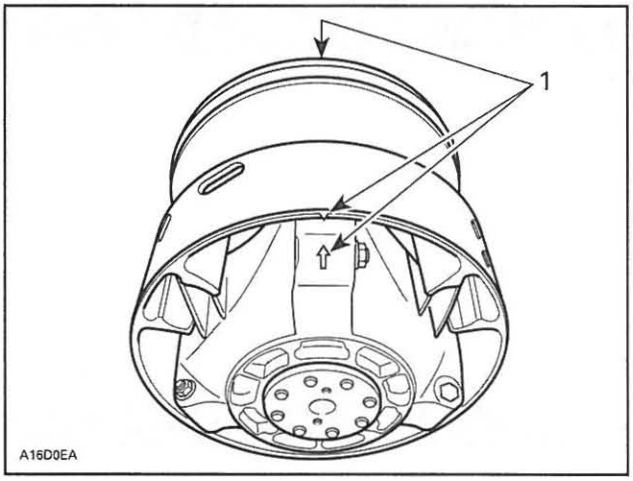
Install a slider shoe fork into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.



TYPICAL

Make sure to align governor cup arrow with sliding sheave and fixed sheave mark.

NOTE: If fixed sheave has no mark, align governor cup mark with **segment no. 1 of inner sheave.** Segments are identified on engine side.



TYPICAL
1. Align

Carefully slide governor cup into sliding sheave. Align mark of governor cup with mark of fixed sheave.

Remove forks and push governor cup down.

INSTALLATION

CAUTION: Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

CAUTION: Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in *CLEANING* above.

Drive Pulley Assembly

The following installation procedure must be strictly adhered.

Install drive pulley on crankshaft extension.

Install a new conical spring washer **no. 3** with its concave side towards drive pulley then install drive pulley bolt **no. 2**.

⚠ WARNING

Never substitute conical spring washer and/or bolt with jobber ones. Always use BRP genuine parts for this particular case.

Use the drive pulley holder (P/N 529 035 674). See removal procedure.

Torque drive pulley bolt to 120 N•m (89 lbf•ft).

Before starting engine, perform drive pulley adjustment, see further in this section.

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque drive pulley bolt to 120 N•m (89 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the drive pulley bolt is properly torqued.

ADJUSTMENT

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

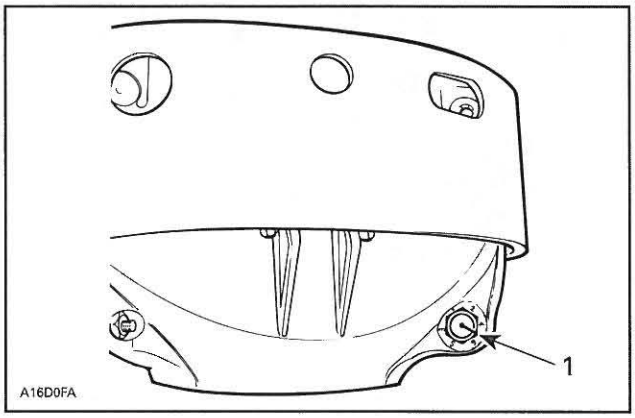
This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in *TECHNICAL SPECIFICATIONS*.

NOTE: Use precision digital tachometer for engine RPM adjustment. The adjustment has an effect on high RPM only.

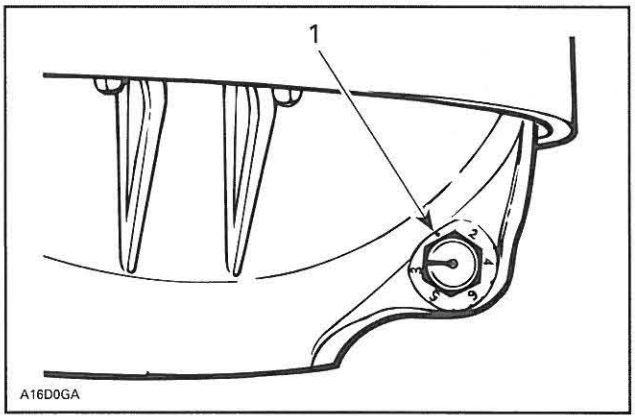
To adjust, modify ramp end position by turning calibration screws.

Calibration screw has a notch on top of its head.



TYPICAL
1. Notch

Governor cup has 6 positions numbered 2 to 6.



TYPICAL
1. Position 1 (not numbered)

See the following table for original factory setting.

CALIBRATION SCREW POSITION		
MODEL		POSITION
MACH Z	Adrenaline	6
	X	
MX Z	Renegade X	6
SUMMIT	Highmark (Canada and U.S.A.)	4
	Highmark (Europe)	3
	Highmark X	4

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

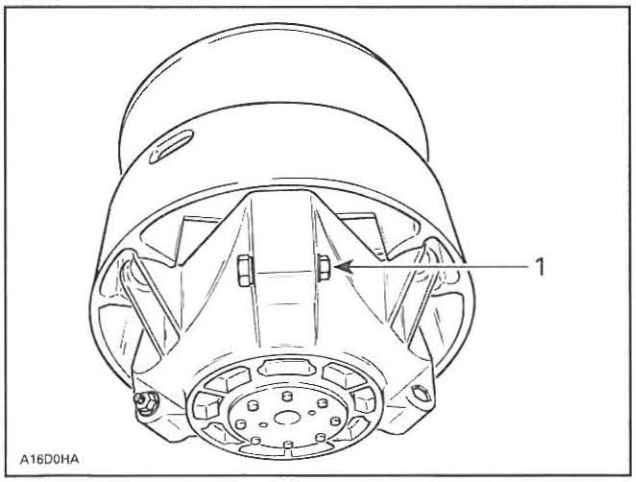
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



TYPICAL
1. Loosen just enough to permit rotating of calibration screw

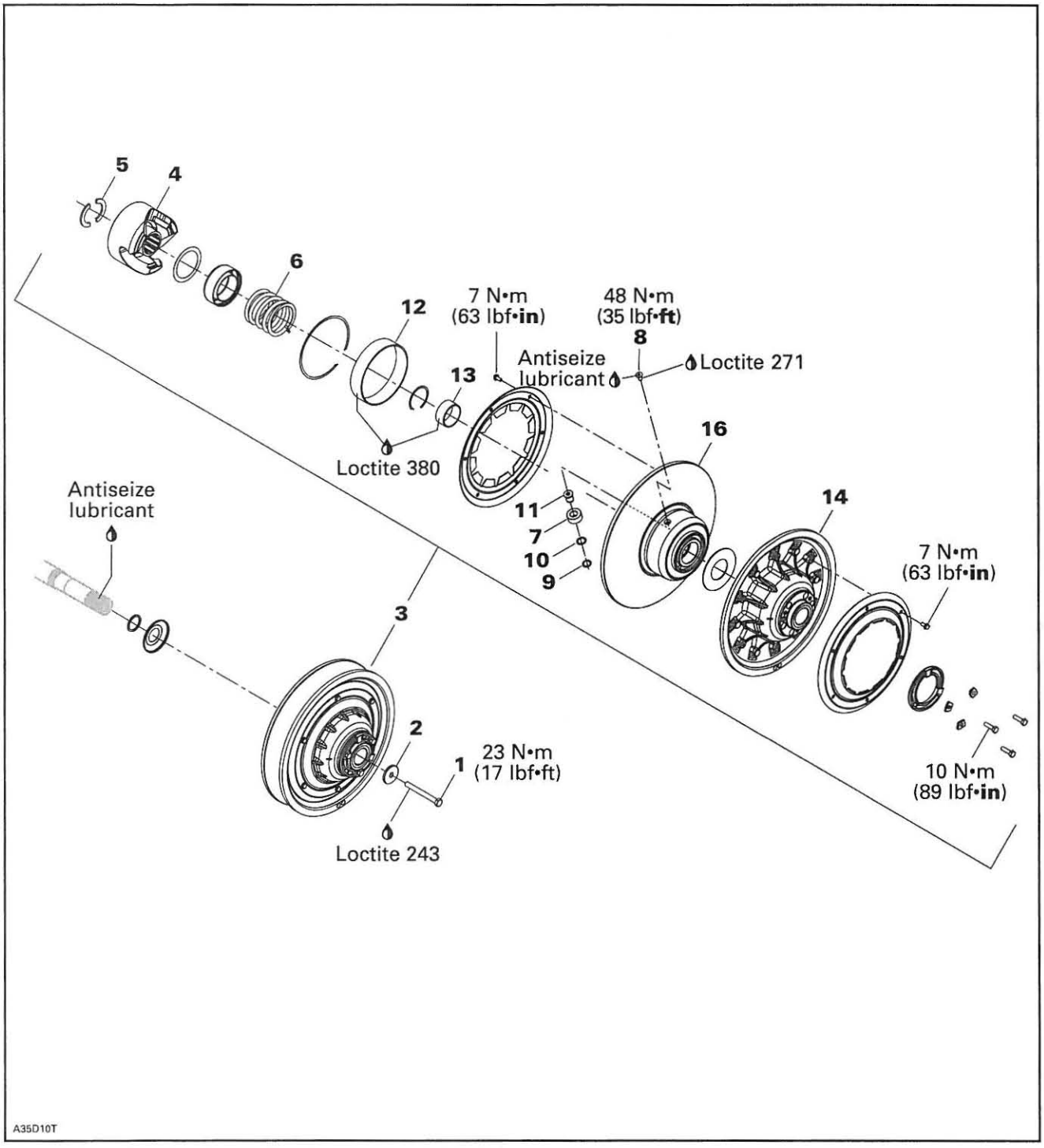
DRIVEN PULLEY

SERVICE TOOLS

Description	Part Number	Page
bushing extractor/installer	529 031 300	242
clutch spring compressor	529 036 012	239, 241
crankshaft protector	420 876 552	242
large bushing extractor	529 031 100	241
large bushing extractor	529 035 575	241

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	242
Loctite 271 (red)	293 800 005	242
Loctite 380 (Black Max)	413 408 300	241–242
Loctite 767 (antiseize lubricant)	293 800 070	242
pulley flange cleaner	413 711 809	240–241


5
4
6
12
7 N•m
(63 lbf•in)
48 N•m
(35 lbf•ft)
8
Antiseize
lubricant
Loctite 271
13
16
Loctite 380
Antiseize
lubricant
11
7
10
9
14
7 N•m
(63 lbf•in)
3
2
1
23 N•m
(17 lbf•ft)
Loctite 243
10 N•m
(89 lbf•in)
A35D10T

GENERAL

During assembly/installation, use the torque values and the 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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Never start engine when the pulley guard is removed.

⚠ WARNING

The driven pulley is a precisely balanced unit. Never replace parts with used parts from another driven pulley.

PROCEDURES

DRIVEN PULLEY REMOVAL

Remove belt guard and drive belt.

Remove driven pulley bolt **no. 1** and shouldered washer **no. 2** then pull the driven pulley **no. 3** from the countershaft.

Note shouldered washer position for reinstallation. Take care not to lose spacer **no. 4**.

Countershaft and Countershaft Bearing

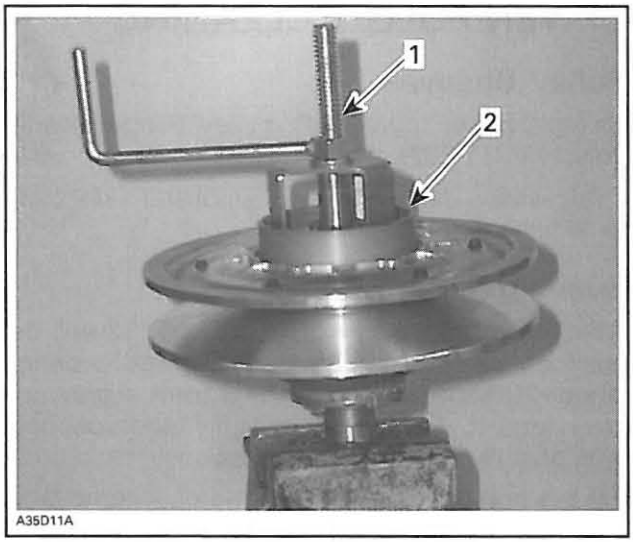
To remove and install countershaft and its bearing refer to *CHAINCASE AND COUNTERSHAFT*.

DRIVEN PULLEY DISASSEMBLY

Using the clutch spring compressor (P/N 529 036 012), push the cam **no. 4**.

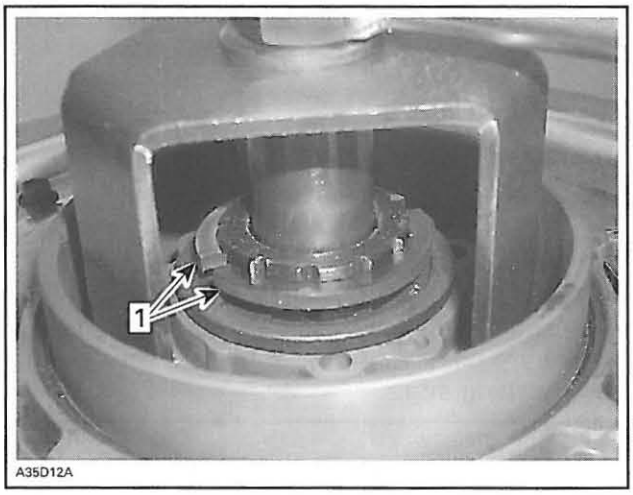
⚠ WARNING

Driven pulley cam is spring loaded, use only the above mentioned tool. Do not use other clutch spring compressor.



1. Clutch spring compressor
2. Cam

Remove the half keys **no. 5**.



1. Half keys

Unscrew clutch spring compressor then remove cam and spring **no. 6** and separate the 2 pulley sheaves.

Remove the roller circlip **no. 9** and its washer **no. 10** then remove the roller **no. 7** from the roller axle **no. 11**.

If a roller axle must be removed, do the following:

- Heat, with a propane torch, the roller axle to break the threadlocker (heat 2 minutes approximately), never heat screw head.
- Using an impact tool, unscrew roller axle screw **no. 8**.
- Repeat procedure for other axles.

DRIVEN PULLEY CLEANING

Pulley Sheaves

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean pulley sheaves.

If necessary, use a fine steel wool and a dry cloth to remove a stubborn deposit.

Bushings and Cam

Teflon from bushings **no. 12** and **no. 13** will deposit on cam and shaft during break-in period (about 10 hours of use). It will form a gray colored deposit. Do not remove this teflon deposit, it helps pulley for smooth operation.

Always use dry cloth for dirt and dust removal in order not to remove the gray teflon deposit.

DRIVEN PULLEY INSPECTION

NOTE: Inner flanges, threads, countershaft and all surfaces which have contacts with other moving parts must be free of dust, scratches or rust.

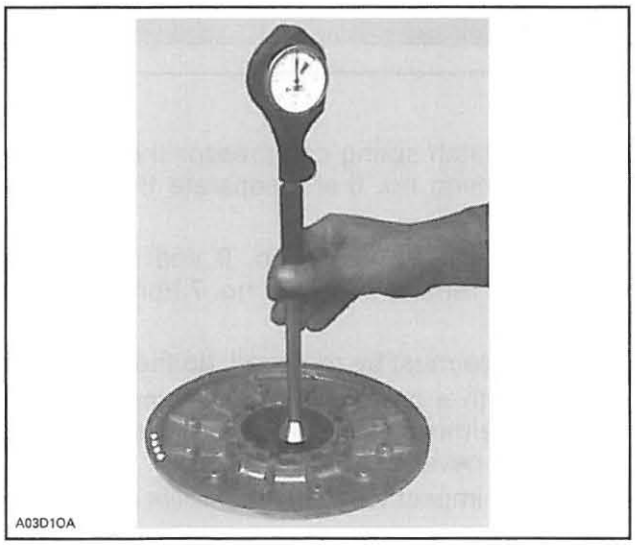
Pulley Sheaves

Check pulley sheaves for marks or scratches.

Check splines in fixed sheave pulley **no. 14**.

Bushings

Using a dial bore gauge, measure the inner diameter of small and large bushings **no. 12** and **no. 13**. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



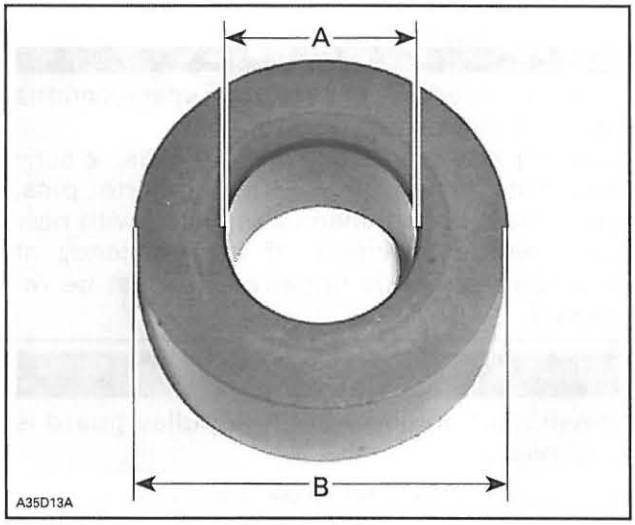
BUSHING	SERVICE LIMIT
Small bushing	38.30 mm (1.508 in)
Large bushing	108.2 mm (4.260 in)

Replace the bushing if the measurement is out of specification. Refer to *BUSHING REPLACEMENT*.

Rollers

Check the rollers **no. 7** for flat spots, cracks or other visible damages.

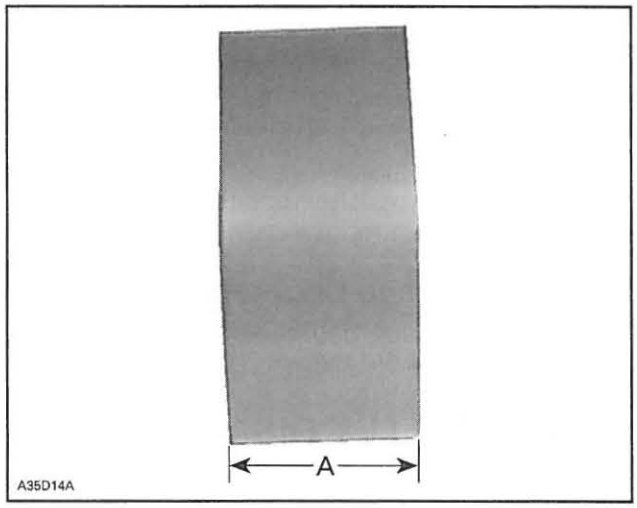
Measure inner and outer diameter of rollers.



A. Inner diameter
B. Outer diameter

ROLLER DIAMETER	SERVICE LIMIT
Inner diameter	12.5 mm (.492 in)
Outer diameter	23.5 mm (.925 in)

Measure the roller thickness.



A. Thickness of roller

ROLLER THICKNESS	
Service limit	10.5 mm (.413 in)

Cam

Verify contact surfaces of cam **no. 4** for visible damages.

Check splines condition.

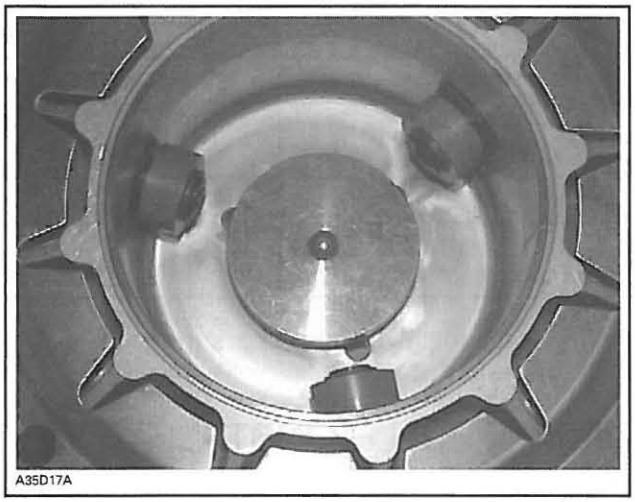
Replace as required.

BUSHING REPLACEMENT

Large Bushing

Remove circlip.

Install the support plate included with the large bushing extractor (P/N 529 031 100) inside sliding sheave.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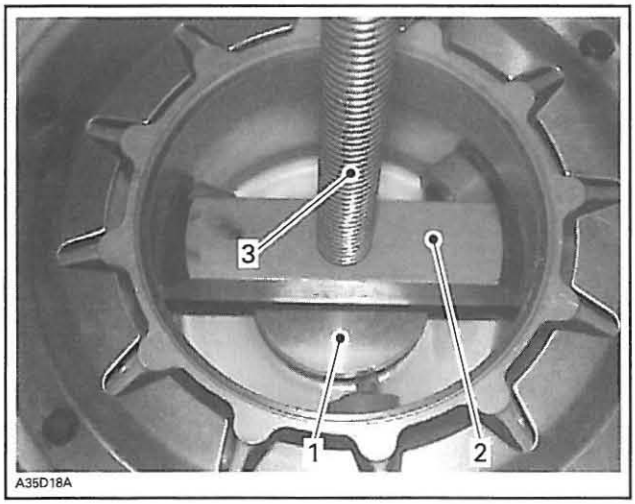
Place the large bushing extractor (P/N 529 035 575) below bushing and screw the threaded rod of the clutch spring compressor (P/N 529 036 012) in the large bushing extractor hole until the end of threaded rod reaches against the support plate.



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TYPICAL
1. *Support plate*
2. *Large bushing extractor*
3. *Threaded rod of spring compressor*

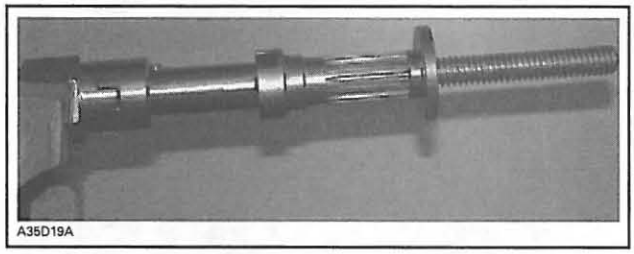
Mount the clutch spring compressor head in a vise.

Using a heat gun, heat bushing to break the adhesive product.

Turn pulley sheave by hand to extract old bushing.

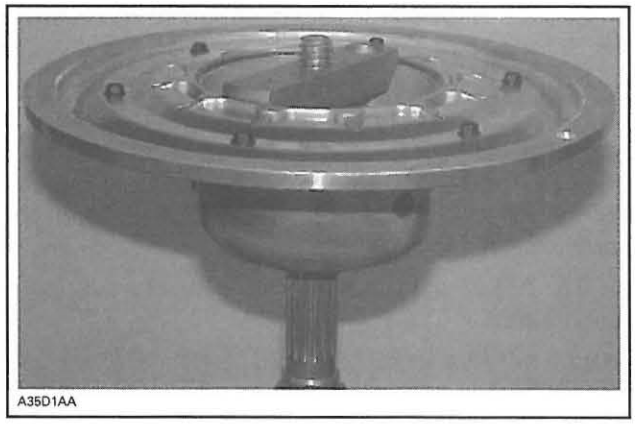
Before bushing installation, clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

On threaded rod install both sleeves and one spacer included with the clutch spring compressor (P/N 529 036 012).


A35D19A

Coat bushing outside diameter with Loctite 380 (Black Max) (P/N 413 408 300). Place new bushing on sliding sheave and slightly tap to engage squarely the bushing in the sliding.

Install the sliding pulley on threaded rod and screw in the large bushing extractor (P/N 529 035 575).


A35D1AA

Turn pulley sheave by hand to insert the new bushing.

NOTE: Change the position of extractor often to push the bushing straight and avoid damages.

Install circlip.

Small Bushing

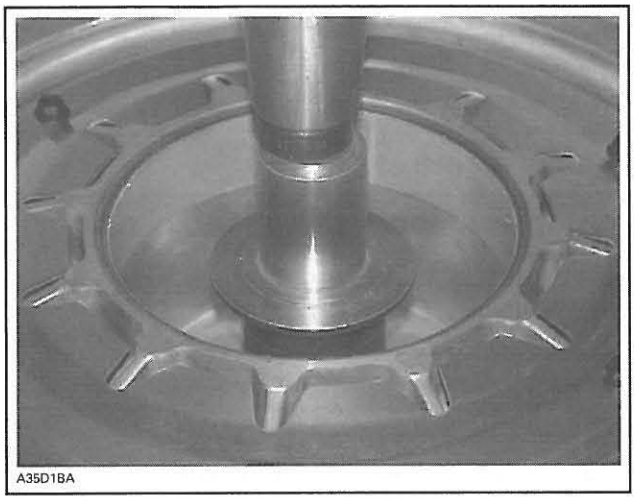
Remove circlip.

Using a press, extract the small bushing. Push the bushing out of its location by using a pipe with proper diameter.

Clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

Coat bushing outside diameter with Loctite 380 (Black Max) (P/N 413 408 300).

Using a press, the bushing extractor/installer (P/N 529 031 300) and the crankshaft protector (P/N 420 876 552), insert small bushing in its location.


A35D18A

Install circlip.

DRIVEN PULLEY ASSEMBLY

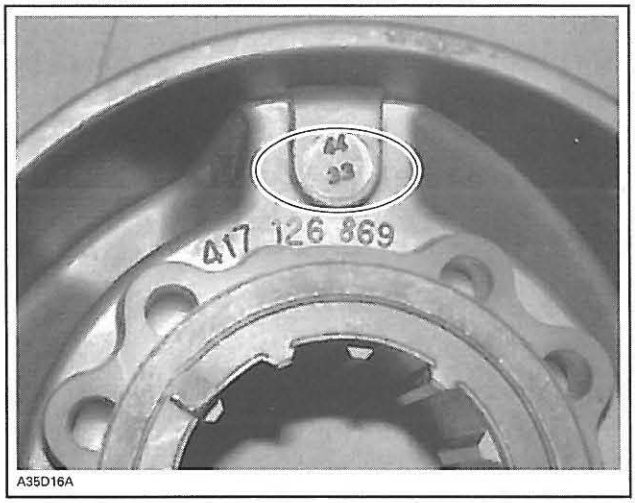
The assembly is the reverse of the disassembly procedure. However, pay attention to the following details.

Using a tap and a die of 8 mm x 1.25, clean threads of roller axles **no. 11** and threads of screws **no. 8** before installing them. Apply Loctite 271 (red) (P/N 293 800 005) on screw threads and Loctite 767 (antiseize lubricant) (P/N 293 800 070) under screw head.

NOTE: Make sure there is no antiseize lubricant on threads.

Torque screws to 48 N•m (35 lbf•ft). Do not use impact tool.

Install the proper cam. The cam angle is indicated on the cam.



A35D16A

MODELS	CAM ANGLES
MACH Z (Adrenaline and X)	44°/33°
MX Z (Renegade X)	44°/33°
SUMMIT (Highmark and Highmark X)	44°/36°

During cam installation, make sure to align the cam slides with the rollers.

DRIVEN PULLEY INSTALLATION

The installation is the reverse of the removal procedure. However, pay attention to the following details.

Apply Loctite 767 (antiseize lubricant) (P/N 293 800 070) on countershaft splines.

Apply Loctite 243 (blue) (P/N 293 800 060) on driven pulley bolt.

Perform a pulley alignment before starting engine and verify drive belt height. Refer to *PULLEY ALIGNMENT* and *DRIVE BELT*.

PULLEY ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
alignment bar	529 035 831	244
driven pulley opening tool	529 017 200	243

GENERAL

Pulley alignment must be checked out to ensure the highest efficiency of the transmission system. Furthermore, optimum drive belt operation and minimal wear will be obtained only with proper pulley alignment.

CAUTION: Before checking pulley adjustment, the rear suspension must be mounted on the vehicle and track tension/alignment must be done. Always check pulley adjustment after suspension is adjusted.

⚠ WARNING

Failure to correctly perform pulley alignment may cause the vehicle to creep forward at idle.

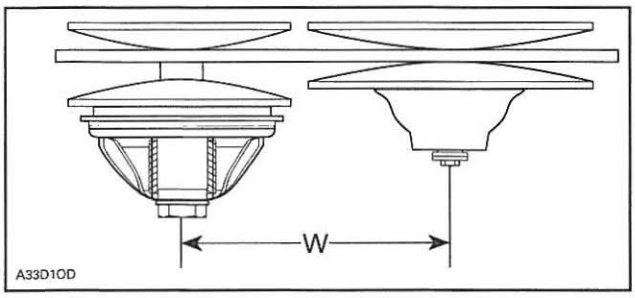
PROCEDURES

W AND Z MEASUREMENTS

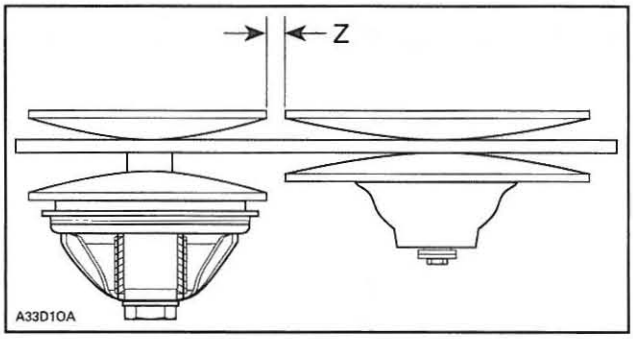
W = Distance between both pulley shafts (center to center).
Z = Distance between both pulleys.

Remove guard and drive belt.

Measure the distance between both pulleys to know if the engine and the frame are positioned correctly. The distance pulley is not adjustable on the RT series vehicles.



TYPICAL
W = Distance between both pulley shaft (center to center)



TYPICAL
Z = Distance between both pulleys

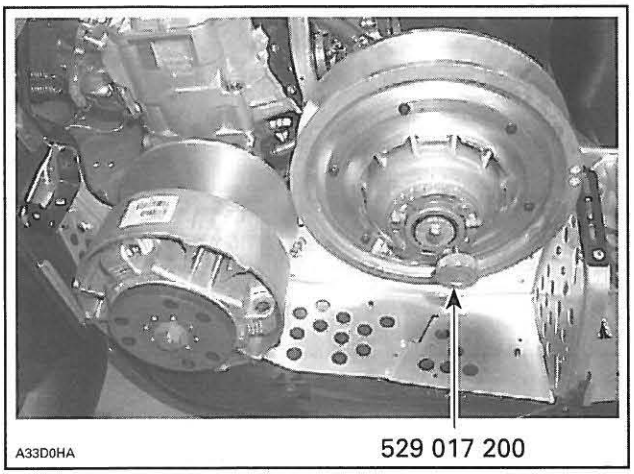
MEASUREMENT		
DRIVE PULLEY/ DRIVEN PULLEY	W mm (in)	Z mm (in)
TRA V/HPV roller	265 ± 0.5 (10.433 ± .02)	27.5 (1.083)

If measurements W and/or X are out of specifications, check engine mounting bolts, chaincase or frame alignment.

X MEASUREMENT

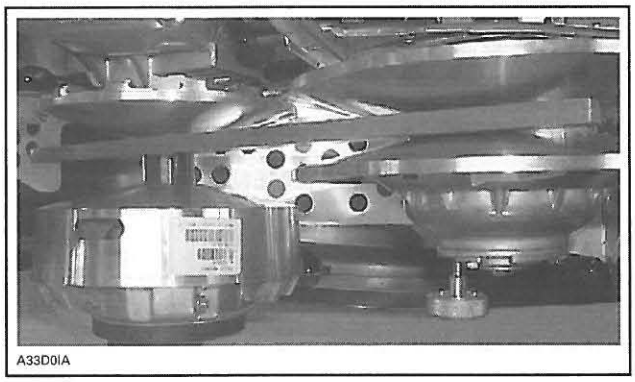
X = Distance between alignment bar and drive pulley fixed sheave edge, measured between pulleys.

By using driven pulley opening tool (P/N 529 017 200) push the sliding half to open the driven pulley.



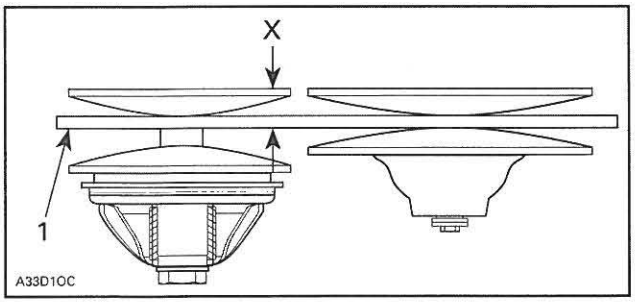
TYPICAL — DRIVEN PULLEY OPENING TOOL

Insert the alignment bar (P/N 529 035 831) into the opened driven pulley.



TYPICAL — ALIGNMENT BAR IN PULLEYS

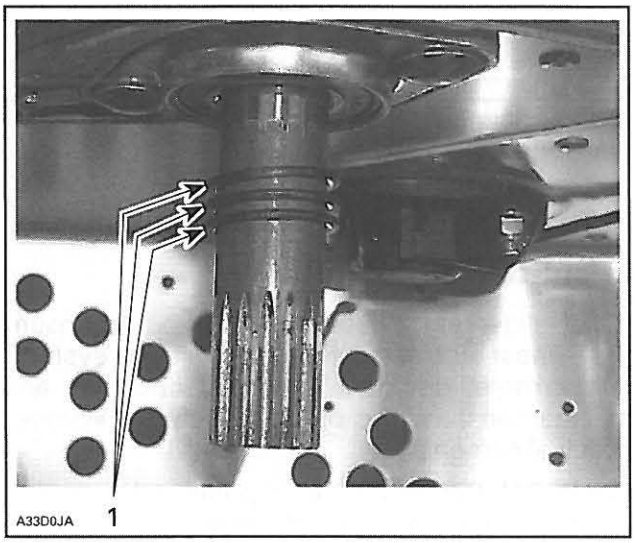
Always measure distance X from the outside of the alignment bar (including its thickness to the fixed sheaves inner edge).



TYPICAL
1. Alignment bar

MEASUREMENT (X)		
DRIVE PULLEY/ DRIVEN PULLEY	DISTANCE mm (in)	
	MINIMUM	MAXIMUM
TRA V/HPV roller	36.5 (1.44)	37.5 (1.48)

If an alignment is necessary, remove driven pulley and add or remove shim(s) as required to obtain the specified alignment.



TYPICAL
1. Shims

Use the following table to choose the proper shim(s).

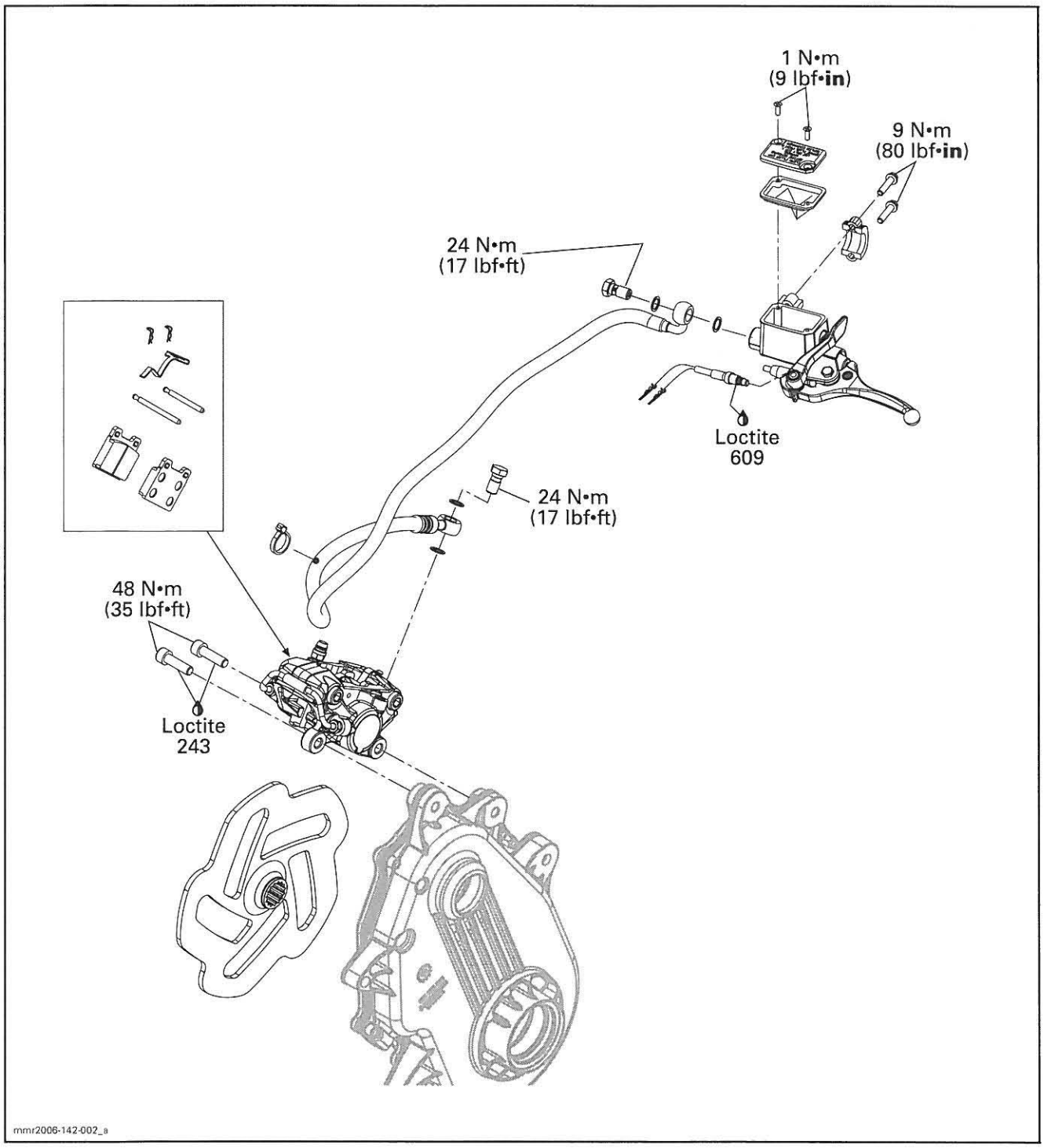
SHIM CHART	
P/N	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

When the alignment is done, torque driven pulley bolt to 23 N•m (17 lbf•ft) then refer to *DRIVE BELT* to adjust the drive belt.

BRAKE

SERVICE PRODUCTS

Description	Part Number	Page
DOT 4 brake fluid GTLMA	293 600 062	247
DOT 4 brake fluid SRF	293 600 063	247
Loctite 609	413 703 100	253


1 N•m
(9 lbf•in)
9 N•m
(80 lbf•in)
24 N•m
(17 lbf•ft)
Loctite
609
24 N•m
(17 lbf•ft)
48 N•m
(35 lbf•ft)
Loctite
243
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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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

A contaminated brake disc or pad reduces stopping power. Discard contaminated pads and clean contaminated disc with a high quality brake degreasing agent.

CAUTION: Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing brake system.

CAUTION: To avoid serious damage to the brake system, use only DOT 4 brake fluid from a sealed container. Do not use brake fluid taken from old or already opened containers, nor mix different fluids for topping off.

CAUTION: Sealing washers must be discarded and replaced with new proper ones every time a Banjo fitting is unscrewed.

MAINTENANCE

BRAKE FLUID

The brake fluid must be changed in accordance with the maintenance chart.

Recommended Fluid

Always use brake fluid meeting the specification DOT 4 such as the DOT 4 brake fluid GTLMA (P/N 293 600 062) or the DOT 4 brake fluid SRF (P/N 293 600 063) sold by BRP.

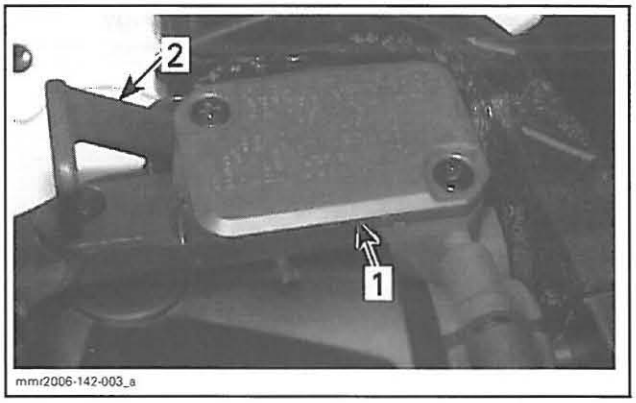
Fluid Level

With the vehicle on a level surface, position steering in straight-ahead position to ensure reservoir is level. Check brake fluid level, the reservoir is full when the fluid reaches the top of window.

Brake Fluid Replacement

Draining

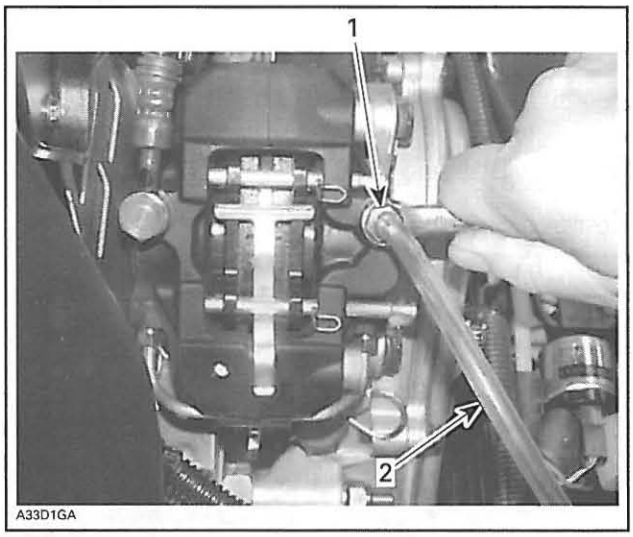
Remove reservoir cover with its diaphragm.



1. Reservoir cover
2. Parking brake lever

Connect a clear hose to caliper bleed screw. Route this hose to an empty container.

Loosen bleed screw and pump brake lever until no more fluid flows out of bleed screw.



TYPICAL
1. Open bleed screw
2. Clear hose to catch used brake fluid

Filling and Bleeding

Tighten bleed screw.

Fill reservoir with recommended DOT 4 brake fluid.

Unscrew bleed screw until brake fluid freely flows out of hose. Tighten bleed screw. Refill reservoir when the fluid level is low to prevent air into system. Keep sufficient fluid in reservoir at all times.

Pump up system pressure with brake lever until resistance is felt.

Squeeze brake lever and open bleed screw. When lever touches the handlebar, do not release lever and tighten bleed screw.

Repeat the procedure until no air bubbles appear in the hose and brake lever is not spongy.

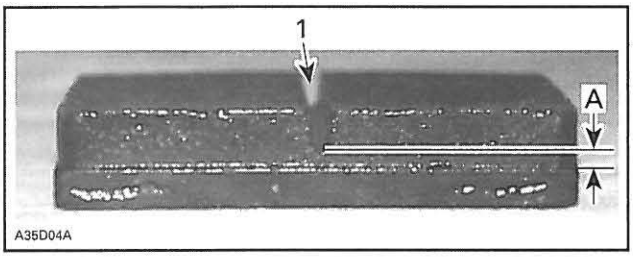
PROCEDURES

BRAKE PADS

Inspection

Brake pad must be replaced when lining is 1 mm (1/32 in) thick or less or if the wear groove, on lining pad, is no longer visible.

CAUTION: Brake pads must always be replaced in pairs.



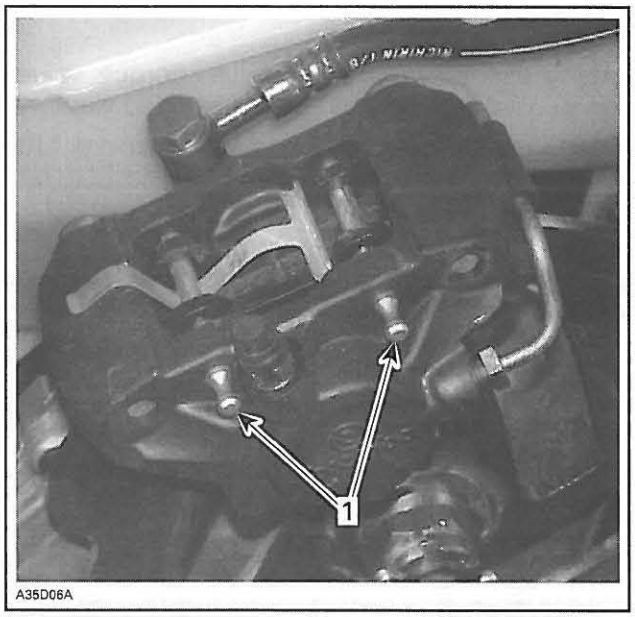
1. Wear groove on pad lining
A. Minimum thickness 1 mm (1/32 in)

Removal

Remove clips that retain pad pins.

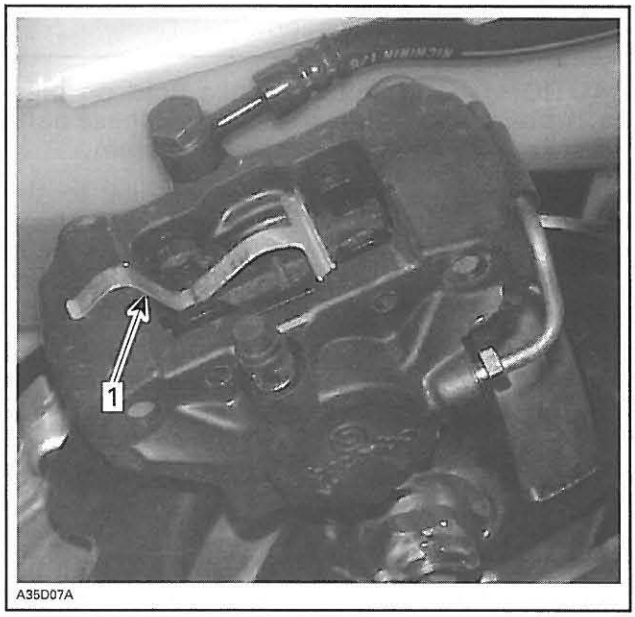
TYPICAL
1. Clips

Hold pad spring and pull pad pins out of caliper.



TYPICAL
1. Pad pins

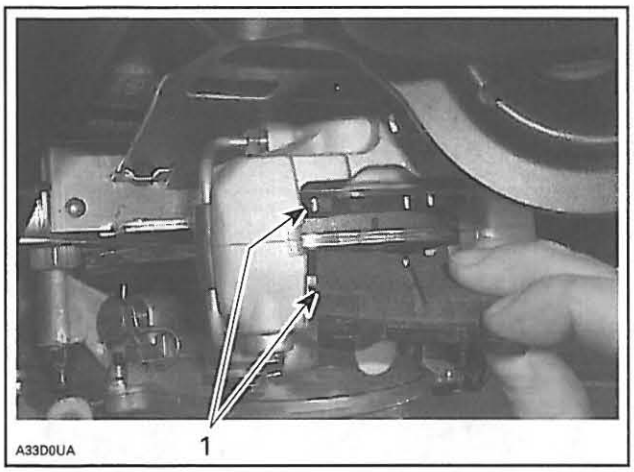
Remove pad spring.



TYPICAL
1. Pad spring

Insert a flat screwdriver between brake disc and a brake pad to compress a caliper piston. Pay attention to avoid scratching brake disc.

Remove brake pads from caliper.



TYPICAL
1. Brake pad

Installation

Clean pistons then push them inward before installing new brake pads.

Install:

- new brake pads
- pad spring and push pad pins to lock the brake pads
- both clips in the pin holes.

⚠ WARNING

Avoid getting fluid, oil or grease on brake pads. Contaminated brake pads can greatly affect stopping capacities.

Press the brake lever until both new pads are touching the brake disc.

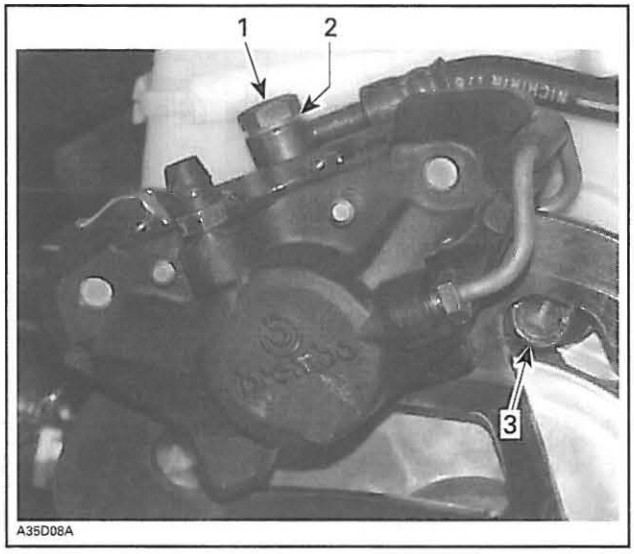
Center the brake disc into the caliper. Refer to *CALIPER*.

CALIPER

Removal

To Separate Caliper from Chaincase

Align brake disc slots with caliper bolts then using a 8 mm Allen key, unscrew them.



1. Banjo fitting
2. Sealing washer
3. Caliper bolt

Remove caliper.

CAUTION: Do not let the caliper hang by the hose and do not stretch or twist the hose.

To Change the Caliper

Drain brake system.

Use procedure described in *TO SEPARATE CALIPER FROM CHAINCASE* above.

Unscrew Banjo fitting and discard sealing washers.

Inspection

Check caliper for cracks or leakages. Replace if necessary.

Check pistons for scratches , rust or other damages. If so, replace the caliper as an assembly.

NOTE: Only brake pads are available as spare parts.

Installation

Push pistons all the way in to allow caliper installation over brake disc.

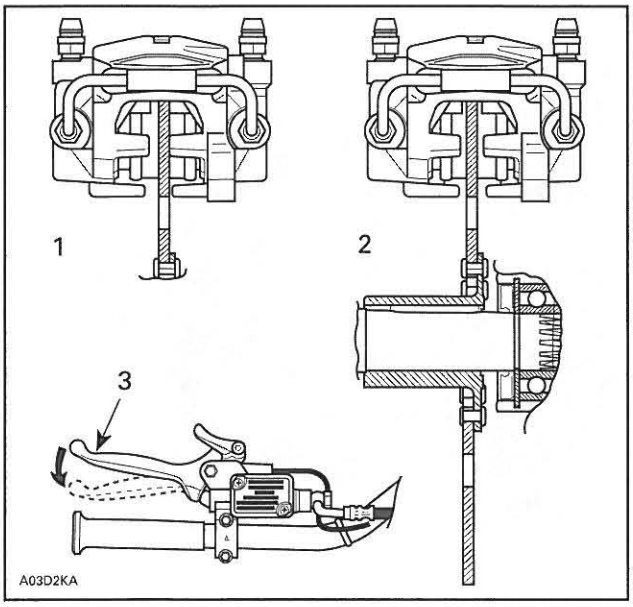
Install the Banjo fitting with two new sealing washers.

Fasten caliper on chaincase.

Fill the brake system and bleed it. Refer to *MAINTENANCE* in this section.

The brake disc must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



TYPICAL
1. Brake disc not centered
2. Brake disc centered
3. Apply brake before checking

Apply brake then recheck.

BRAKE DISC

Inspection

The brake disc can be inspected without removing it from the vehicle.

Check for scoring, cracking or bending, replace as required.

Measure brake disc thickness. The minimum thickness should be 4.5 mm (.177 in). If the brake disc is out of specification, replace it with a new one.

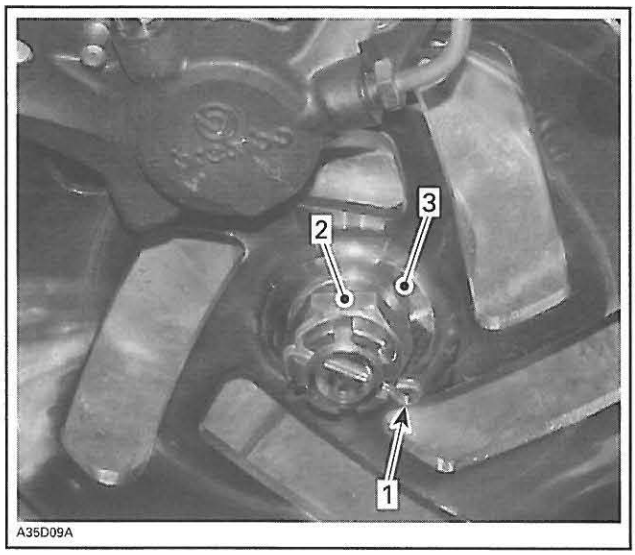
CAUTION: The brake disc must never be machined.

Removal

Apply parking brake.

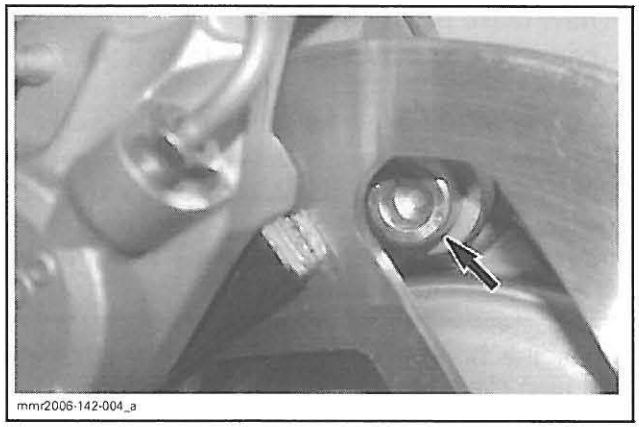
Remove the cotter pin and discard it.

Unscrew the brake disc nut then remove it with the spacer.



1. Cotter pin
2. Brake disc nut
3. Spacer

Using a 8 mm Allen key, unscrew caliper bolts and place caliper out of the way.



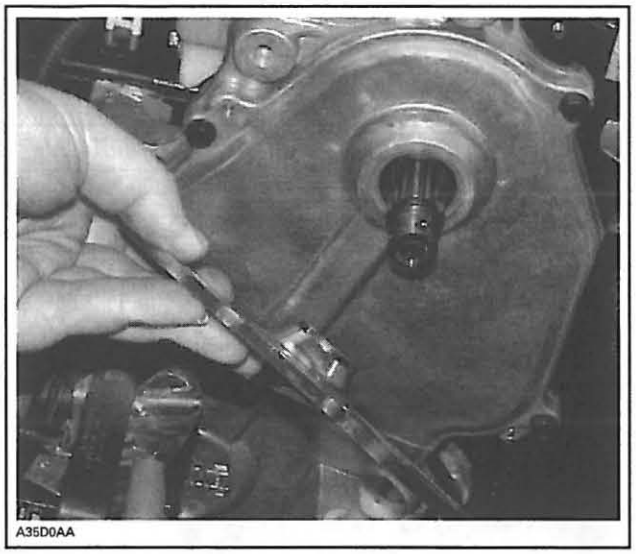
CAUTION: Do not let the caliper hang by the hose and do not stretch or twist the hose.

Remove the brake disc.

Installation

The installation is the reverse of removal procedure. However, pay attention to the following.

Install the brake disc with the collar toward chaincase.


A35D0AA

Torque brake disc nut to 60 N•m (44 lbf•ft) and further tighten until its grooves align with the next cotter pin hole.

Install a new cotter pin. Both end of cotter pin must be folded over nut.

MASTER CYLINDER

Removal

Drain brake fluid until master cylinder is empty.

Remove the Banjo fitting and discard sealing washers.

Unscrew master cylinder screws from the master cylinder holder then remove master cylinder from handlebar.

Inspection

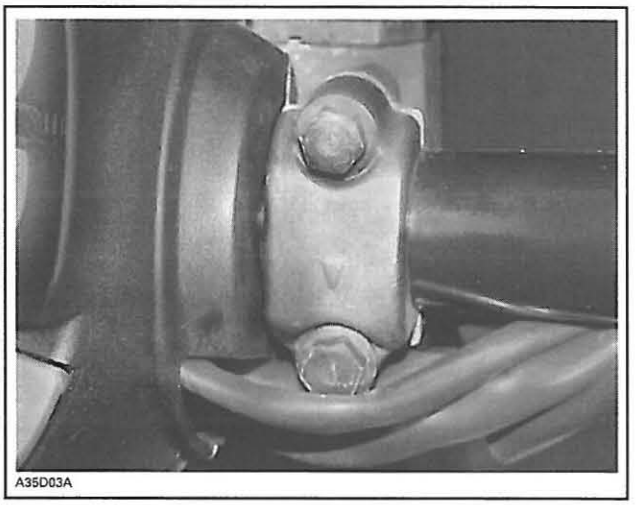
Check master cylinder for cracks or leakage. Replace if necessary.

Installation

The installation is essentially the reverse of the removal procedure but pay attention at the following.

Always use new sealing washers during installation.

Install the master cylinder holder with the arrow pointing downwards.


A35D03A

Torque the lower screw first to 8 N•m (71 lbf•**in**) then the upper screw to the same torque.

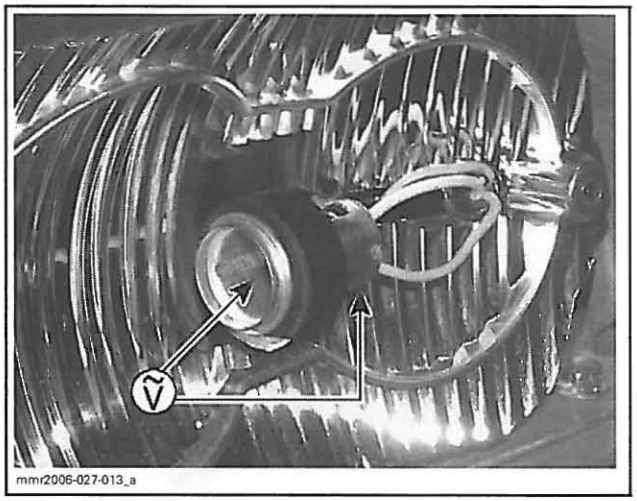
Bleed the brake system. Refer to *MAINTENANCE* in this section.

BRAKE LIGHT SWITCH

Brake Light and Switch Test

Remove bulb.

Using a multimeter, measure the voltage in bulb socket as follows.



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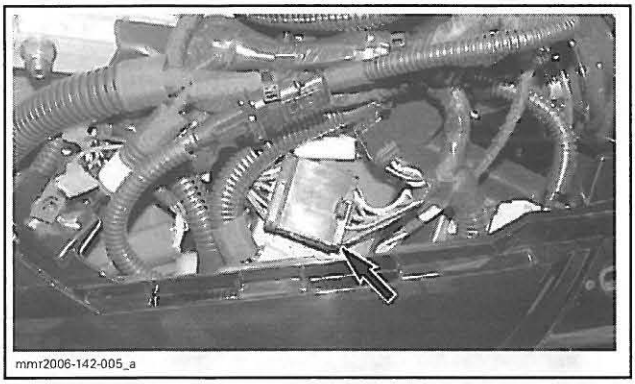
Start engine and read voltage. Apply brake and hold for measurement.

POSITION IN SOCKET		VOLTAGE
WHITE wire terminal	Socket shell (BLACK)	12 Vac

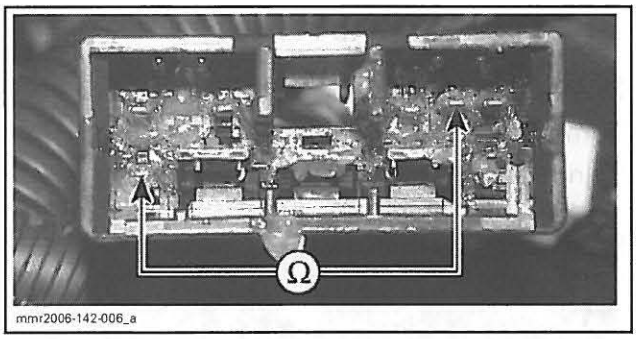
– Voltage is good:
  • Change taillight bulb.
– No voltage:
  • Check brake light switch as follows.

- Disconnect steering connector.

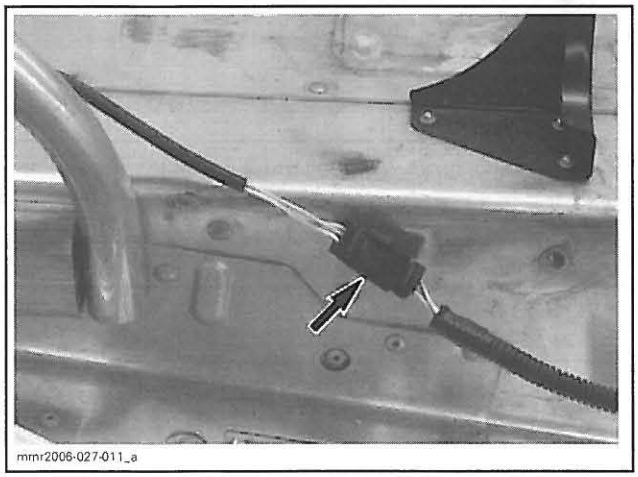


- Validate switch operation with an ohmmeter.

SWITCH	TERMINAL		RESISTANCE
Released	WHITE	RED/YELLOW (small terminal)	Infinite (0L.)
Pushed and held			0.2 Ω (closed)



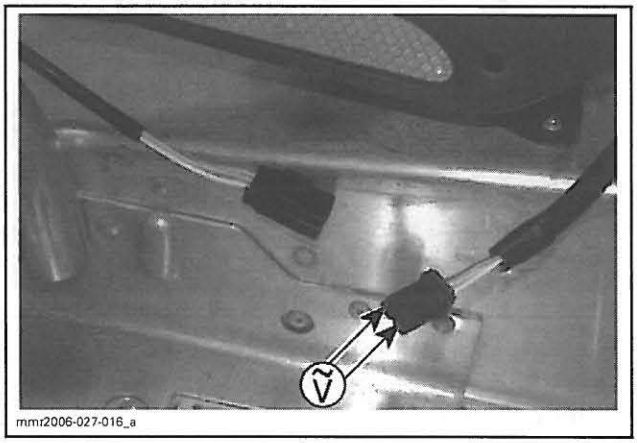
- If readings do not correspond to the above specifications, check wiring/connectors going to switch. If they are good, replace switch.
- If everything was good, remove seat(s) or trunk.
- Disconnect taillight connector.



TYPICAL

- Start engine and read voltage on connector from main harness. Ensure to depress brake lever to read voltage.

TERMINAL		VOLTAGE
WHITE	BLACK	12 Vac



TYPICAL

- If voltage is good, check rear light wiring/connector going to taillight and if adequate, replace rear light. If voltage is not good, refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES.*

Removal

The brake light switch is located near the brake lever. To remove the switch, use the following.

Disconnect the switch.

Take out the master cylinder from the handlebar.

Overturn the master cylinder so that the bottom is on the top.

Fix the master cylinder in a rigid way preferably in a vise.

Pull out the switch wire and rubber cover.

Activate the parking brake.

With the help of a proper tool, unscrew the switch body pay attention to apply a torque in axial direction with steps of little torque angles and pay attention to not apply a force in radial direction (flexion).

Remove the glue remaining with alcohol on a piece of cotton and then clean the seat threads.

NOTE: In case of accidental breakage while removing switch body from master cylinder, ensure to thoroughly restore and clean threads as needed before installing new switch.

Installation

NOTE: The brake light switch is not adjustable.

Put the switch on the seat, rotating it only for 1 or 1.5 turns.

Put one drop of Loctite 609 (P/N 413 703 100) on the free switch threads.

Screw the switch by hand until it is in a correct position.

For safety reasons, check the activation of the switch by pulling the brake lever. In case of no switch activation, repeat all the procedure replacing a new switch.

NOTE: If parking brake releases during the mounting operations, set the master cylinder in a sloping position (with lever on the top) and hold the master cylinder lever for 45 minutes.

Reinstall the master cylinder on the handlebar taking it in a horizontal position avoiding the risk of glue contamination for the switch rod.

Release the parking brake.

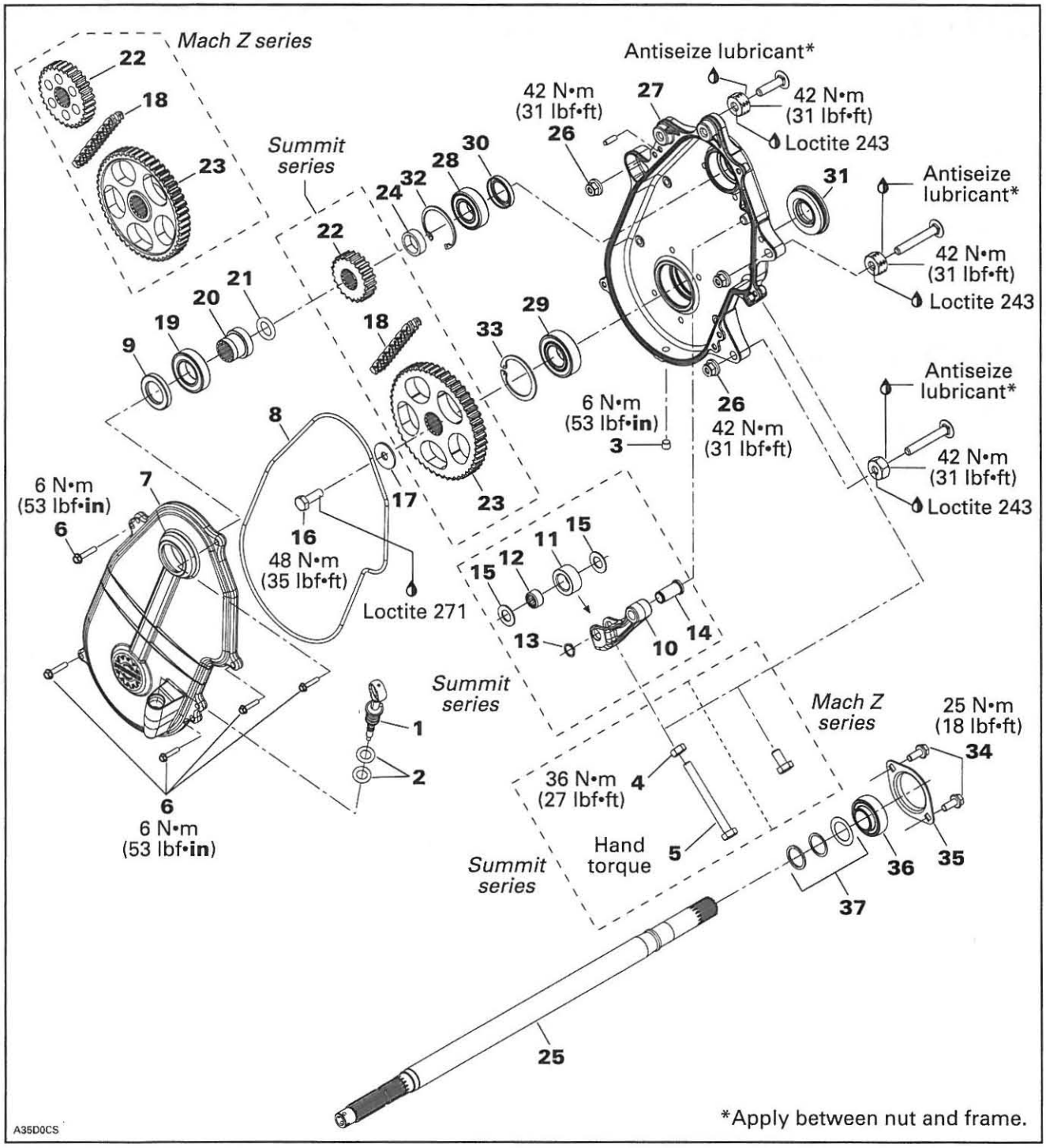
Wait 24 hours to allow glue to set.

Recheck if switch is working properly.

CHAINCASE AND COUNTERSHAFT

SERVICE TOOLS

SERVICE PRODUCTS


Mach Z series
Summit series
Antiseize lubricant*
42 N•m (31 lbf•ft)
Loctite 243
6 N•m (53 lbf•in)
48 N•m (35 lbf•ft)
Loctite 271
36 N•m (27 lbf•ft)
Hand torque
25 N•m (18 lbf•ft)
*Apply between nut and frame.
A35D0CS

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAINTENANCE

CHAINCASE OIL

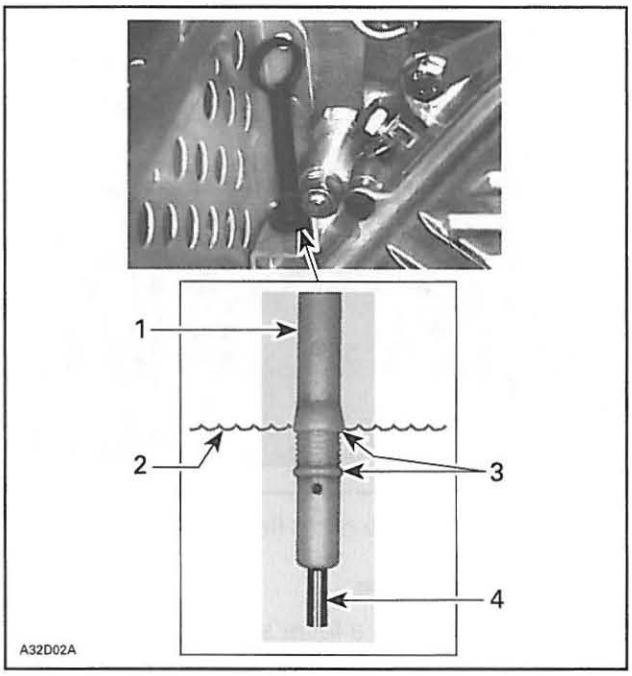
Recommended Oil

NOTE: Do not mix different oil (mineral and synthetic) for topping off.

Use XP-S synthetic chaincase oil (P/N 413 803 300).

Oil Level Verification

With the vehicle on a level surface, check the oil level by removing dipstick **no. 1**. Oil level must be between lower and upper marks.



TYPICAL
1. *Dipstick*
2. *Oil level*
3. *Level between marks*
4. *Magnet*

NOTE: It is normal to find metallic particles stuck to dipstick magnet. If bigger pieces of metal are found, remove the chaincase cover and inspect the chaincase parts.

Remove metal particles from magnet.

Refill to upper mark using the XP-S synthetic chaincase oil (P/N 413 803 300).

CAUTION: Do not use unrecommended types of oil when servicing. Do not mix synthetic oil with other types of oil.

Check dipstick O-rings **no. 2**. If the O-rings are brittle, hard or otherwise damaged, replace them.

Draining Procedure

Place a drain pan under chaincase drain plug area.

Remove dipstick **no. 1**.

Using an Allen key, remove the drain plug **no. 3**.


A33D1NA

Wait a while to allow oil to flow out of chaincase.

Filling Procedure

Place the vehicle on a level surface.

Using a funnel, pour 250 mL (8.5 U.S. oz) of XP-S synthetic chaincase oil (P/N 413 803 300).

Check oil level with the dipstick and add oil if necessary. The level must be between lower and upper dipstick's marks.

DRIVE CHAIN ADJUSTMENT

All Models except MACH Z

NOTE: Brake disc and countershaft splines must be in good condition before checking if chain is loose.

Unscrew lock nut **no. 4**.

Tighten tensioner adjustment screw **no. 5 BY HAND**, then unscrew 1/2 turn. Hold tensioner screw and tighten lock nut **no. 4** to 36 N•m (26.5 lbf•ft).

PROCEDURES

CHAINCASE COVER

Removal

Drain chaincase, see the above procedure.

Remove battery, battery rack and toe hold to allow a better access.

Remove the brake disc. Refer to *BRAKE*.

Unscrew the chaincase cover screws **no. 6** then remove chaincase cover **no. 7**.

Inspection

Check the cover for cracks or distortion.

Check if the O-ring **no. 8** is brittle, hard or otherwise damaged.

Verify if the oil seal **no. 9** is in good condition.

Replace any defective parts.

Installation

The installation is the reverse of removal procedure.

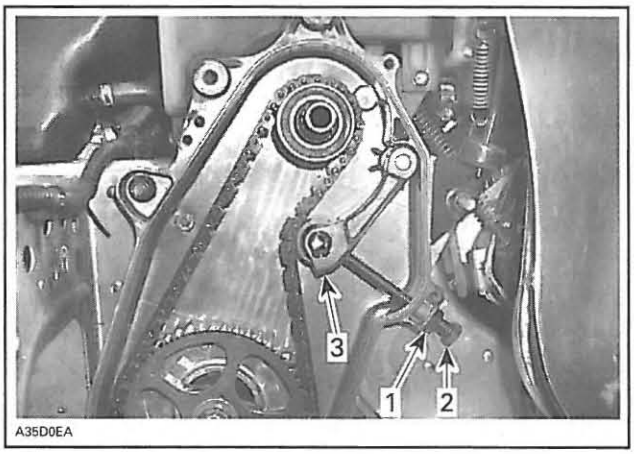
TENSIONER

All Models except MACH Z

Removal

Drain chaincase and remove chaincase cover. See procedure above.

Unscrew the lock nut then release drive chain tension by unscrewing the tensioner bolt.



A35D0EA

1. Lock nut
2. Tensioner bolt
3. Tensioner lever

Pull tensioner lever **no. 10** out of chaincase housing.

Inspection

Check if the roller **no. 11** turns smoothly and freely. If not replace its needle bearing **no. 12**.

Check tensioner lever for cracks or other damages, replace if necessary.

Installation

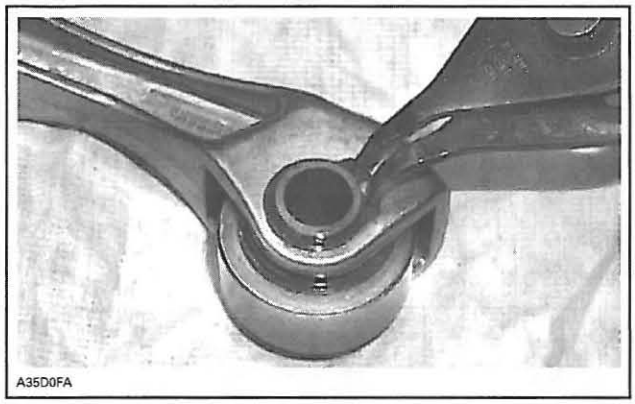
The installation is the reverse of the removal procedure. When the installation is completed, perform the drive chain adjustment.

TENSIONER ROLLER BEARING

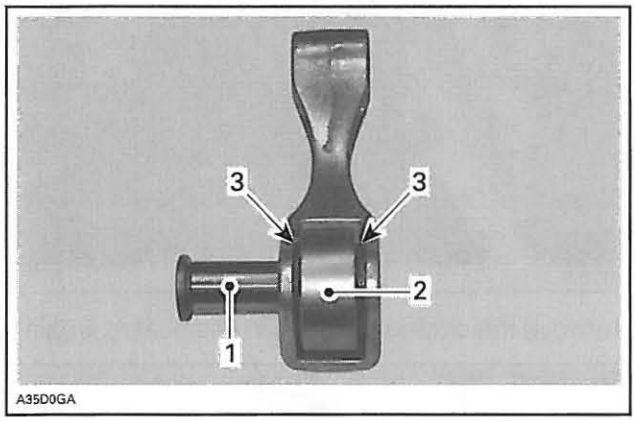
All Models except MACH Z

Removal

First, remove the tensioner lever **no. 10** then remove the circlip **no. 13**.


A35D0FA

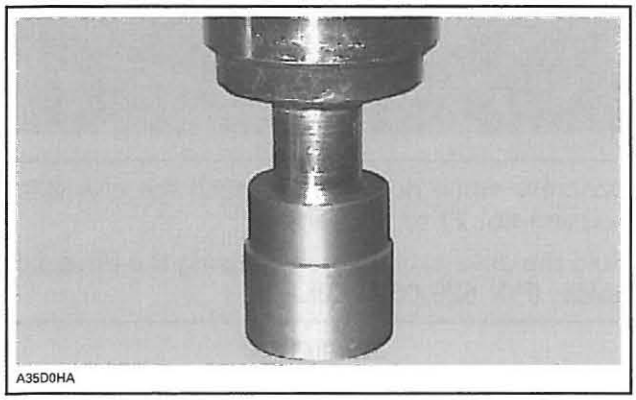
Remove tensioner axle, roller and washers.



A35D0GA

1. *Tensioner axle*
2. *Roller*
3. *Washers*

Using a press machine and suitable tappet, push needle bearing **no. 12** out of roller.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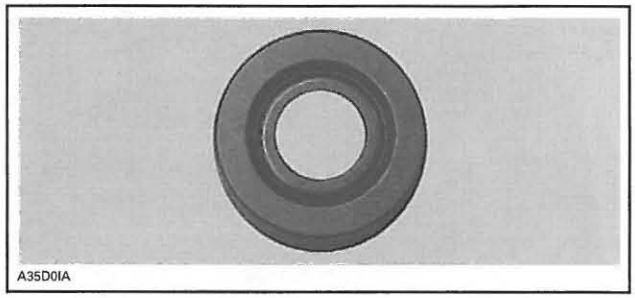
Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

The needle bearing must be installed with the engraved side toward the circlip.


A35D0IA

ENGRAVED SIDE OF NEEDLE BEARING

Do not forget both washers **no. 15** on each side of roller **no. 11**.

Insert tensioner axle **no. 14** and install a new circlip. The circlip must be visible when the tensioner is installed.

DRIVE CHAIN AND SPROCKETS

Removal

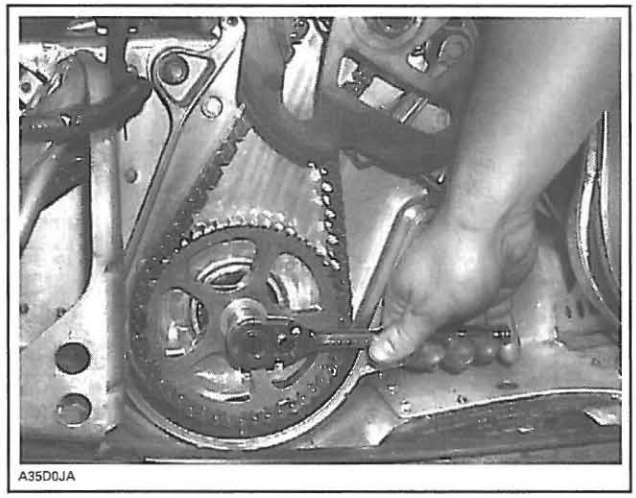
Remove chaincase cover. See procedure above.

Temporarily, install the brake disc and its nut, do not torque nut.

Install the caliper. Torque bolts.

Apply parking brake.

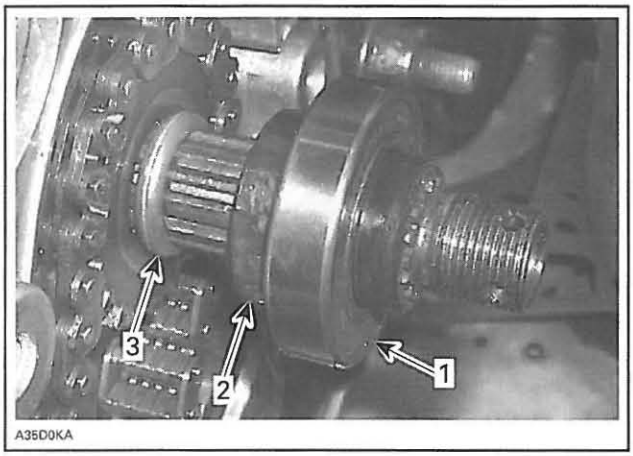
Remove the lower sprocket bolt **no. 16** and its washer **no. 17**.


A35D0JA

Release parking brake and remove caliper and brake disc.

On so equipped models, release tension on drive chain **no. 18** and remove the tensioner lever **no. 10**.

Remove bearing **no. 19** and splined spacer **no. 20** then O-ring **no. 21**.



1. Bearing
2. Splined spacer
3. O-ring

Pull the upper sprocket **no. 22** and the lower sprocket **no. 23** with the drive chain out of chaincase housing.

Inspection

Check sprocket teeth for wear or cracks. Replace if necessary.

CAUTION: Replace sprockets and chain as an assembly to prevent accelerated wear.

Check if O-ring **no. 21** is brittle, hard or damaged. Replace if necessary.

Check splines inside spacer **no. 20** for wear. Replace if necessary.

Check if the bearing **no. 19** turns smoothly and freely. Replace if defective.

Installation

On **MACH Z series**, the rocker style chain can not be used with an upper sprocket having fewer than 29 teeth. On all other models, do not use another chain than the 13-plates wide one.

IMPORTANT: Due to the difference in pitch between the rocker type chain and the standard type chain, it is necessary to use a standard chain and a standard lower sprocket if a smaller upper sprocket is used. The chaincase housing is threaded to accept a tensioner.

Fit chain on upper sprocket to make sure that you are using right one according to width.

NOTE: No work (separation, lengthening) can be done on the silent chain type.

The installation is the reverse of the removal procedure. Pay attention to the following details.

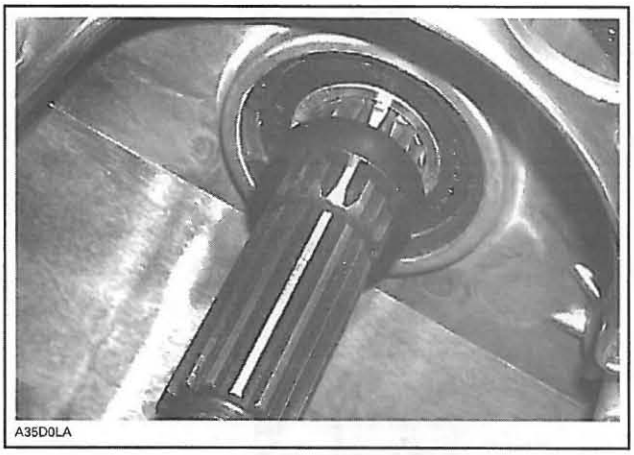
Reinstall the brake disc and the caliper to torque the lower sprocket bolt. Apply Loctite 271 (red) (P/N 293 800 005) on sprocket bolt threads before torquing.

CHAINCASE HOUSING

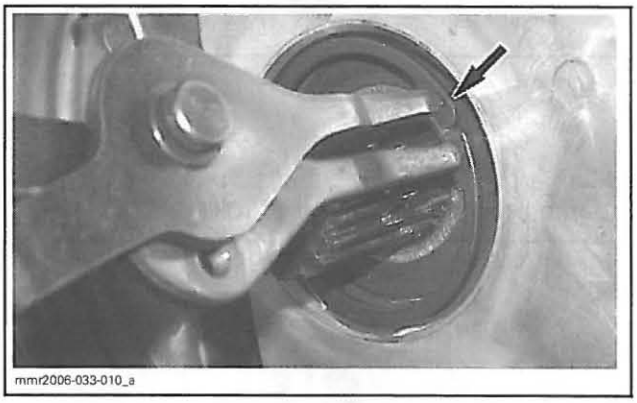
Removal

Remove chaincase cover, drive chain and sprockets.

Remove spacer **no. 24** on countershaft **no. 25**.



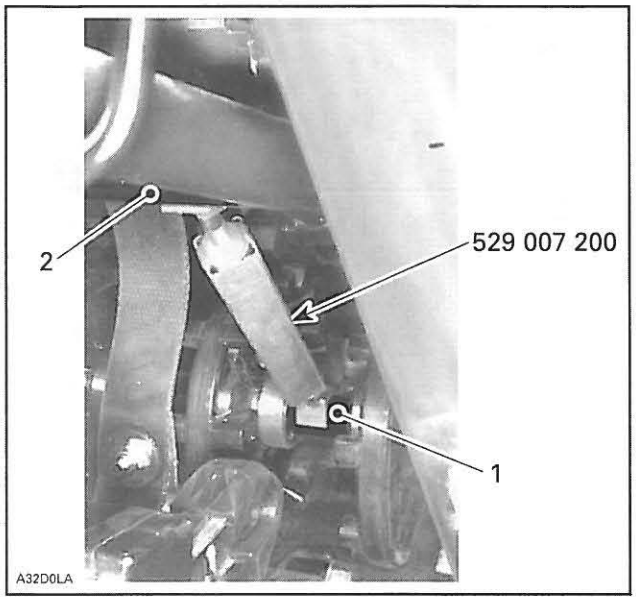
Remove the circlip **no. 33** from chaincase housing.



Unscrew nut(s) **no. 26** that attach the chaincase housing **no. 27** to the vehicle.

Hold the drive axle in place by using the drive axle holder (P/N 529 007 200).

529 007 200



TYPICAL
1. Drive axle
2. Suspension front arm

Pry out drive axle oil seal **no. 31** from chaincase.

Pull chaincase from drive axle and countershaft.

Using 2 large prybars inserted between chaincase housing **no. 27** and frame, pry complete assembly from vehicle.

NOTE: Note quantity and location of shims to reposition them correctly during installation.

Inspection

Check housing for cracks or distortion.

Verify if ball bearings **no. 28** and **no. 29** turn smoothly and freely.

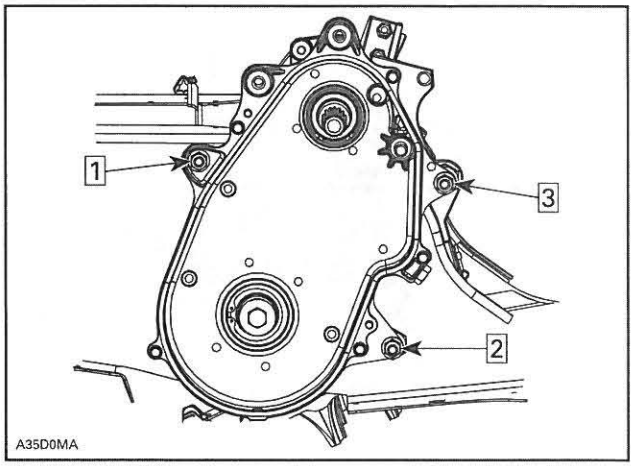
Check condition of oil seals **no. 30** and **no. 31**.

Replace all defective parts.

Installation

Install all removed shims at their original locations.

Install chaincase housing and screw in nuts. Use the following sequence to torque nuts to 42 N•m (31 lbf•ft).



Install all other removed parts.

CHAINCASE HOUSING BEARINGS

Inspection

The bearings must turn smoothly and freely. If not, replace them.

Removal

To remove the upper bearing **no. 28**, remove the circlip **no. 32** and pull the bearing out of the housing. The bearing is not installed press fit in the housing.

For the lower bearing **no. 29** a press machine will be necessary.

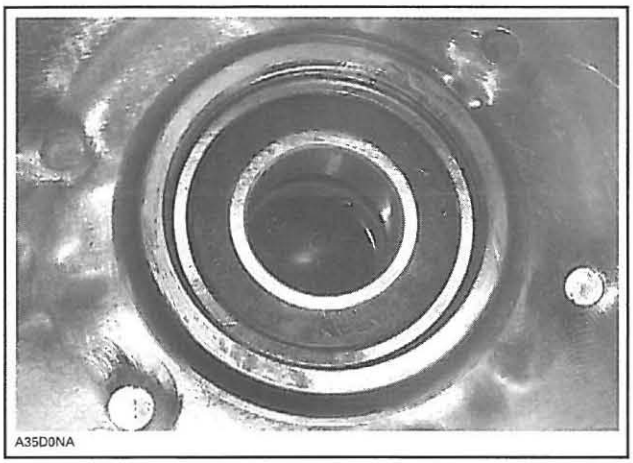
Remove the circlip **no. 33**. Turn the housing and remove the oil seal **no. 31**.

Support the housing around bearing location and push the bearing out of housing with the press.

Installation

The installation is the reverse of the removal procedure.

NOTE: Always install bearings with their seals towards inside of chaincase.


A35D0NA

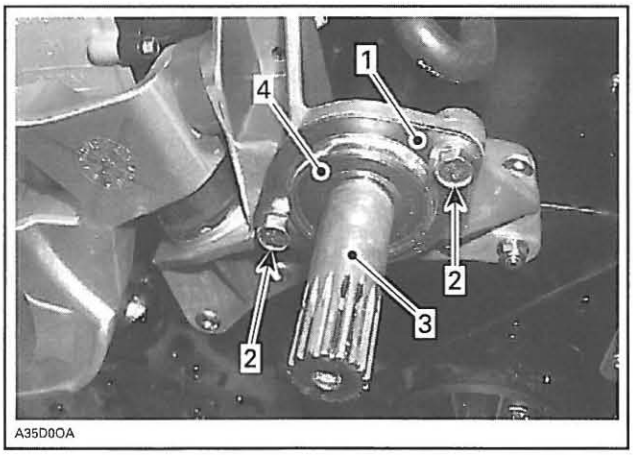
COUNTERSHAFT

Removal

On Left Side of Vehicle:

Remove driven pulley and its shims, refer to *DRIVEN PULLEY*.

Unscrew the bearing flange bolts **no. 34** and remove the bearing flange **no. 35**.

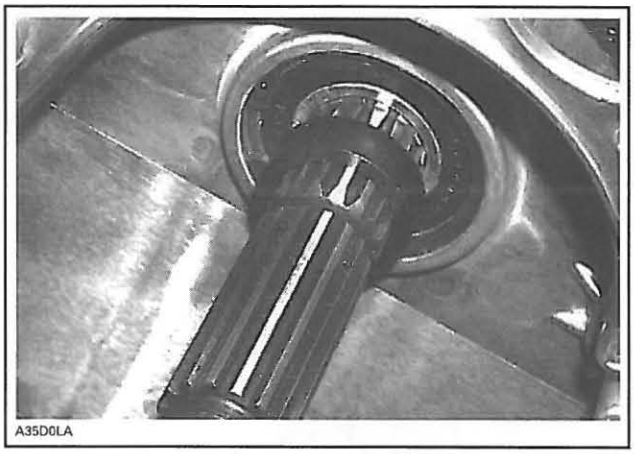


A35D0OA

1. *Bearing flange*
2. *Bearing flange bolts*
3. *Countershaft*
4. *Countershaft bearing*

On the Right Side of Vehicle:

Remove:
- drive chain and sprockets
- spacer **no. 24**.


A35D0LA

Using a plastic hammer, knock on the countershaft **no. 25** until the countershaft bearing comes out of its support.

Remove countershaft.

To remove the countershaft bearing **no. 36**, see *COUNTERSHAFT BEARING* further in this section.

Inspection

Check countershaft for wear, bend or cracks.

Check splines for wear or damages.

Replace countershaft if any damage is detected.

Installation

The installation is the reverse of the removal procedure.

NOTE: If a new countershaft is installed, perform bearing shimming procedure and pulley alignment. Refer to *COUNTERSHAFT BEARING* and *PULLEY ALIGNMENT*.

COUNTERSHAFT BEARING

Inspection

No play must be felt between countershaft bearing **no. 36** and countershaft **no. 25**.

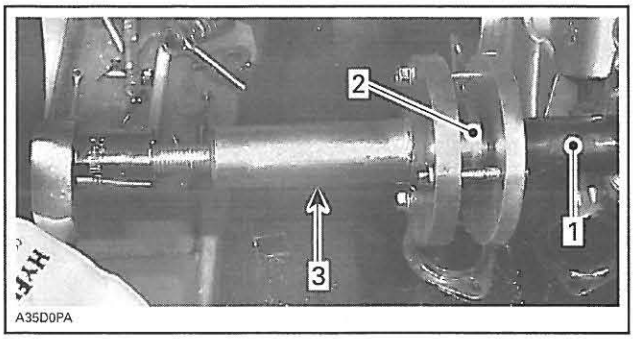
Check if the bearing turns smoothly and freely.

Replace bearing if any damage is detected.

Removal

Remove the countershaft, see procedure above.

Install the countershaft bearing remover/installer (P/N 529 035 699) and the countershaft bearing remover/installer bolt (P/N 529 036 010) on the end of countershaft to remove the bearing.



1. Countershaft
2. Countershaft bearing
3. Countershaft bearing remover/installer

Remove bearing and its shim(s) **no. 37**.

Discard the bearing.

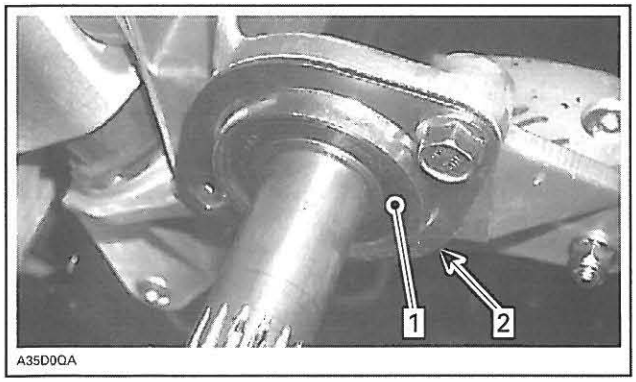
CAUTION: Never use a countershaft bearing a second time, each time when it is removed it must be replaced by a new one.

Installation

NOTE: If a new countershaft or a new bearing support is installed, it will be necessary to measure shims thickness between bearing and countershaft shoulder.

Shimming Procedure

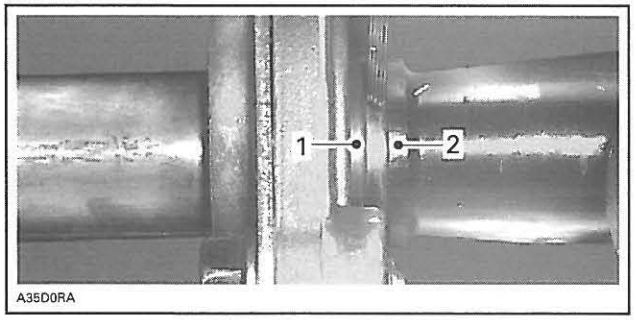
To perform the measurement of shims, install the countershaft measurement tool (P/N 529 036 009) instead of the countershaft bearing **no. 36** and install the bearing flange **no. 35**.



1. Countershaft measurement tool
2. Bearing flange

CAUTION: The countershaft measurement tool is a countershaft bearing modified. Never use the tool instead of the bearing. Damages to the countershaft, support and chaincase could occur.

Using a feeler gauge, measure the gap between inner race of bearing and countershaft shoulder.



1. Bearing inner race
2. Countershaft shoulder

Round up or down to the nearest 0.5 mm (.020 in).

Use the following table to select the proper shim(s).

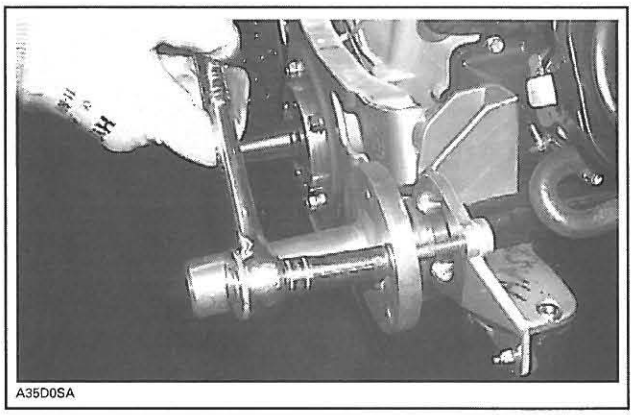
SHIM CHART	
SHIM P/N	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

Countershaft Bearing Installation

Remove countershaft measurement tool from countershaft.

Install shim(s) then place the new countershaft bearing on countershaft.

Install the countershaft bearing remover/installer (P/N 529 035 699) and push bearing in its location.



Install all other removed parts in the reverse order of their removal.

DRIVE AXLE

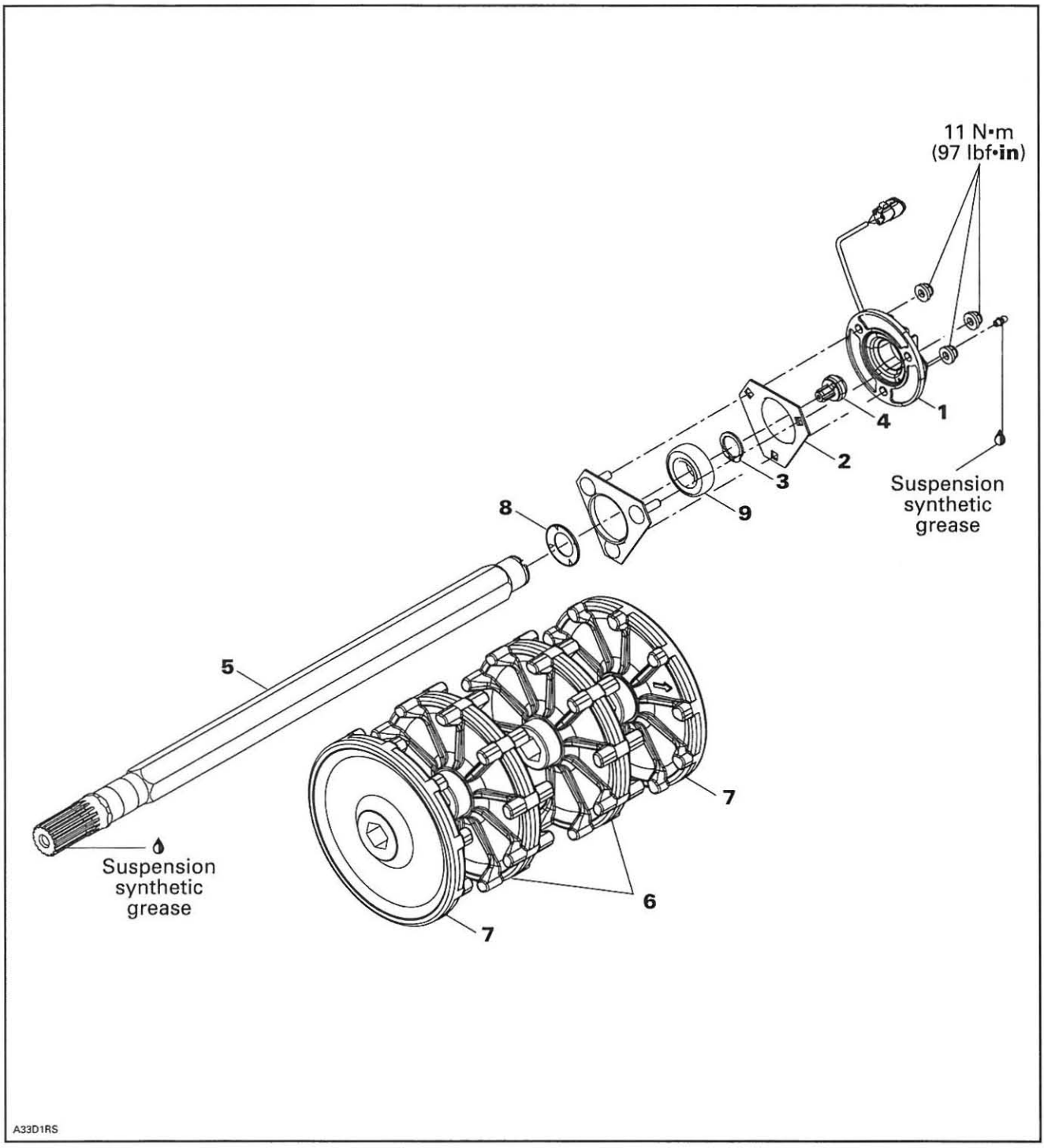
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	268

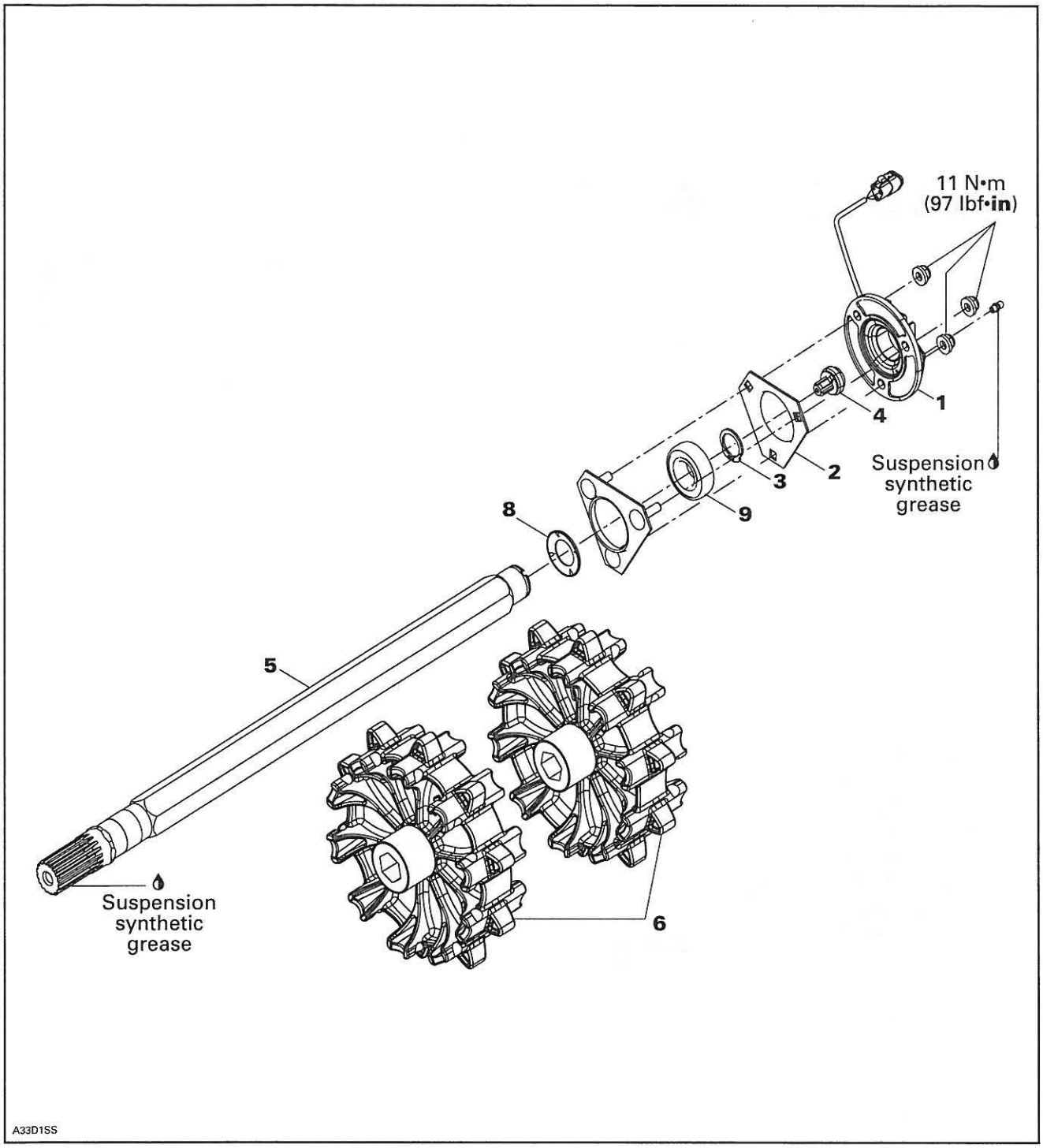
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	269

MACH Z and MX Z Renegade X Models



SUMMIT Highmark and SUMMIT Highmark X Models



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

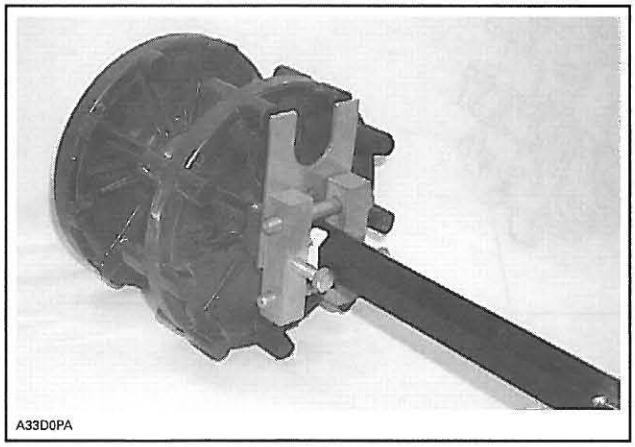
Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Sprocket/Track Alignment

CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets may be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



PROCEDURES

DRIVE AXLE

Removal

Remove battery (if so equipped), battery rack and toehold to gain access.

Drain oil from chaincase.

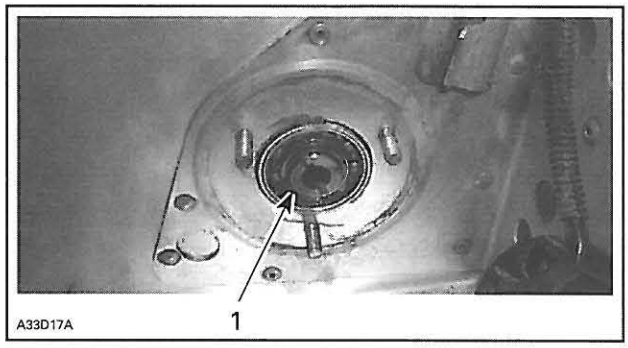
Raise and block rear of vehicle off the ground.

Remove rear suspension. Refer to proper subsection.

Remove driven pulley. Refer to *DRIVEN PULLEY*.

Remove speedometer sensor **no. 1**, outer flange **no. 2** and speedometer magnetic adapter **no. 4** from drive axle **no. 5**.

Remove circlip **no. 3**.



TYPICAL
1. Circlip

Remove chaincase cover, chain and sprockets. Refer to *CHAINCASE*.

Remove circlip on drive shaft.

Release drive axle sprocket from track and at the same time, push the drive axle **no. 5** toward the right side. Drive axle bearing in chaincase will fall off.

Remove bearing and move the drive axle towards the left side to remove it from vehicle.

Inspection

Check drive axle for bending, wear or other damages. Replace as required.

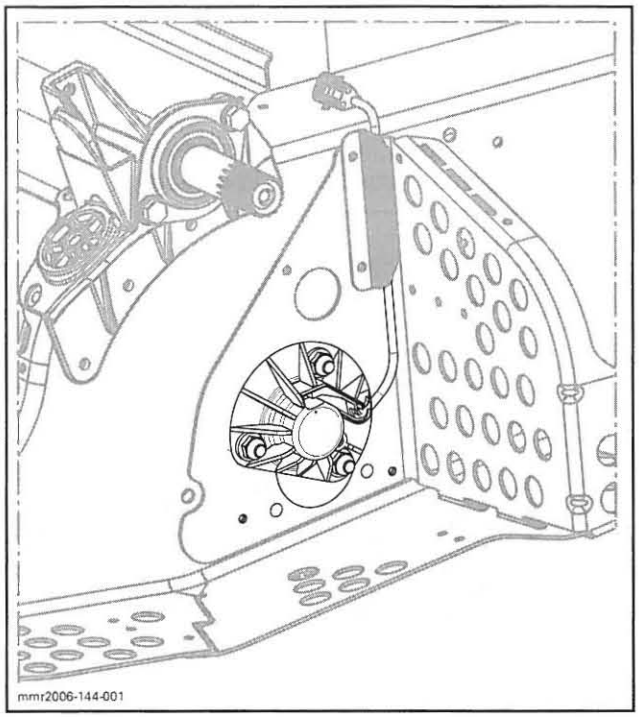
Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

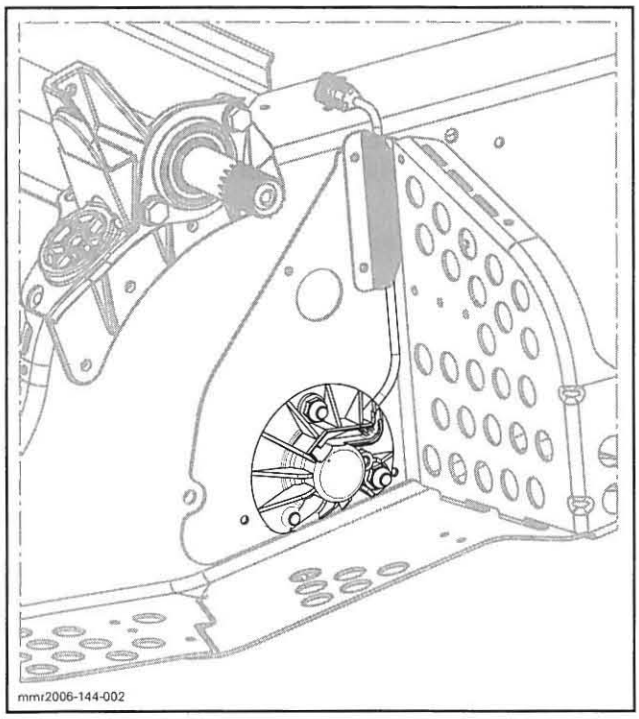
Index speedometer magnetic adapter **no. 4** in drive axle and push until it is completely inserted in its hole.

The drive axle bearing in chaincase must have its shield facing cover.

Install speedometer in accordance with the following illustrations.



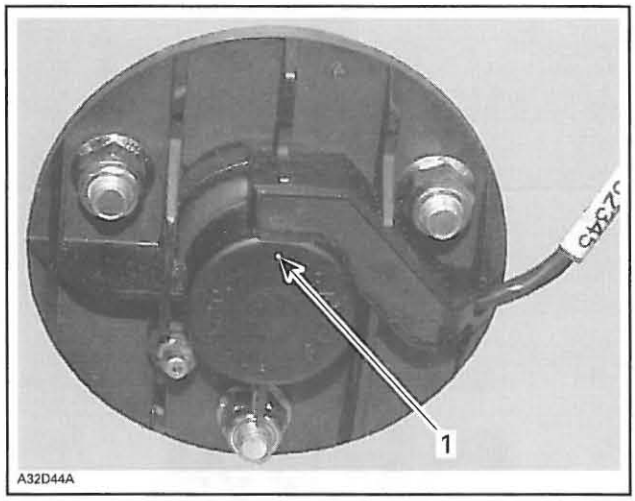
MACH Z AND MX Z RENEGADE X



SUMMIT

Lubrication

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.



1. Lubricate until grease flows out here

DRIVE AXLE BEARING

Removal

Remove drive axle from vehicle.

Using a suitable puller, remove bearing **no. 9** from drive shaft.

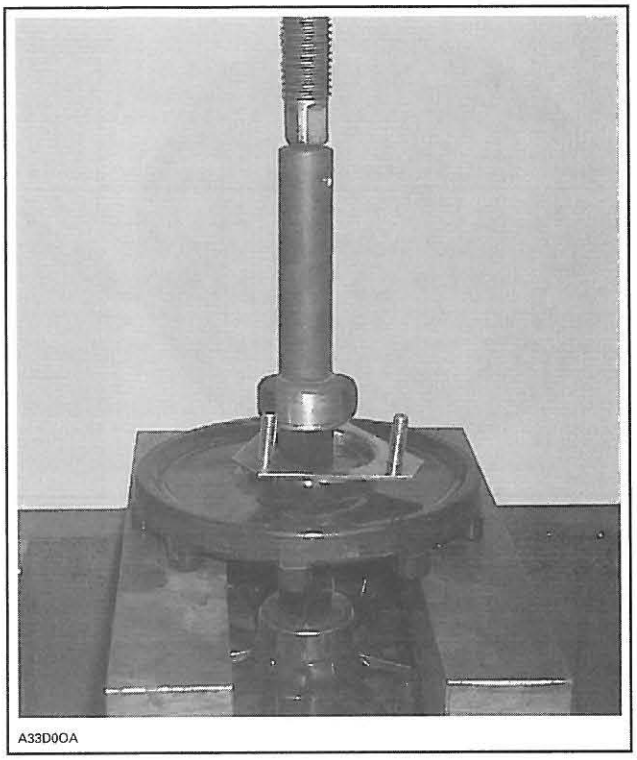
Inspection

Before removing bearing from drive shaft, check if it turns smoothly and freely. Replace if necessary.

Installation

Install bearing protector **no. 8** and one bearing flange on drive axle. Install bearing protector so that its flat side is against bearing.

Using a press and a suitable pipe, push the bearing. Always push bearing by inner race. Push bearing until it leans on its protector.


A33D0OA

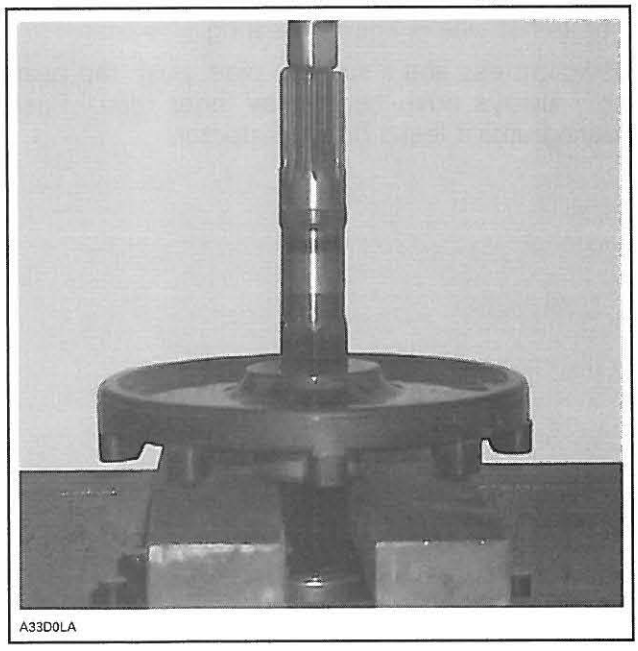
Install drive axle and all other removed parts.

SPROCKETS

Removal

Remove drive axle from vehicle.

To remove press fit sprockets **no. 6** and **no. 7**, use a press and a suitable support as illustrated.

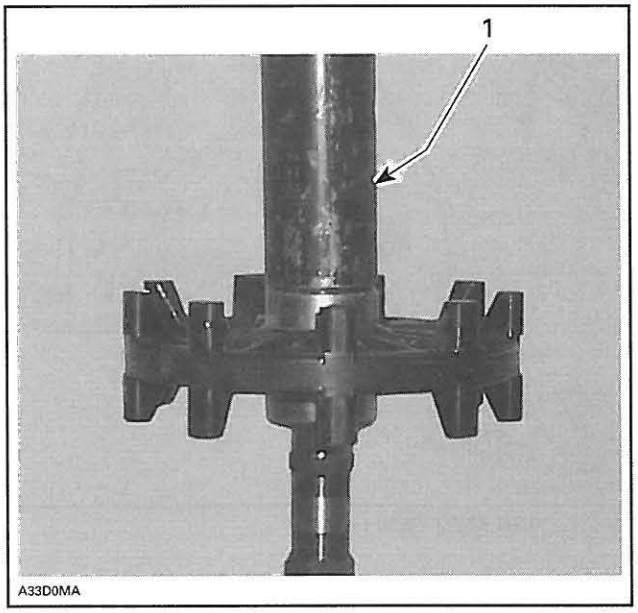

A33D0LA

SUPPORT SPROCKET NEAR HUB

Installation

CAUTION: The same sprocket must not be pressed twice on the axle.

To assemble press fit sprockets **no. 6** and **no. 7**, use a press and a suitable pipe as illustrated.

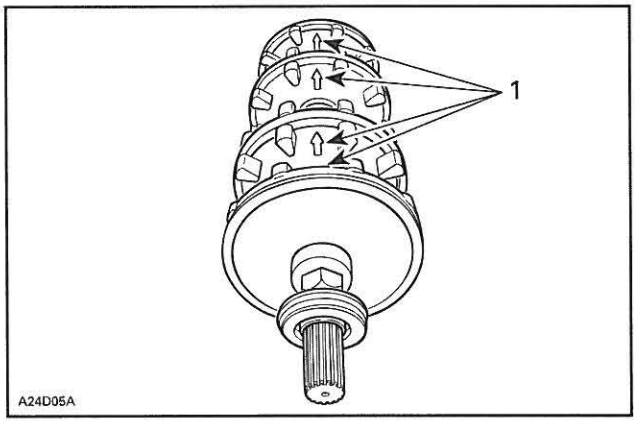


A33D0MA

1. Pipe

CAUTION: Never allow sprockets to contact the press plates and never support sprockets with blocks. Always press on center hub with appropriate pipe.

Ensure to align indexing marks of each sprocket when assembling.

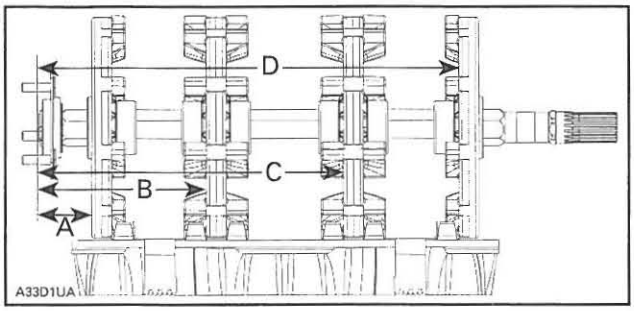


A24D05A

TYPICAL
1. Indexing marks aligned

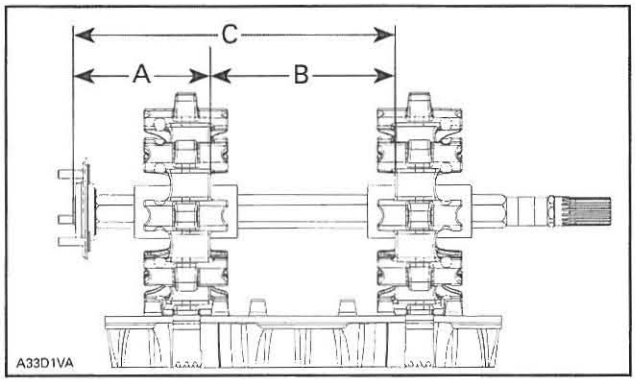
Sprockets must be assembled according to the following dimensions measured from drive axle end.

MACH Z and MX Z Renegade X Models



MEASURE FROM END OF DRIVE SHAFT
A. 48.3 mm (1.902 in)
B. 150.8 mm (5.937 in)
C. 273.8 mm (10.780 in)
D. 376.3 mm (14.815 in)

Summit Highmark and Summit Highmark X Models



MEASURE FROM END OF DRIVE SHAFT
A. 132.2 mm (5.205 in)
B. 178.1 mm (7.0118 in)
C. 310.4 mm (12.220 in)

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	274
cleat remover	529 028 700	273
narrow-cleat installer	529 028 800	273

INSPECTION

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones.

⚠ WARNING

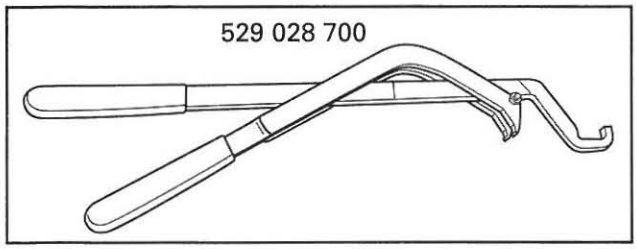
Do not operate a snowmobile with a cut, torn or damaged track.

REPAIR

Track Cleat

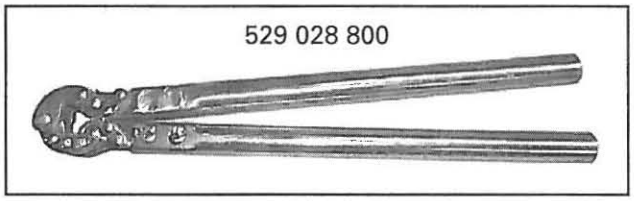
Removal

- Raise rear of vehicle off the ground and lift snow guard then hand rotate track to expose a cleat to be replaced.
- Use track cleat remover (P/N 529 028 700) for all models.

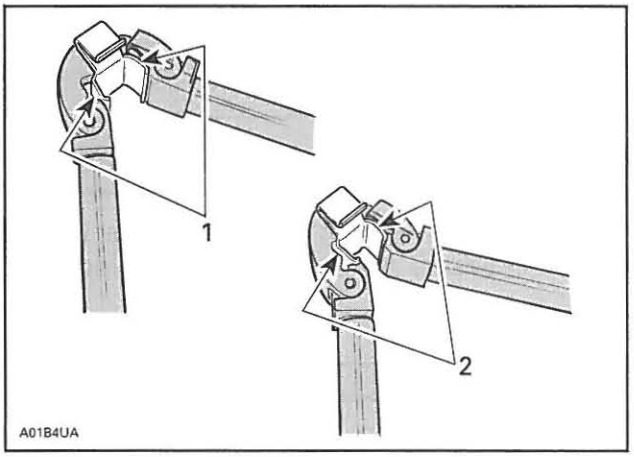


Installation

- Place new cleat in position on the track and using the narrow-cleat installer (P/N 529 028 800) bend cleat then push tabs into rubber.



- Re-open installer, then position cleat tabs on open end of tool and squeeze tabs until they are indented in rubber.



TYPICAL
1. *First step*
2. *Second step (to push tabs into rubber)*

REMOVAL

Remove the following parts:
- rear suspension (refer to *SUSPENSION*)
- drive axle (refer to *DRIVE AXLE*)
- track.

INSTALLATION

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Check sprocket/track alignment as described in *DRIVE AXLE*.

ADJUSTMENT

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Tension

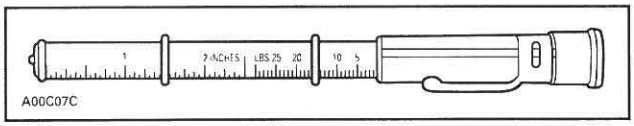
NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

Lift snowmobile by a rope, chain or lift strap hooked to rear bumper.

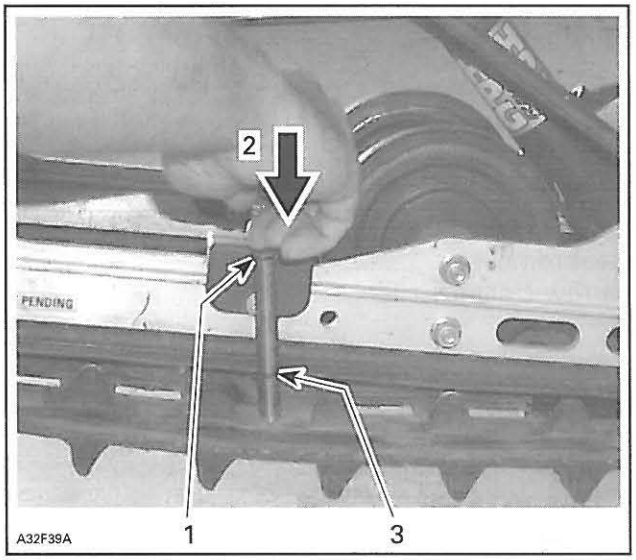
Allow the rear suspension to fully extend and check gap halfway between front and rear idler wheels. Measure between slider shoe bottom and inside of track. The gap should be as given in the following table. If the track tension is too loose, track will have a tendency to thump.

TRACK ADJUSTMENT	
TRACK ADJUSTMENT FORCE	7.3 kgf (16 lbf)
TRACK MINIMUM DEFLECTION	30.00 mm (1.181 in)
TRACK MAXIMUM DEFLECTION	35.00 mm (1.378 in)

The belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

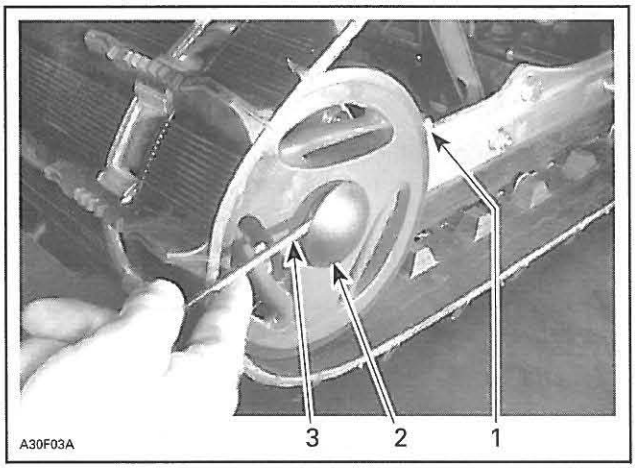


1. *Tool top O-ring positioned at 7.3 kgf (16 lbf)*
2. *Apply pressure on tool until it contacts the upper O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To adjust tension, do the following:

- Remove wheel caps.
- Loosen the rear idler wheel retaining screws.
- Turn adjustment screws to adjust.



TYPICAL
1. *Adjustment screw*
2. *Retaining screw*
3. *Wheel cap removal*

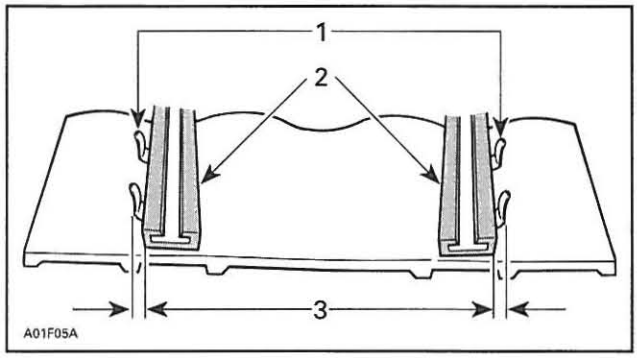
Alignment

⚠ WARNING

Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

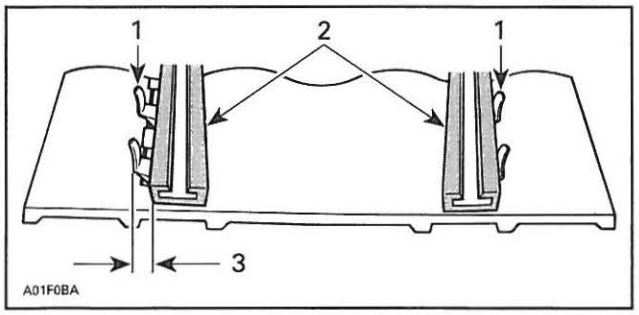
Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (1 to 2 minutes).

Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. Guides
2. Slider shoes
3. Equal distance

To correct, stop engine, loosen rear wheel screws, then tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.



1. Guides
2. Slider shoes
3. Tighten on this side

Restart engine, rotate track slowly and recheck alignment. If the satisfactory alignment is achieved, then tighten the idler wheel retaining screws to 48 N•m (35 lbf•ft). Reinstall the wheel caps.

TRACTION ENHANCING PRODUCTS (studs)

Important Safety Rules

⚠ WARNING

To prevent serious injury to individuals near the snowmobile:
- **NEVER stand behind or near a moving track.**
- **ALWAYS use a wide-base snowmobile stand with a rear deflector panel.**
- **When the track is raised off the ground, only run it at lowest possible speed.**

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

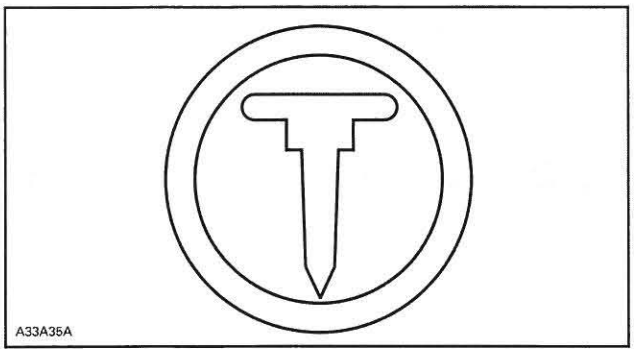
Effects of Studding on the Life of the Snowmobile

The use of traction enhancing products can increase the load and the stress on certain snowmobile components, as well as the vibration level. This can cause premature wear on parts such as belts, brake lining, bearings, chain, and chaincase sprockets, and shorten track life. For this reason, it is even more important to follow the detailed maintenance program given in the *MAINTENANCE CHART*.

Studs can also cause serious damage to the snowmobile if it is not equipped with the tunnel protectors designed for the particular model. Damage to the electrical wiring or perforation of the heat exchangers are potential hazards, that could cause the engine to overheat and be severely damaged.

⚠ WARNING

If tunnel protectors are excessively worn or not installed, the gas tank could be punctured, causing a fire.



APPROVED TRACKS CAN BE IDENTIFIED BY THIS SYMBOL

Maintenance/Replacement

A visual inspection of the track should be performed before each use.

Look for any defects, such as:

- perforations in the track
- tears in the track (particularly around traction product holes)
- lugs that are broken or torn off, exposing portion of rods
- delamination of the rubber
- broken rods
- broken studs
- bent studs
- studs that are torn off the track
- missing track guide(s).

Replace broken or damaged studs immediately. If the track shows signs of deterioration, it must be replaced immediately. In doubt, replace the track.

⚠ WARNING

Riding with a damaged track or studs could lead to loss of control, resulting in a risk of serious injury or death.

Installation

To install studs, refer to the manufacturer's instructions.

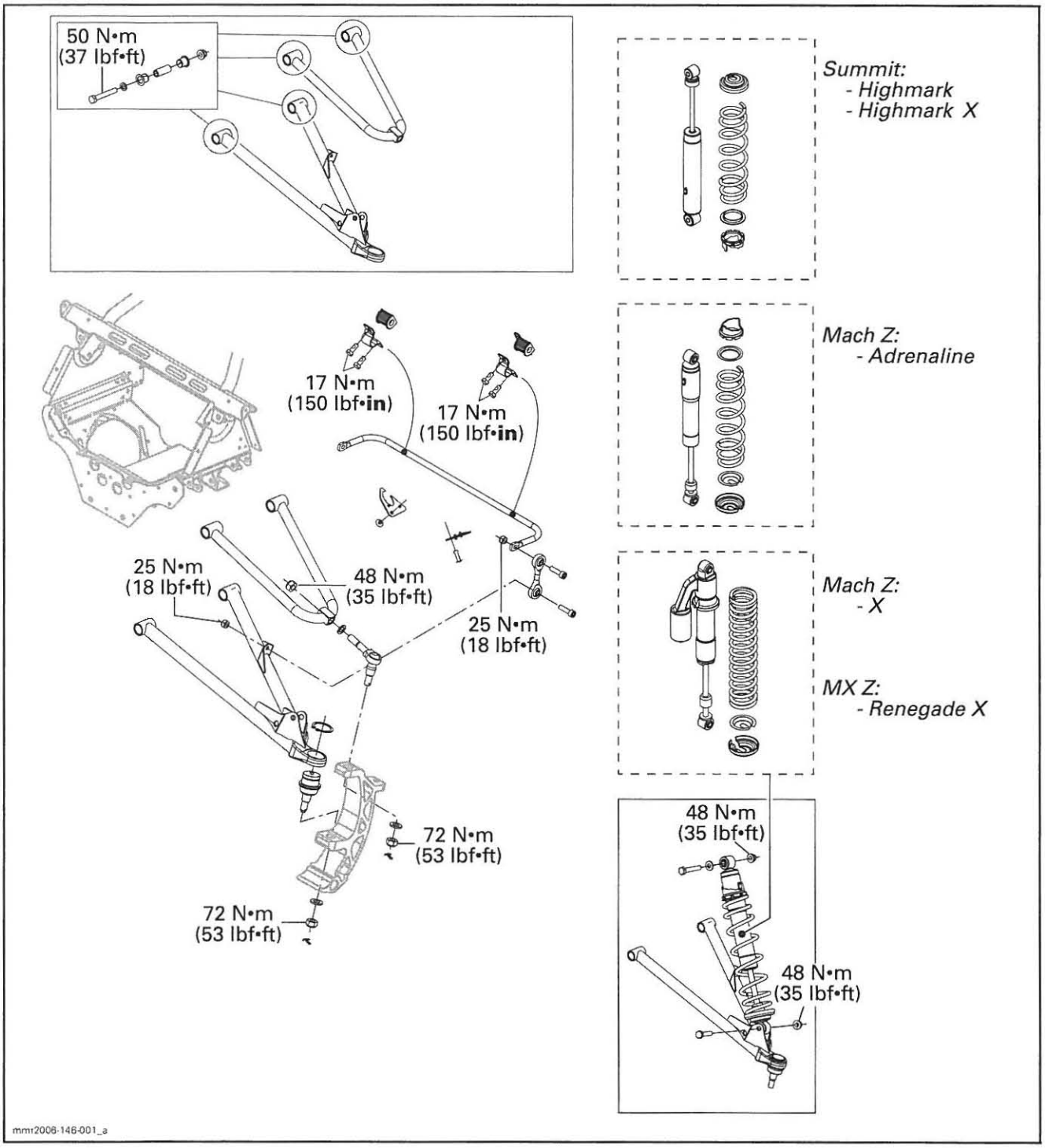
TRACK		MODELS		PROTECTOR KIT (P/N)
PROFILE HEIGHT	TRACK LENGTH			
25.4 mm (1 in)	3.07 m (121 in)	Mach Z	Adrenaline	861 802 800
			X	861 802 800
31.8 mm (1.25 in)	3.07 m (121 in)	Mach Z	Adrenaline	861 786 400
			X	861 786 400
	3.45 m (136 in)	MX Z	Renegade X	861 786 400

NOTE: Take care, different protector type must be used if a RipSaw track is installed.

R.A.S. FRONT SUSPENSION

SERVICE TOOLS

Description	Part Number	Page
A-arm nut wrench	529 035 876	283
ball joint installer	529 035 975	283
ball joint lock tool	529 035 945	283
ball joint remover	529 035 827	281–282
ball joint remover support	529 035 873	282
ball joint support	529 035 875	283
spring compressor tool	529 036 007	280


50 N•m
(37 lbf•ft)
17 N•m
(150 lbf•in)
17 N•m
(150 lbf•in)
25 N•m
(18 lbf•ft)
48 N•m
(35 lbf•ft)
25 N•m
(18 lbf•ft)
72 N•m
(53 lbf•ft)
72 N•m
(53 lbf•ft)
Summit:
- Highmark
- Highmark X
Mach Z:
- Adrenaline
Mach Z:
- X
MX Z:
- Renegade X
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
mmr2006-146-001_a

GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise noted.

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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

Check for looseness, bent, worn out, rusted or other damage on components. Ensure cotter pins are in good condition and properly secured. Replace the faulty component.

To check upper arm bushings and ball joint:
- Let vehicle weight compress the suspension.
- Firmly grab upper part of ski leg and try to move sideways to feel the free-play.
- If excessive play is felt, replace the faulty component.

To check lower arm bushings and ball joint:
- Raise front of vehicle off the ground from the frame to release the suspension.
- Firmly grab lower part of ski leg and try to move sideways to feel the free-play.
- If excessive play is felt, replace the faulty component.

PROCEDURES

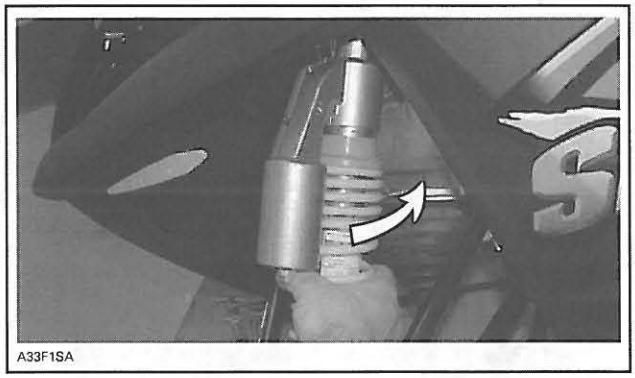
SHOCK ABSORBER AND SPRING

Removal

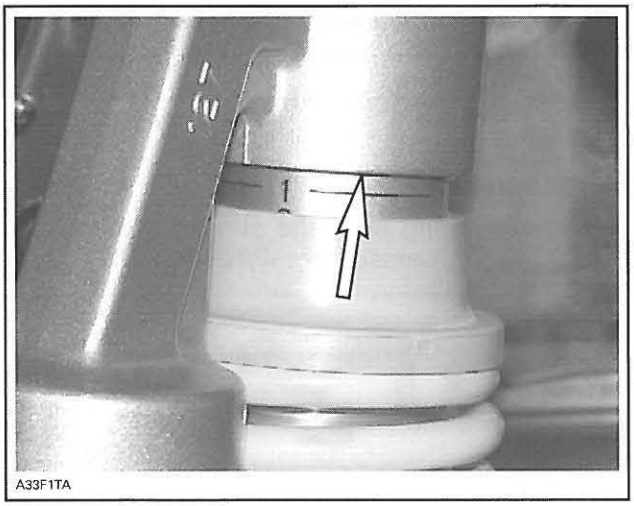
Open hood and remove side panels.

X Models except SUMMIT Highmark X

Reduce spring preload by turning adjusting ring towards position 1 and continue until it stops.


A33F1SA

TYPICAL


A33F1TA

TYPICAL

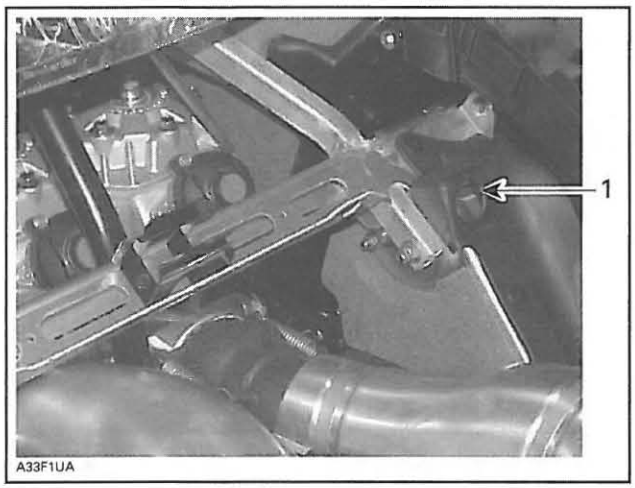
MACH Z Adrenaline Models

Reduce spring preload by turning adjusting cam accordingly.

All Models

Remove lower screw then upper screw of shock absorber.

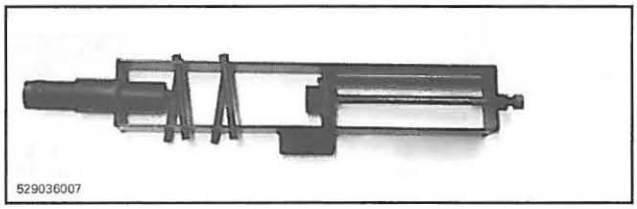
NOTE: To retain upper screw while unscrewing nut, remove access plug in engine compartment.



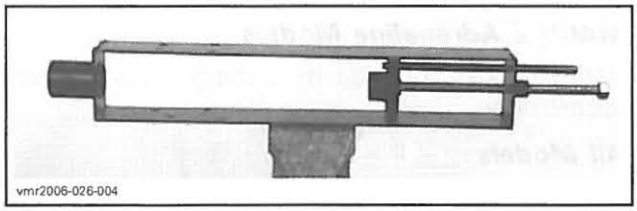
TYPICAL
1. Access hole to reach upper screw

Disassembly

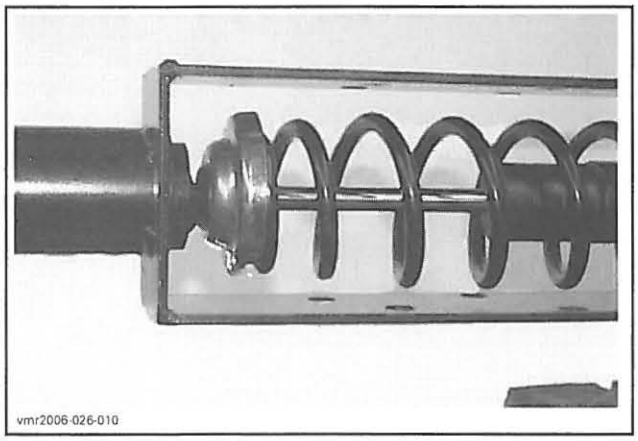
To remove spring from the shock absorber, use the spring compressor tool (P/N 529 036 007).



Place the tool in a vise.

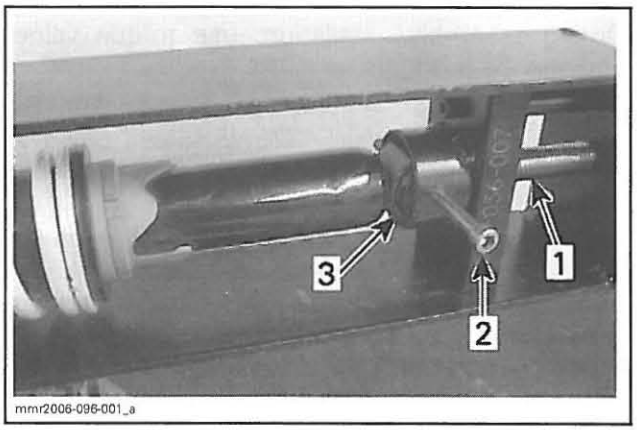


Position the shock absorber in the tool and install the spring compressor pins.



TYPICAL

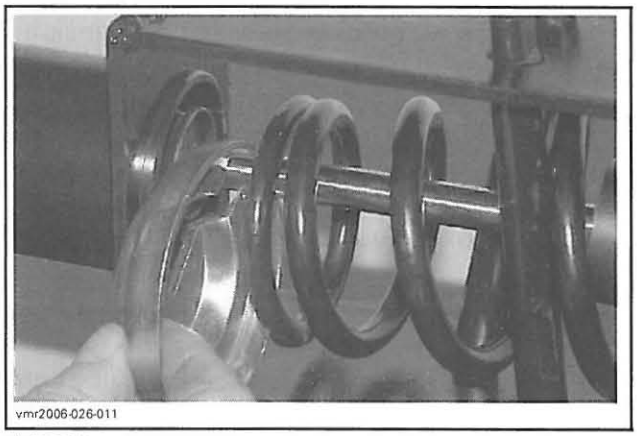
For shock absorbers without reservoir, lock the end of the shock absorber with a bolt or a steel pin.



TYPICAL
1. Spring compressor tool screw
2. Locking device (bolt or steel pin)
3. Shock absorber end

Tighten the spring compressor tool screw until the spring is sufficiently compressed to remove spring locking devices.

Remove spring stopper then release the spring compressor tool screw.



TYPICAL

Inspection

Inspect the spring for damage. Replace if necessary.

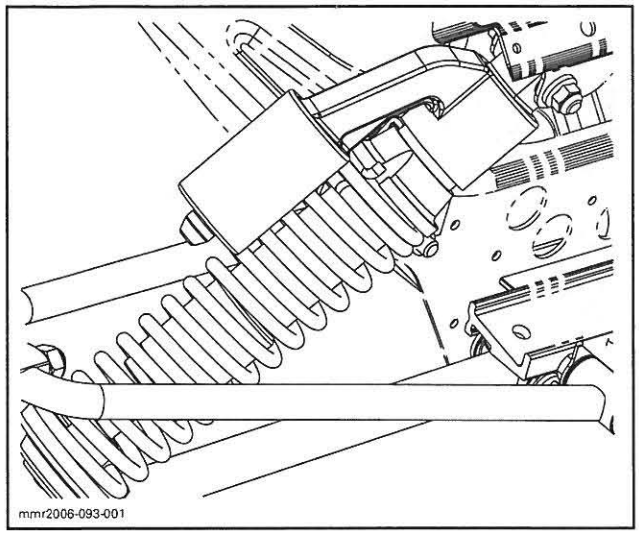
Inspect shock, refer to *SHOCK ABSORBER INSPECTION AND SERVICING.*

Assembly and Installation

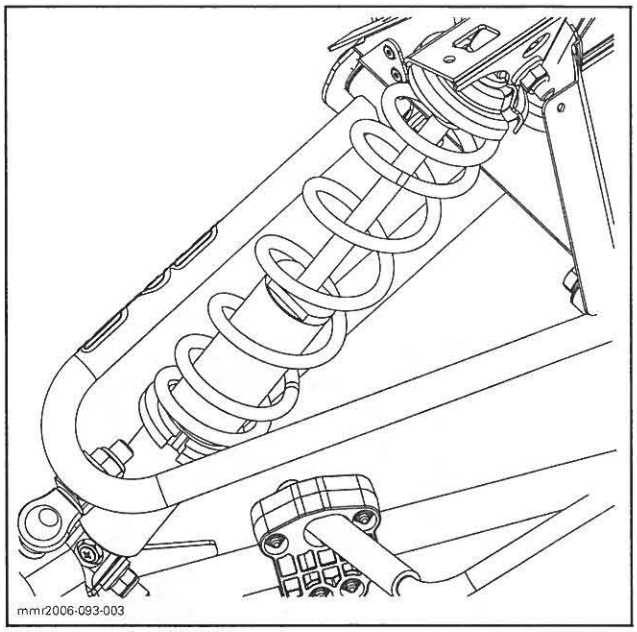
For assembly and installation, reverse the disassembly and removal procedures.

Ensure to reinstall shock absorber in the proper position according to model.

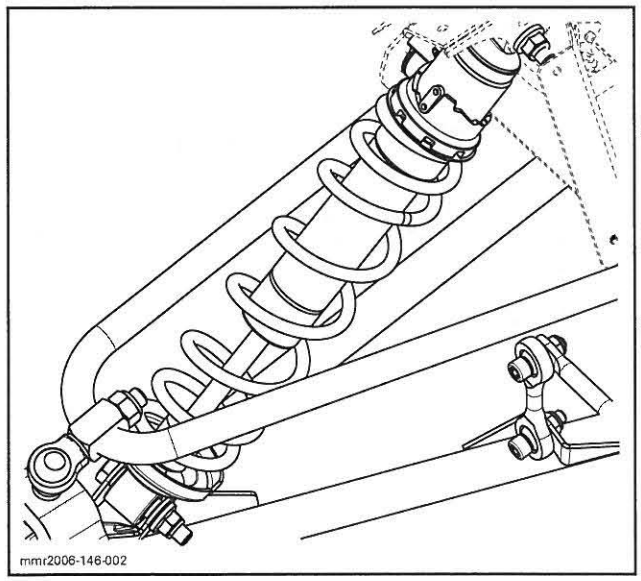
NOTE: Always install shock valve outwards when applicable.



MACH Z X
MX Z RENEGADE X



ALL SUMMIT



MACH Z ADRENALINE

UPPER BALL JOINT

Inspection

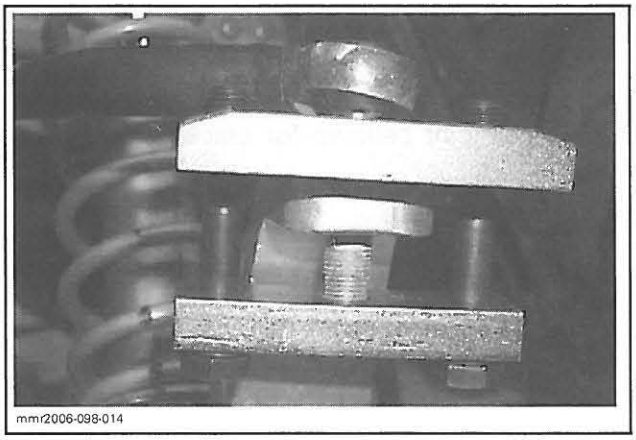
Check both upper ball joints for damage, pitting, looseness and roughness. If so, replace with a new one.

Removal

Remove cotter pin and unscrew ball joint nut. Discard cotter pin.

Position upper suspension arm so that ball joint becomes parallel with ski leg.

Install the ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.

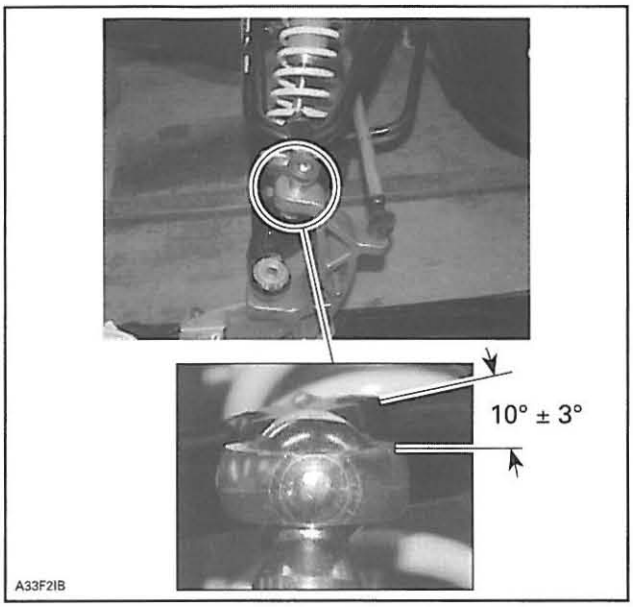


Use a 11 mm (7/16 in) open wrench to hold ball joint housing and unscrew nut , then remove ball joint from upper suspension arm.

Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

When installing upper ball joint, ensure to tilt it with the proper angle as shown. The ball joint housing must be parallel to ski leg tab. This mounting position corresponds to 10° ± 3° angle from upper arm.



Tighten ball joint nut to 72 N•m (53 lbf•ft) and further tighten nut until one of its grooves is aligned with a cotter pin hole.

Install a new cotter pin. Both end of cotter pin must be folded.

LOWER BALL JOINT

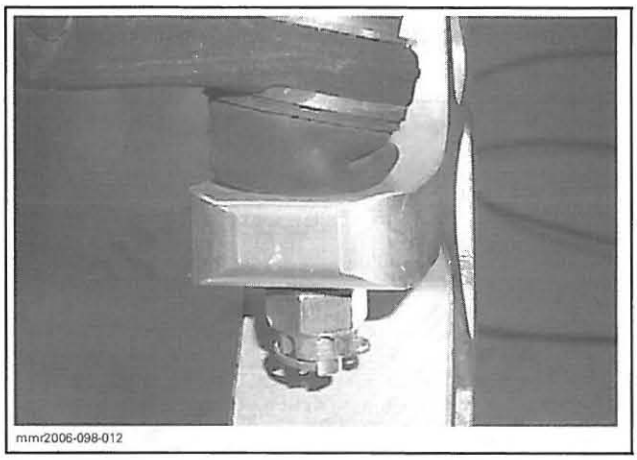
Inspection

Check both lower ball joints for damage, pitting, looseness and roughness. If so, replace with a new one.

Check ball joint bellows for cracks. Replace as required.

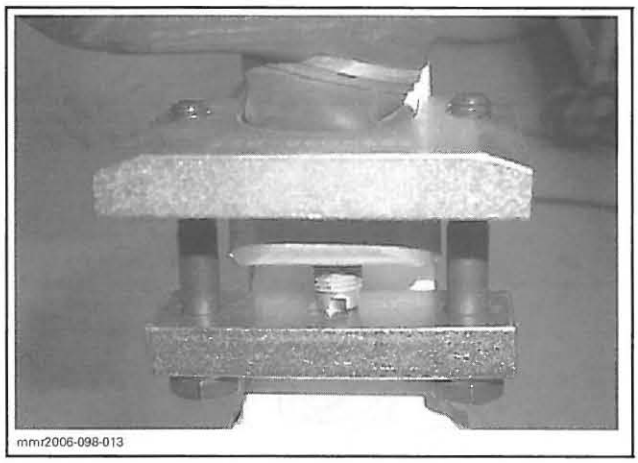
Removal

Remove cotter pin and unscrew ball joint nut. Discard cotter pin



Raise lower arm so that ball joint becomes parallel with ski leg.

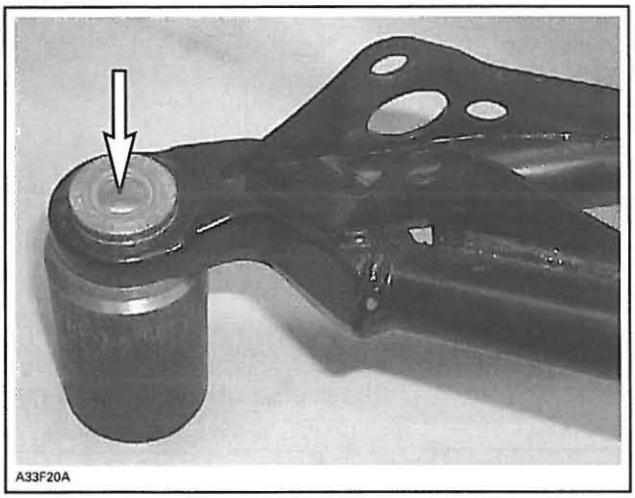
Install the ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.



Remove lower suspension arm from vehicle. Refer to *LOWER SUSPENSION ARM* further in this section.

Remove snap ring.

Install ball joint remover support (P/N 529 035 873) under joint and press ball joint out of lower suspension arm.



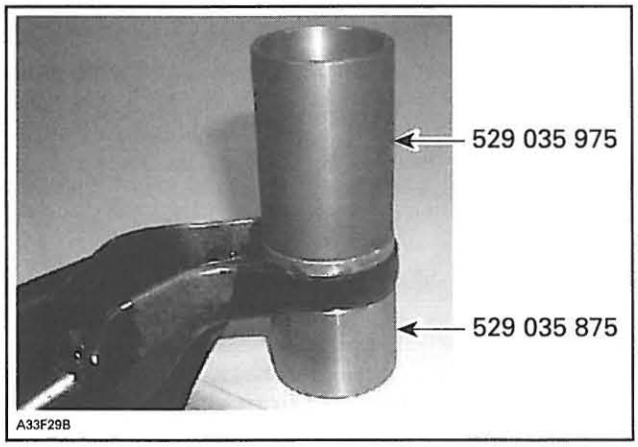
TYPICAL

Installation

Install ball joint support (P/N 529 035 875) on top side of lower arm (operating position).

Position ball joint installer (P/N 529 035 975) on bottom side of lower arm (operating position).

Press joint in.

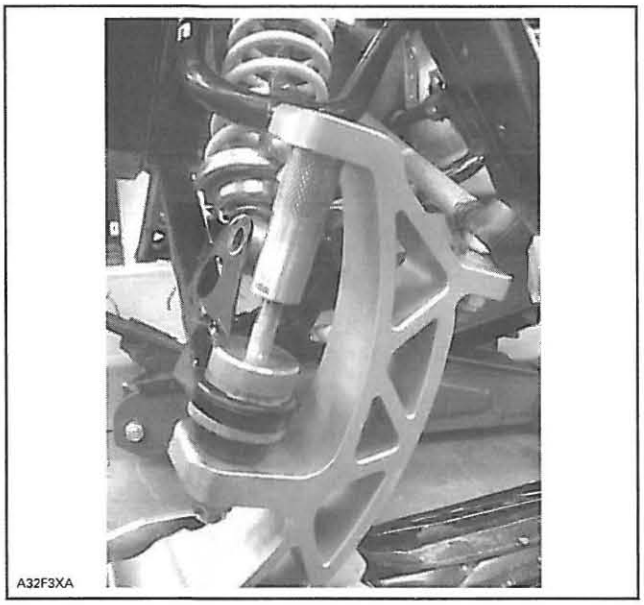


Install snap ring with its opening toward front of vehicle.

Install lower suspension arm on vehicle. Refer to *LOWER SUSPENSION ARM.* further in this section.

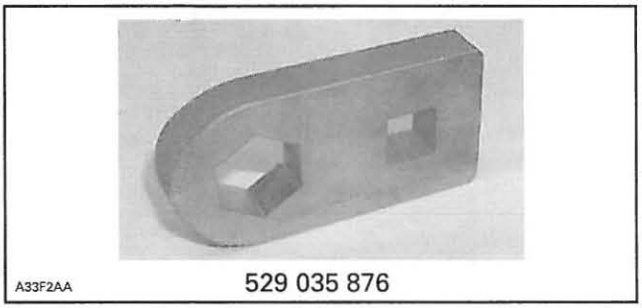
Remove the upper ball joint from ski leg. Refer to *UPPER BALL JOINT* above.

Use ball joint lock tool (P/N 529 035 945) to restrain ball joint during nut tightening.

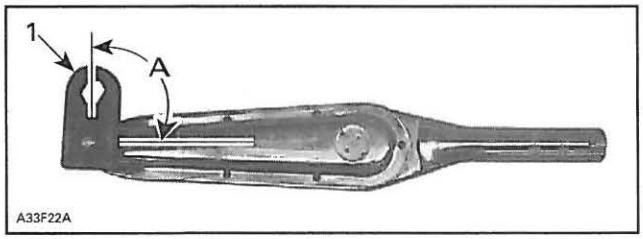


TYPICAL

To properly torque ball joint nut, use the A-arm nut wrench (P/N 529 035 876).



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



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

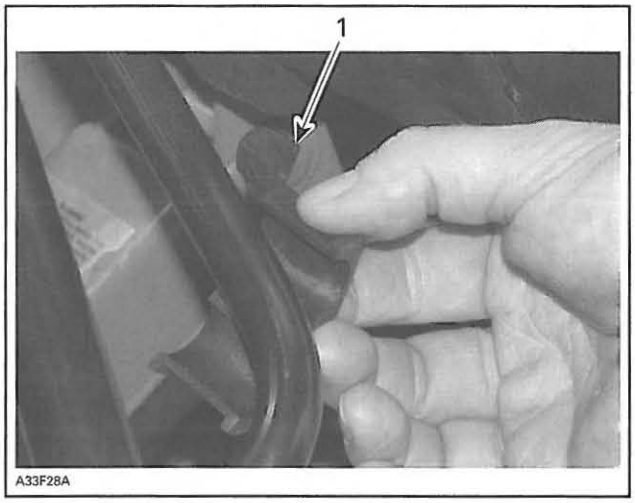
Install all other remove parts.

UPPER SUSPENSION ARM

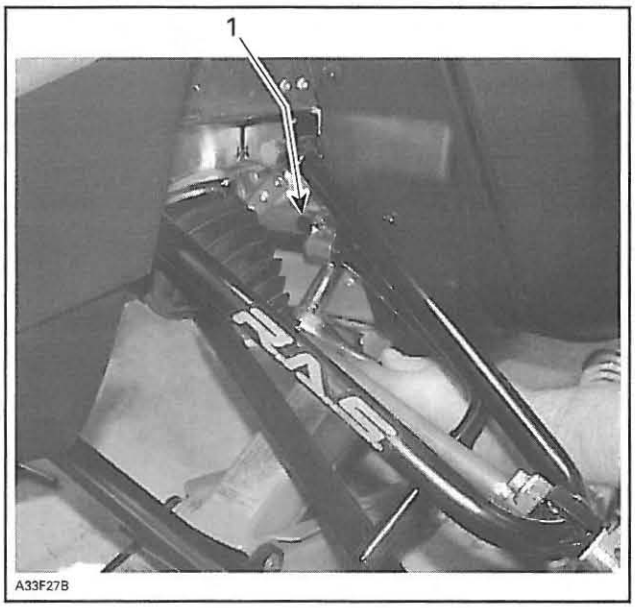
Inspection

Check suspension arm for distortion or damage. Replace if necessary.

Move suspension arm from side to side then up and down. There should be no noticeable loose. Replace bushings and/or sleeves if necessary.



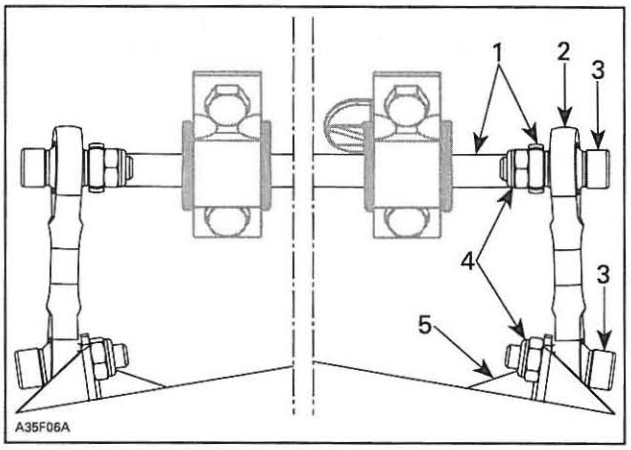
LH SIDE OF VEHICLE
1. *Install bushing as shown*



LH SIDE OF VEHICLE
1. *Tab here to obstruct access hole*

Before attaching double ball joint to stabilizer bar, verify if all ball joints move smoothly and freely. Replace if necessary.

Secure double ball joints to stabilizer bar as per next illustration.



LOOKING FROM THE FRONT OF THE VEHICLE
1. *Stabilizer bar*
2. *Link rod*
3. *Allen socket screw*
4. *Elastic stop nut*
5. *Lower A-arm*

Install all other removed parts.

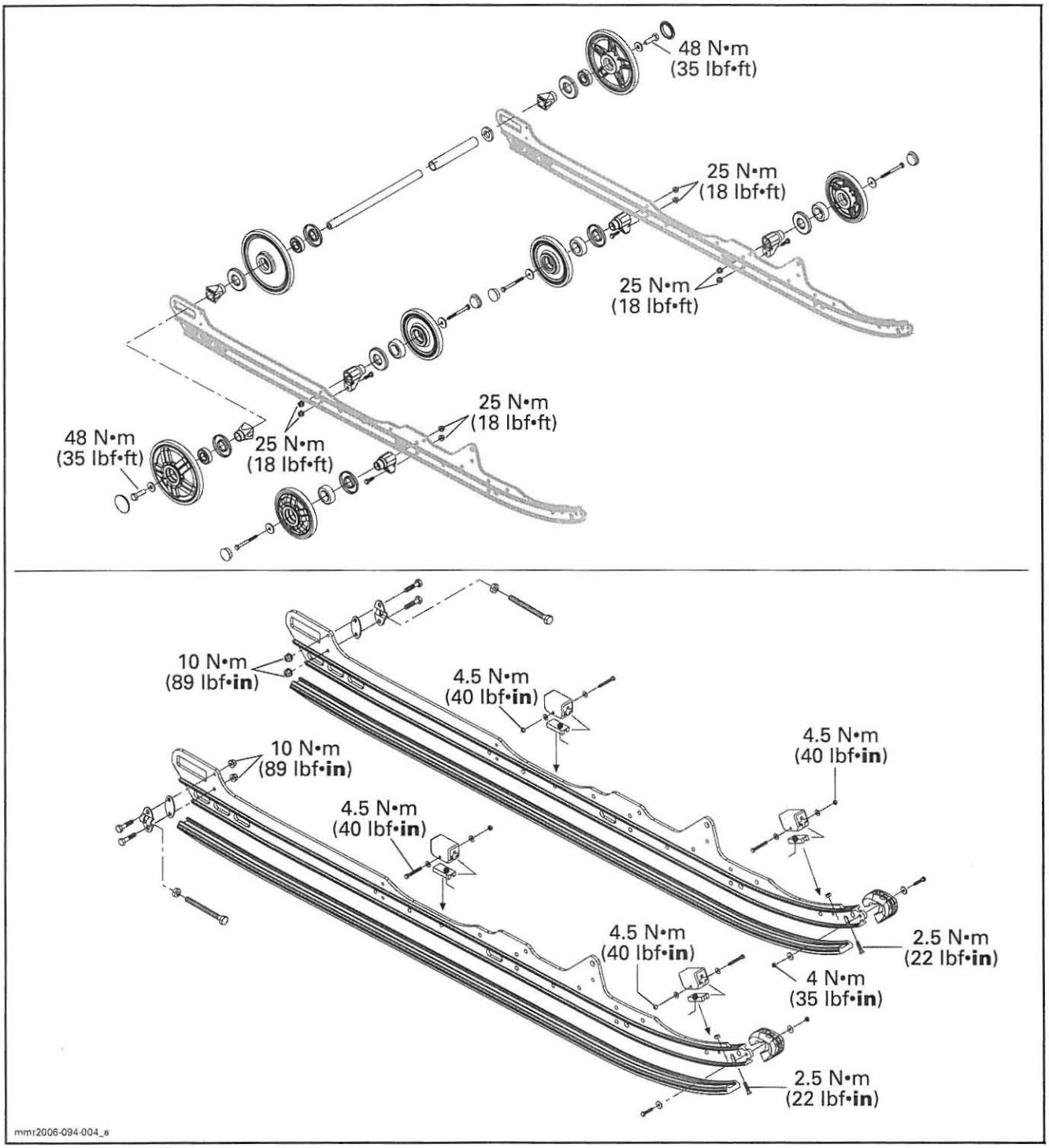
SC REAR SUSPENSION

SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	295–296

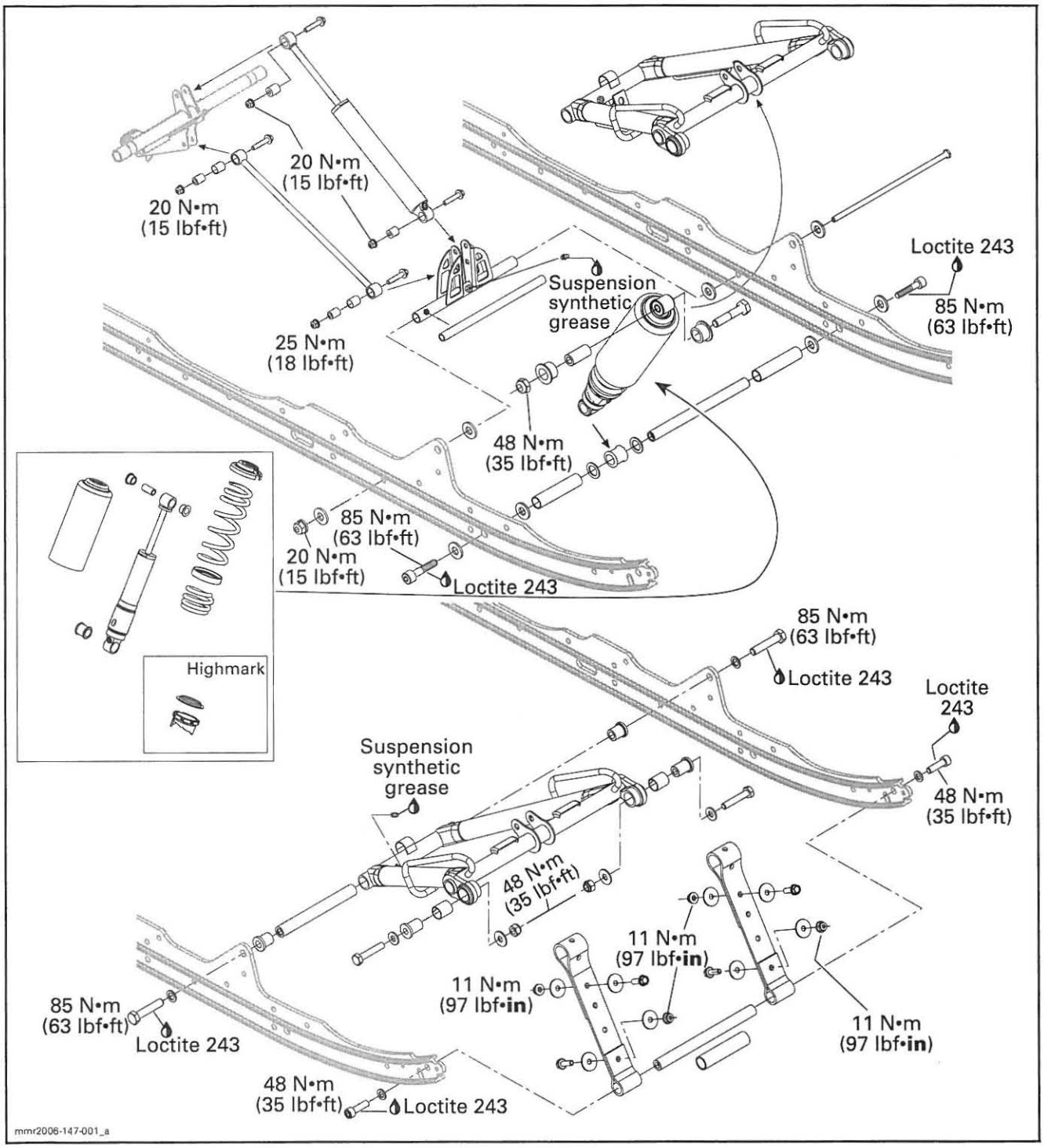
RAILS AND IDLER WHEELS

Summit Highmark and Summit Highmark X Models



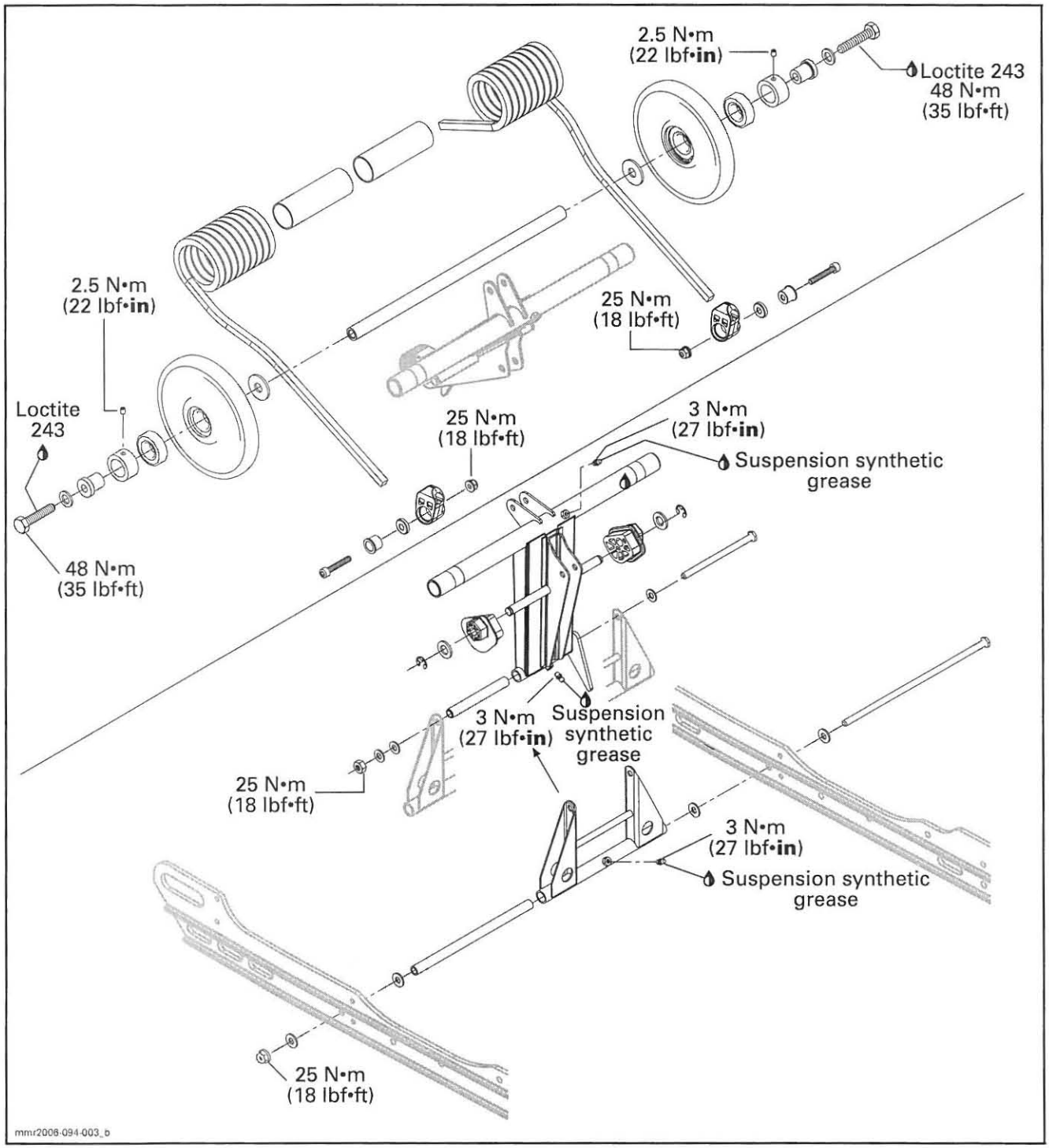
FRONT ARM AND SHOCK ABSORBERS

Summit Highmark and Summit Highmark X Models



REAR ARM, SPRINGS AND TOP IDLER WHEELS

Summit Highmark and Summit Highmark X Models



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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

Suspension Adjustment

To adjust the rear suspension, refer to the appropriate *OPERATOR'S GUIDE*.

PROCEDURES

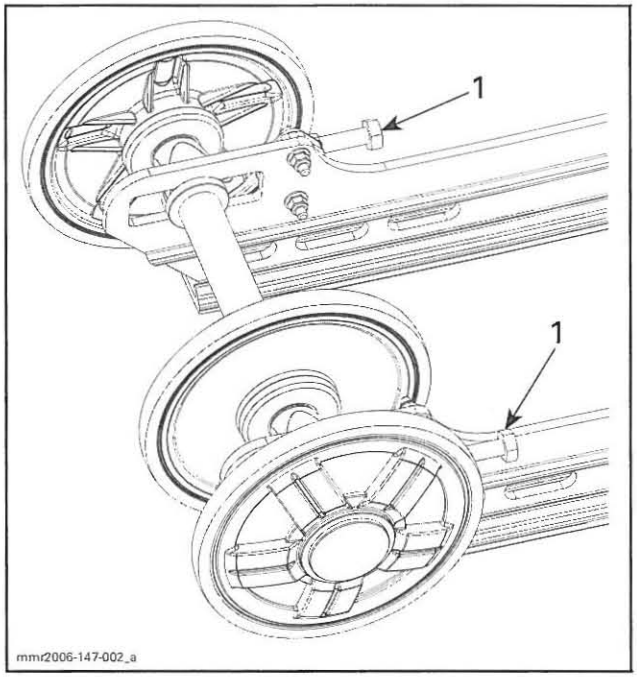
NOTE: The following components can be removed with suspension in place. For suspension assembly removal, refer to *SUSPENSION ASSEMBLY* further in this section.

REAR AXLE

Removal

Lift rear of vehicle and support it off the ground.

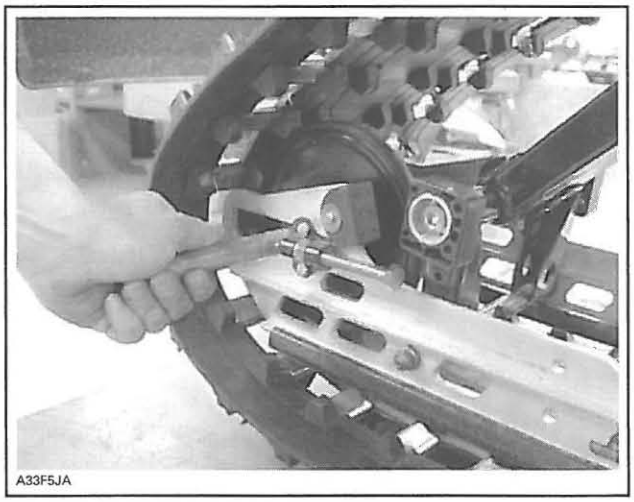
Completely loosen track tension.



TYPICAL
1. Completely loosen track tension

Remove rear idler wheel screws on rear axle.

Pull out rear axle from RH side of vehicle.



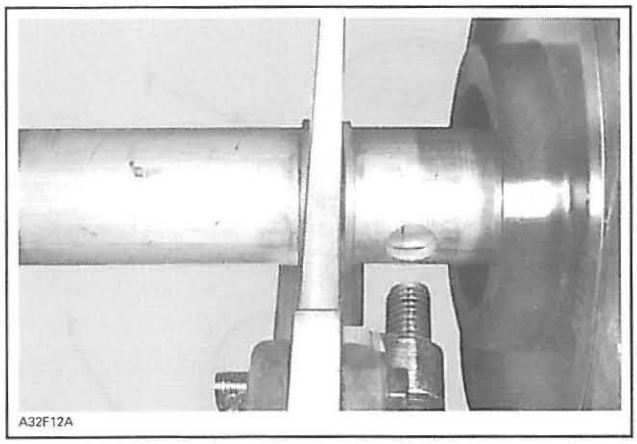
TYPICAL — PULL OUT REAR AXLE

Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

Hole of outer bushing must face adjustment screw.

Make sure to reinstall washer on each side of runner.



OUTER BUSHING POSITION

REAR SHOCK ABSORBER

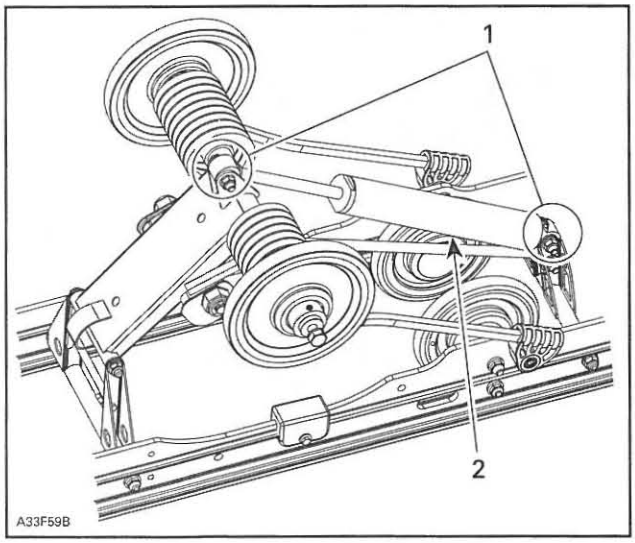
Removal

Lift rear of vehicle and support it off the ground.

Remove shock upper and lower bolt and nut.

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove rear shock absorber.



TYPICAL
1. *Upper/lower bolt and nut*
2. *Rear shock absorber*

Installation

Installation is the reverse of removal procedure.

CAUTION: Take care not to damage grease fitting.

NOTE: If applicable, install shock absorber valve upwards.

FRONT SHOCK ABSORBER

Removal

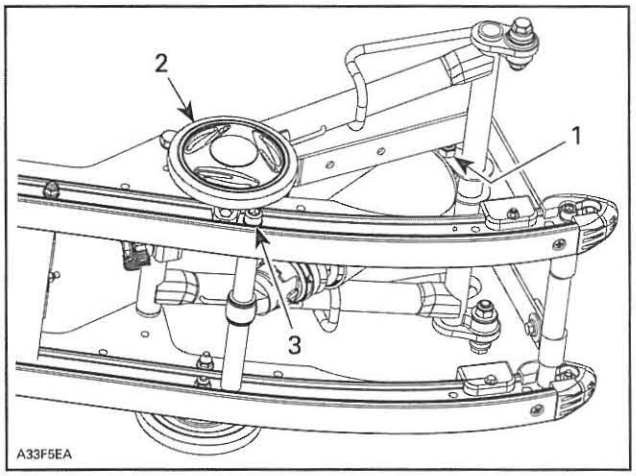
Lift rear of vehicle and support it off the ground.

Unfasten one end of stopper straps to release shock pressure.

Unbolt front shock from the top.

Remove the front idler wheels to gain access to the axle retaining self-locking screws.

Unbolt axle screws and slide out axle to remove shock.



TYPICAL
1. *Front shock upper bolt and nut*
2. *Idler wheel*
3. *Axle screw*

Installation

Installation is the reverse of removal procedure.

REAR SPRING

Removal

Lift rear of vehicle and support it off the ground.

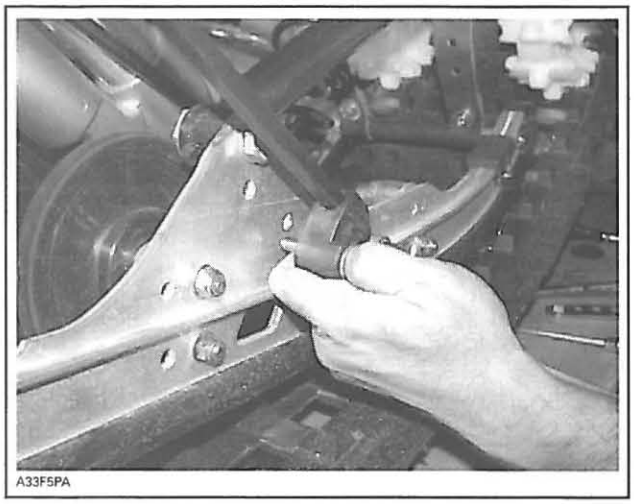
Decrease spring preload by turning cams accordingly.

Unbolt rear arm top axle from chassis.

Remove spring supports.

⚠ WARNING

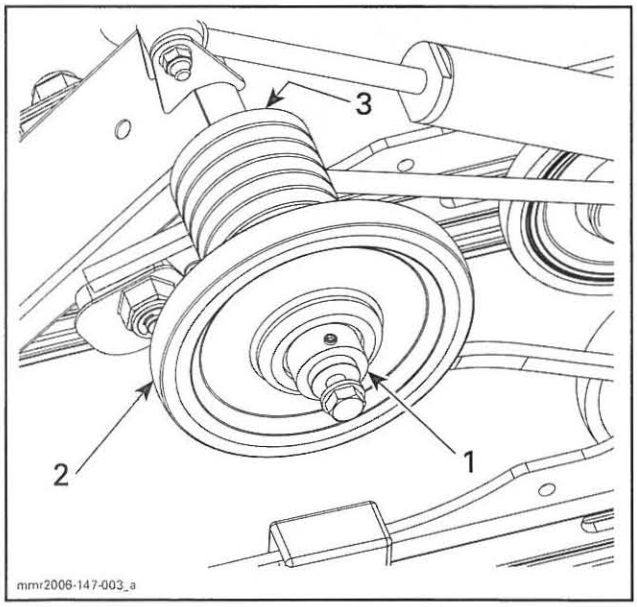
Supports are spring loaded.



TYPICAL — REMOVE SPRING SUPPORTS

Loosen set screw from locking rings.

Remove the following on both sides:
- locking ring
- top idler wheel
- spring.



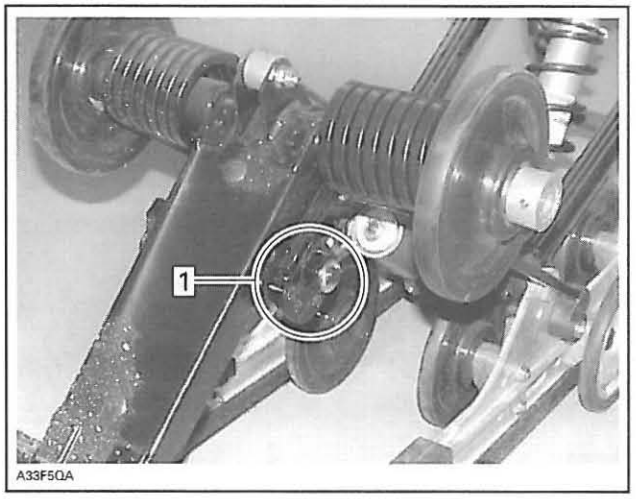
1. Locking ring
2. Top idler wheel
3. Spring

Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

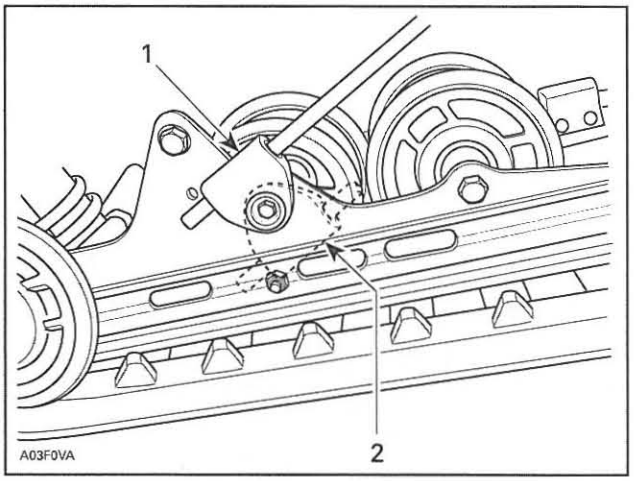
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



TYPICAL — ON BOTH SIDES
1. Spring end in cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.

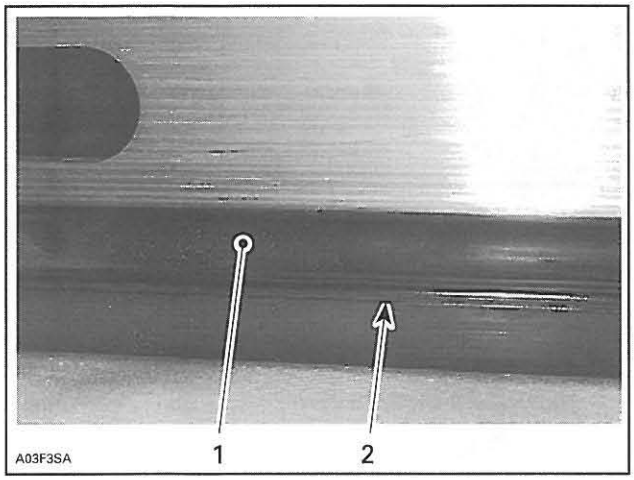


TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

SLIDER SHOE

Inspection

Replace slider shoes when the wear reach 1 - 2 mm (.040 - .079 in) beyond the moulding line.



TYPICAL
1. Slider shoe
2. Molding line

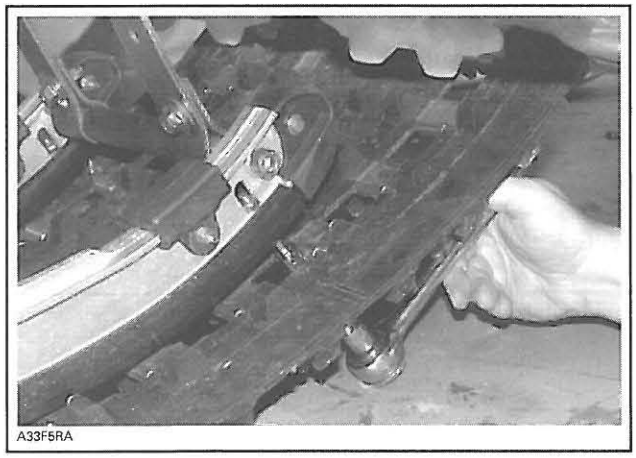
CAUTION: Slider shoes must always be replaced in pairs.

Removal

Lift rear of vehicle and support it off the ground.

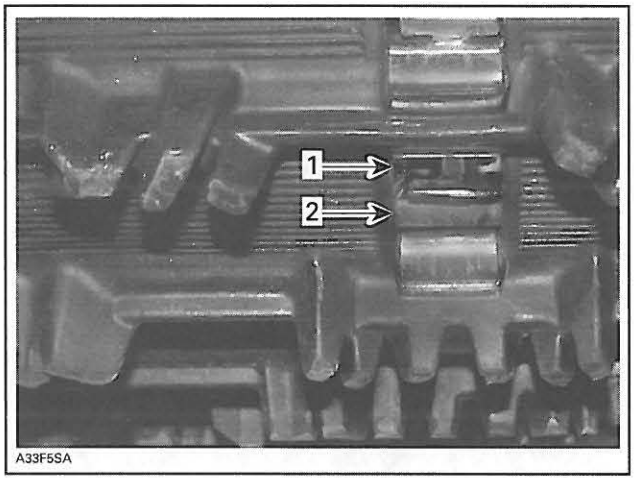
Completely loosen track tension.

Remove front runners nut and screw.



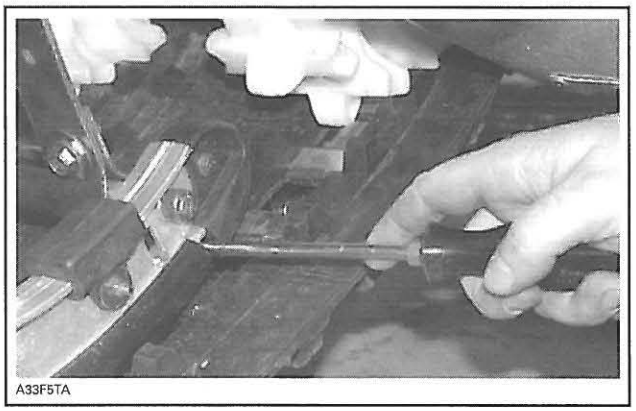
TYPICAL — REMOVE NUT AND SCREW

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

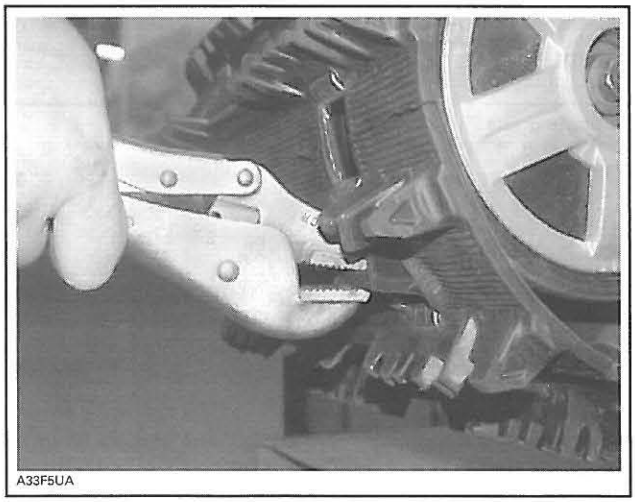
Using a pry bar or screwdriver, push slider shoe until it comes in contact with track.



TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe through track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



TYPICAL — PULL ON SLIDER SHOE TO REMOVE

Installation

Installation is reverse of removal procedure. Pay attention to the following detail.

Make sure to insert slider shoe end with hole first.

FRONT ARM

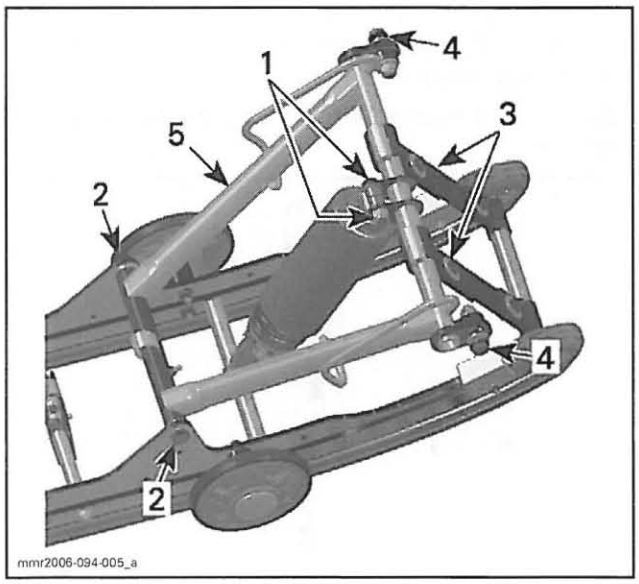
Removal

Lift rear of vehicle and support it off the ground.

Remove the following:

- shock upper bolt and nut
- front arm lower bolts and washers
- one end of stopper strap
- front arm upper bolts, nuts and washers.

Remove front arm.



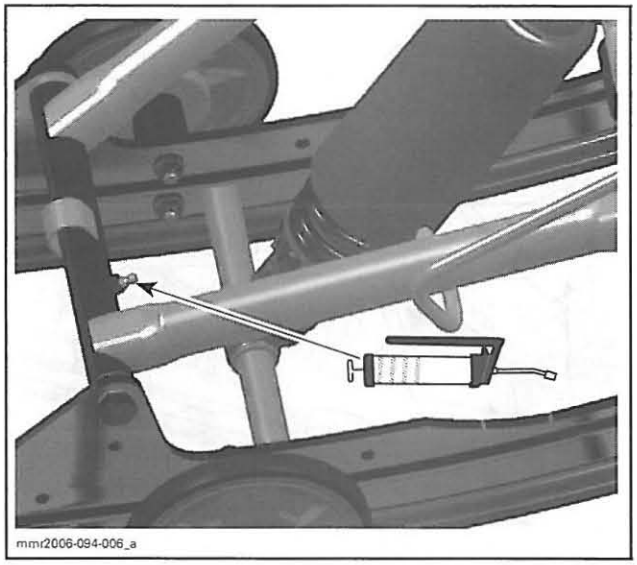
ALL SUMMIT
1. *Shock upper bolt and nut*
2. *Front arm lower bolts and washers*
3. *Unfasten one end of stopper straps*
4. *Front arm upper bolts, nuts and washers*
5. *Front arm*

Installation

Installation is reverse of removal procedure.

Lubrication

Lubricate front arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



REAR ARM

Removal

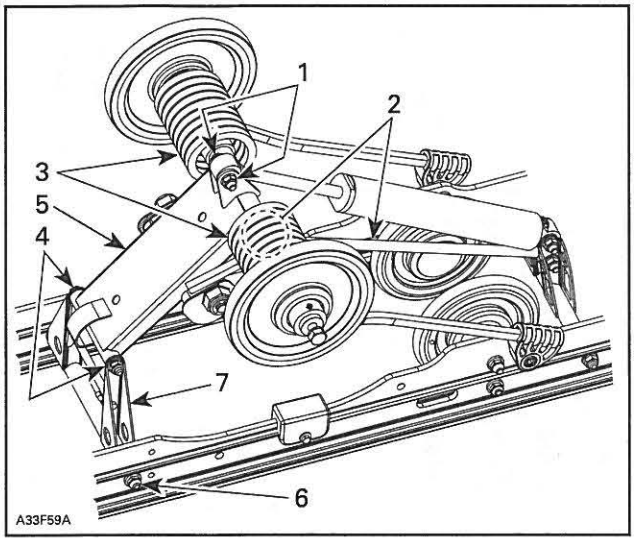
For rear arm removal, remove the following:

- shock upper bolt and nut
- throttle rod upper bolt and nut
- rear springs (refer to procedure above in this section)
- screws and washers holding rear arm to pivot arm.

Remove rear arm.

For pivot arm removal, remove bolt, nut and washers holding pivot arm to runners.

Remove pivot arm.

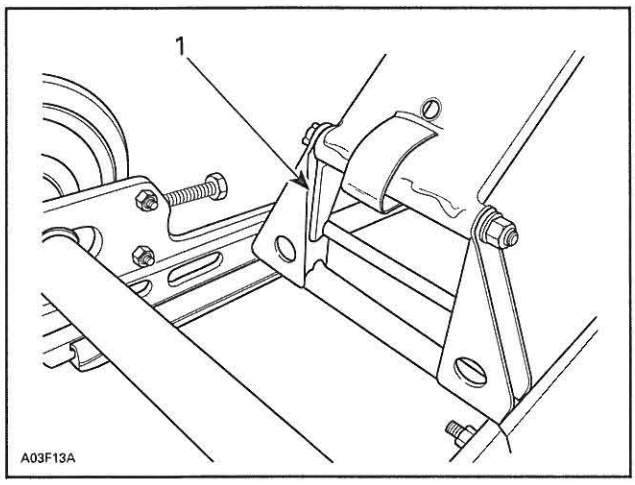


TYPICAL
1. *Shock upper bolt and nut*
2. *Throttle rod upper bolt and nut*
3. *Rear springs*
4. *Rear arm/pivot arm screws and washers*
5. *Rear arm*
6. *Pivot arm/runners bolts, nuts and washers*
7. *Pivot arm*

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

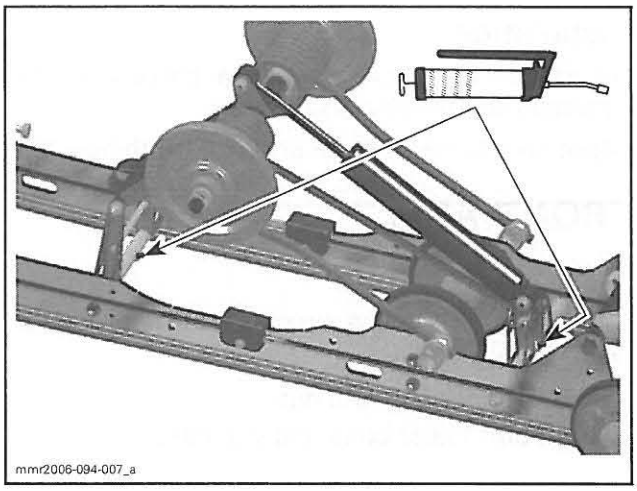
At installation, rear arm stroke limiter must be on rear side.



1. *Stroke limiter on rear side*

Lubrication

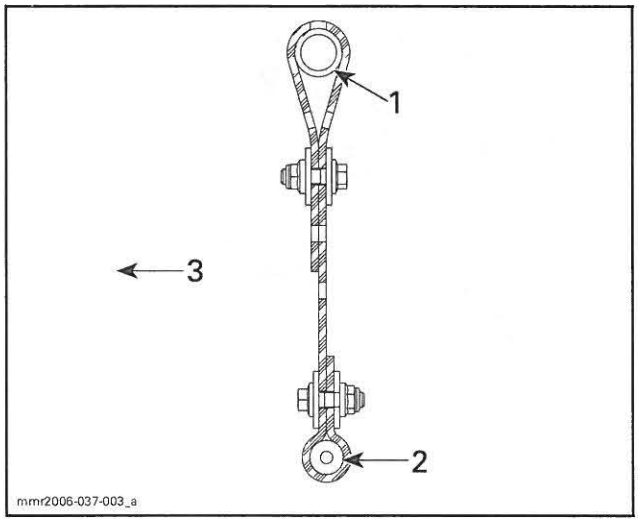
Lubricate rear arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.



POSITION 3-2
1. *Front arm (top)*
2. *Front axle*
3. *Rear of vehicle*

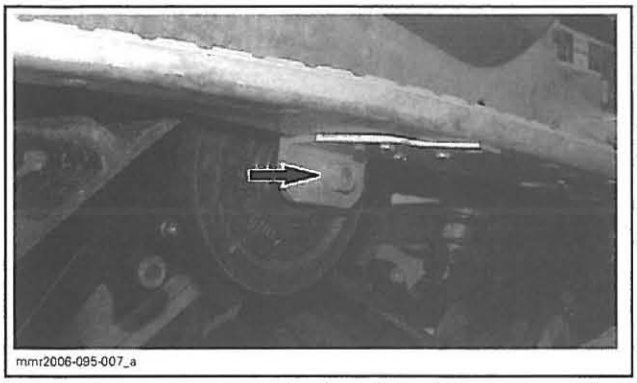
SUSPENSION ASSEMBLY

Removal

Lift rear of vehicle and support it off the ground.

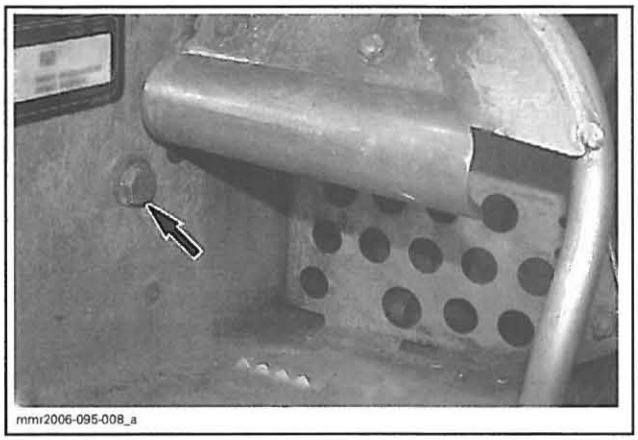
Completely loosen track tension.

Remove rear arm top axle bolts from chassis.



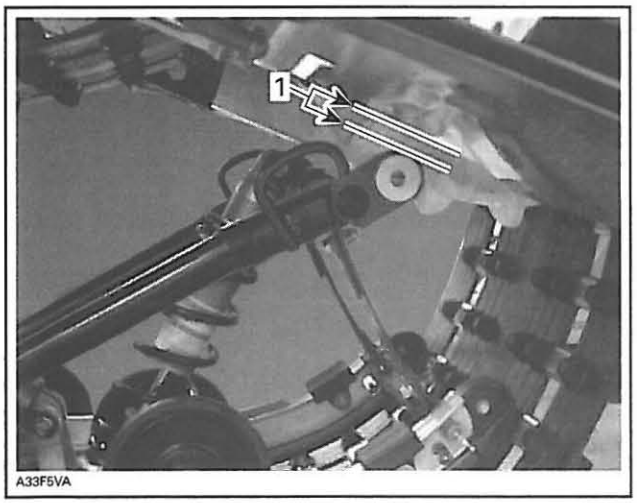
TYPICAL

Remove bolts retaining front arm to tunnel.

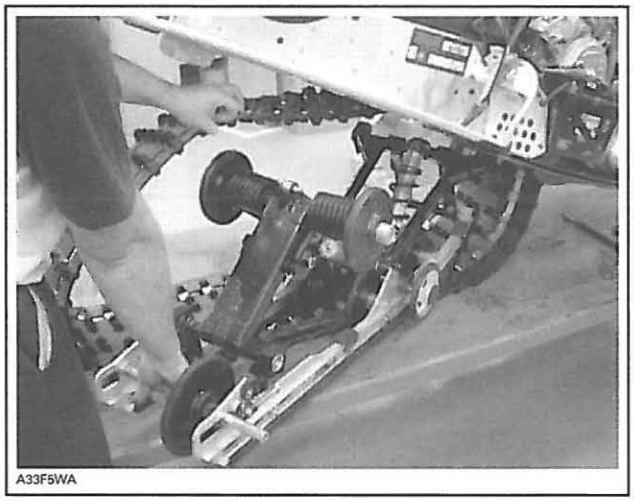


TYPICAL

Lift rear of vehicle until front arm has enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance



TYPICAL — REMOVE SUSPENSION

Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to *TRACK*.

Install suspension into track with front portion first.

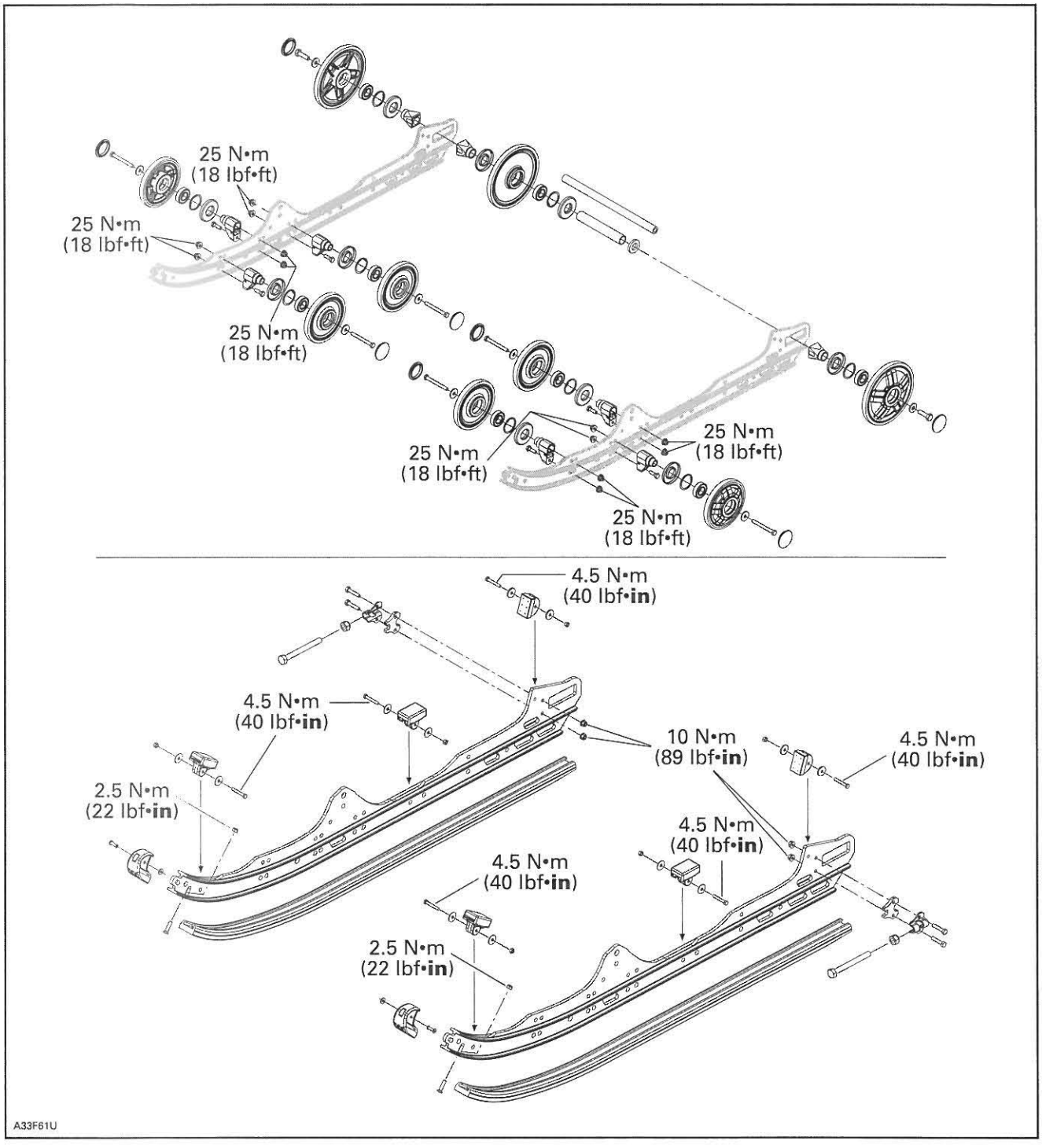
Adjust track tension.

SC 4 REAR SUSPENSION

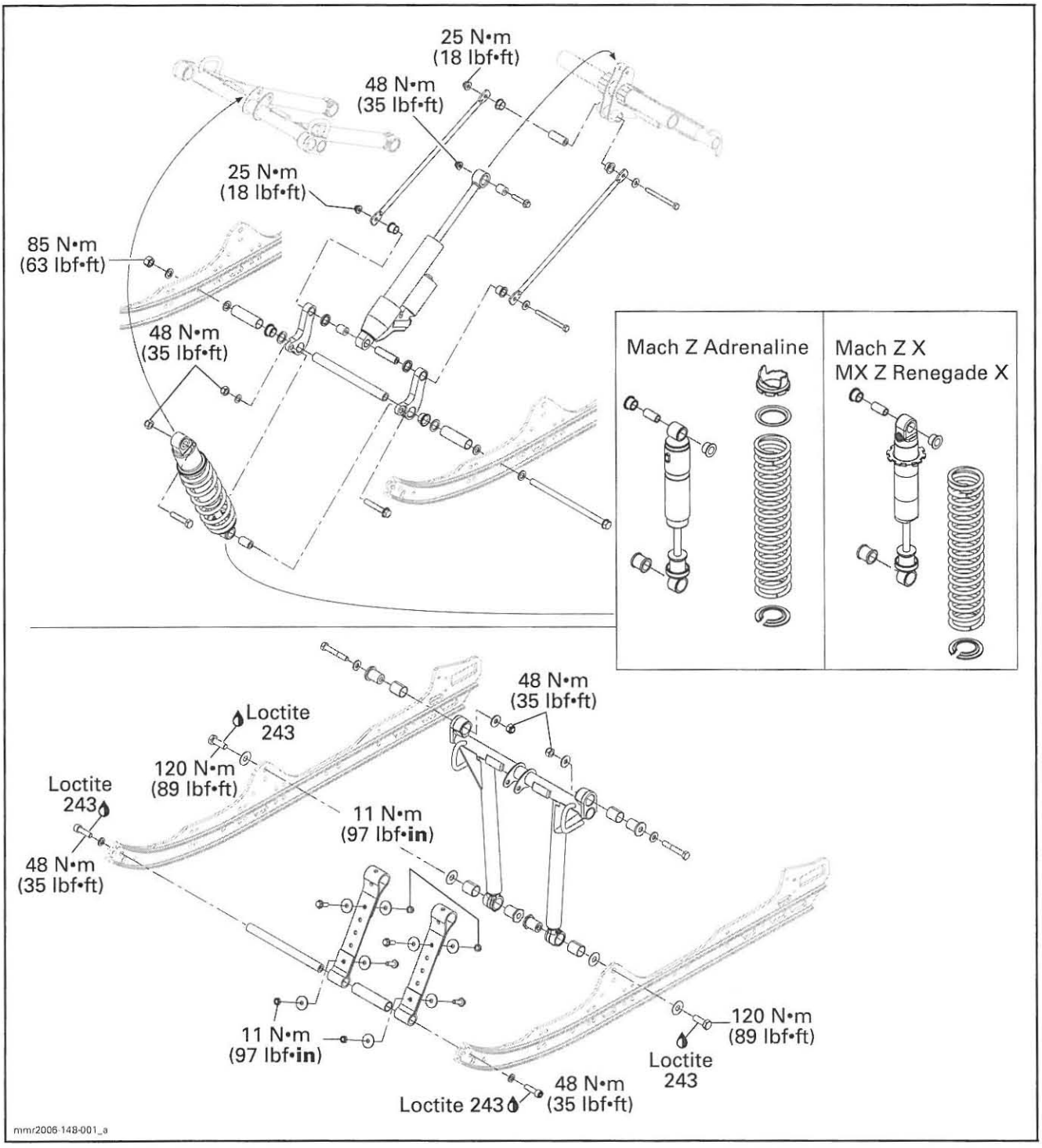
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	308

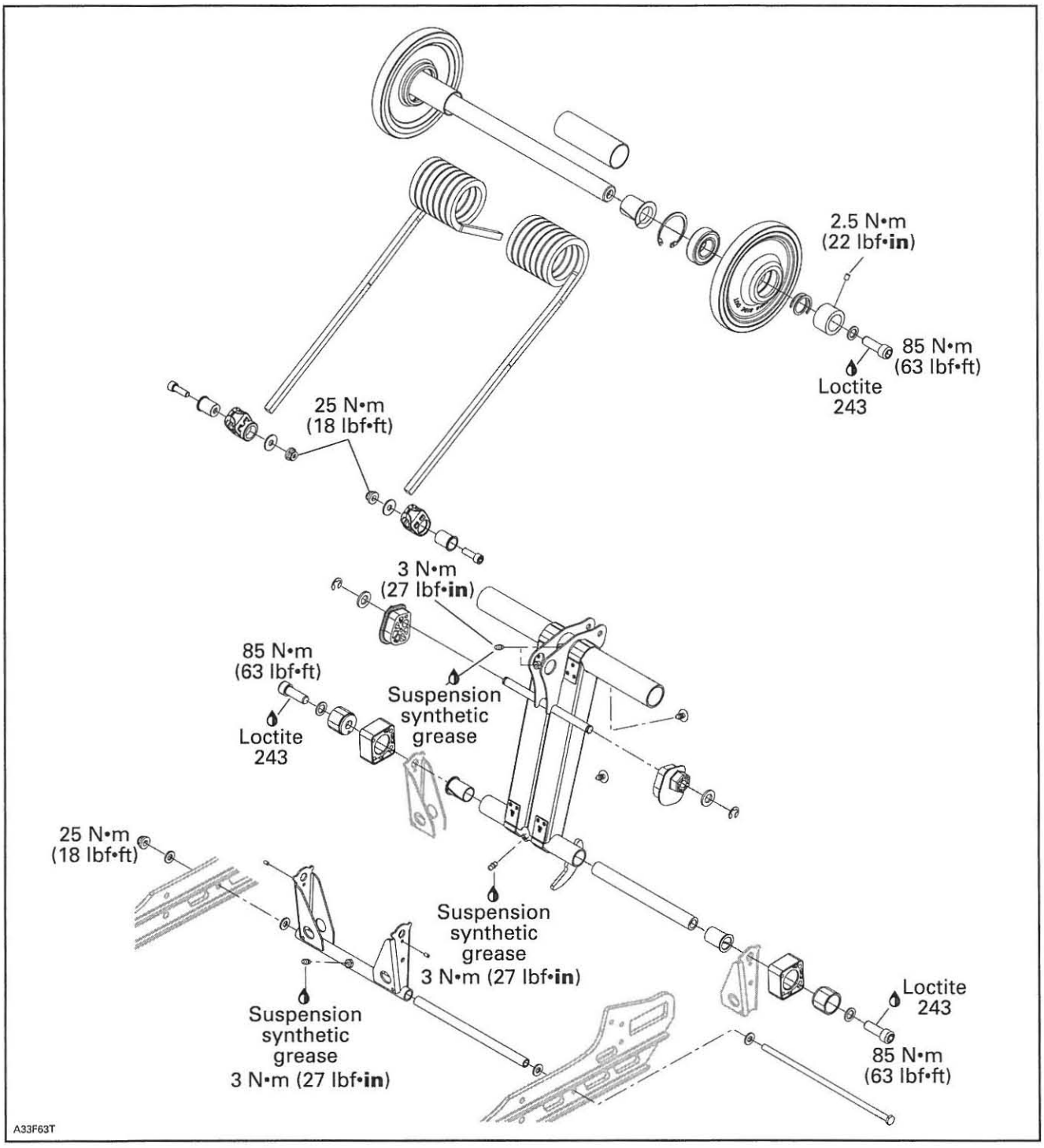
RAILS AND IDLERS WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND IDLER WHEELS



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 strictly be 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 where specified. If the efficiency of a locking device is impaired, it must be renewed.

Suspension Adjustment

To adjust the rear suspension, refer to the appropriate *OPERATOR'S GUIDE*.

PROCEDURES

NOTE: The following components can be removed with suspension in place. For suspension assembly removal, refer to *SUSPENSION ASSEMBLY* further in this section.

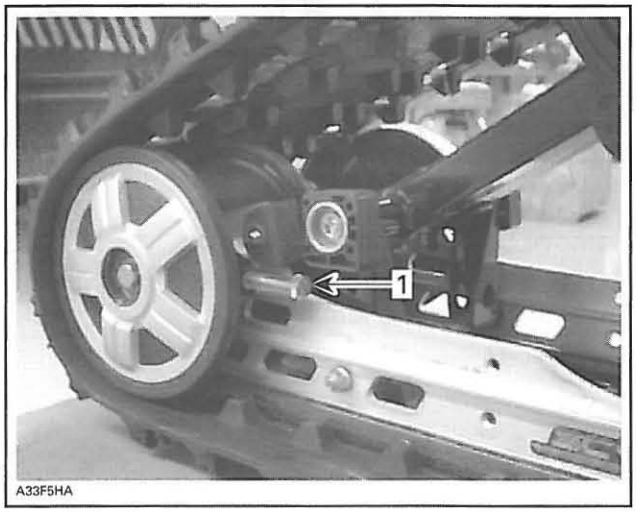
REAR AXLE

Removal

Lift rear of vehicle and support it off the ground.

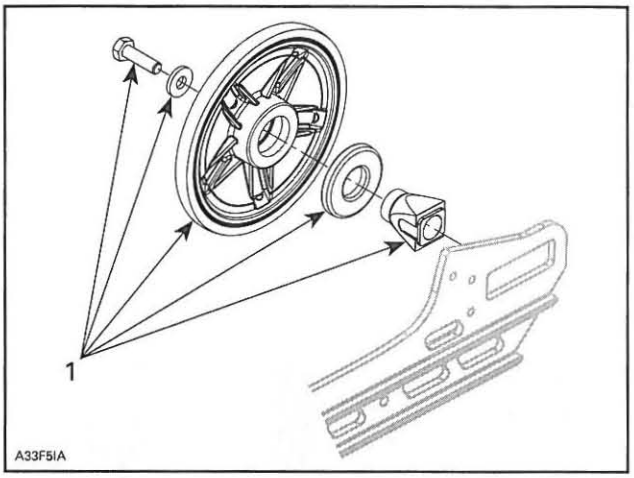
Remove screws on rear axle.

Completely loosen track tension.

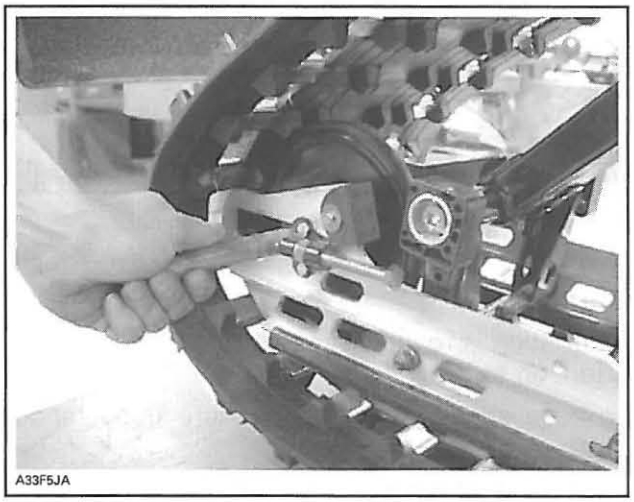


1. Completely loosen track tension

Remove the following:
- rear idler wheels
- idler wheels bearing protector
- idler wheels spacer.



ON BOTH SIDES
1. Remove the following



TYPICAL — PULL OUT REAR AXLE

Installation

Installation is reverse of removal procedure.

REAR SHOCK ABSORBER

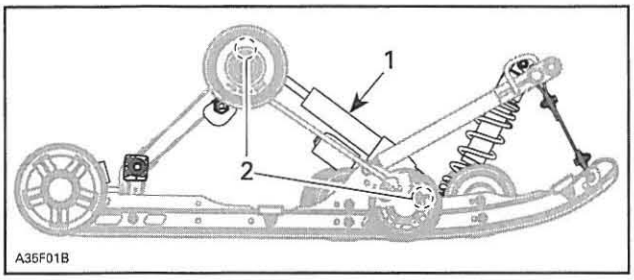
Removal

Lift rear of vehicle and support it off the ground.

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.

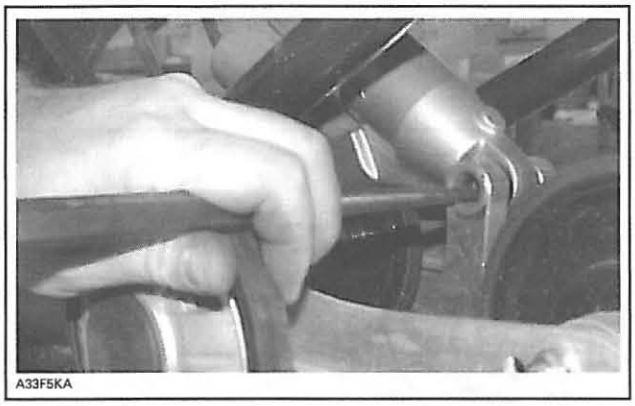


TYPICAL
1. *Rear shock absorber*
2. *Remove bolts and nuts*

Using a punch, remove lower shock bar axle.

Pay attention to plastic spacers.

Remove shock.



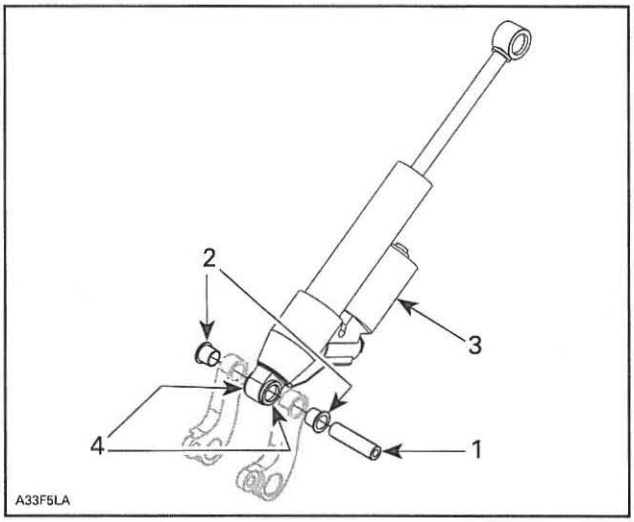
REMOVE BAR AXLE

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

To ease shock installation, secure upper shock first.

CAUTION: Make sure shock bar axle is aligned with swivel bushings before inserting it.



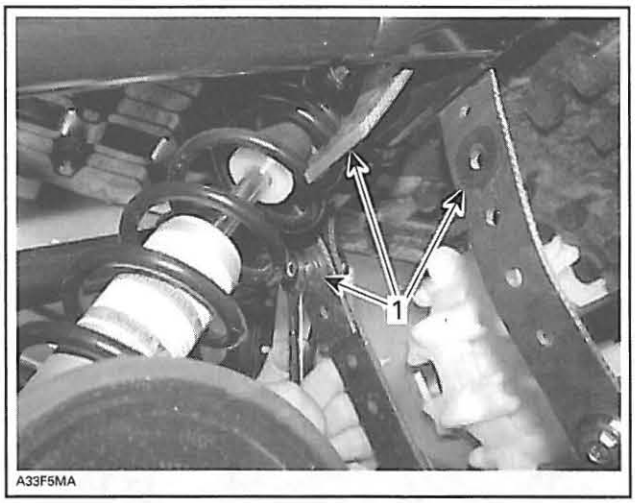
TYPICAL
1. *Bar axle*
2. *Swivel bushings*
3. *Shock reservoir position*
4. *Plastic spacers*

FRONT SHOCK ABSORBER

Removal

Lift rear of vehicle and support it off the ground.

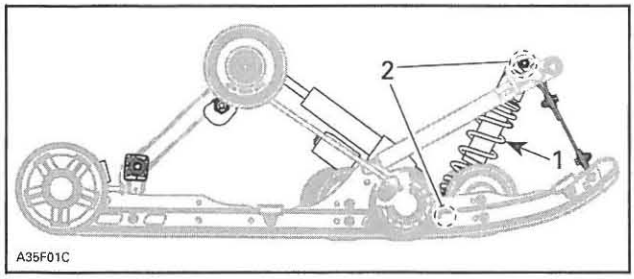
Unfasten one end of stopper straps.



1. Unfasten one end of stopper straps

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.



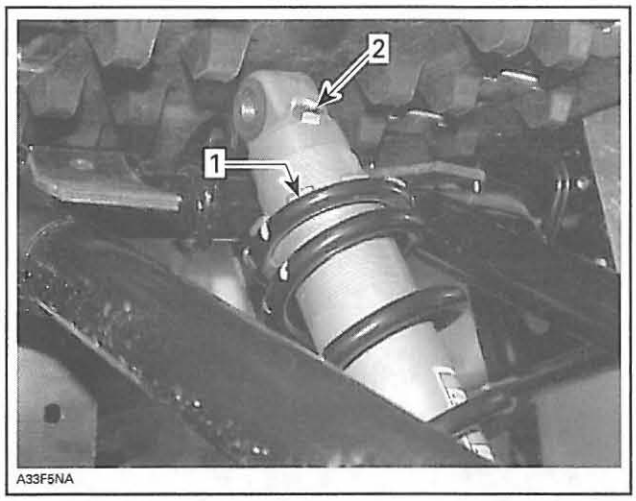
TYPICAL
1. *Front shock absorber*
2. *Remove bolts and nuts*

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

Shock absorber nuts should be on the RH side.

– Install shock adjustment ring towards the top and valve towards tunnel.



TYPICAL — X MODEL SHOWN
1. *Adjustment ring*
2. *Valve*

REAR SPRING

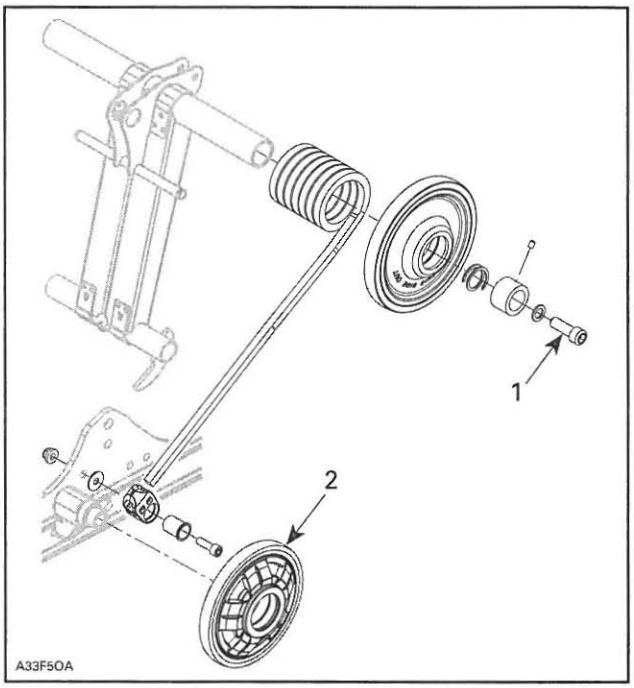
Removal

Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.

Loosen rear arm top axle from chassis.

Remove idler wheels to have access to spring support screws.

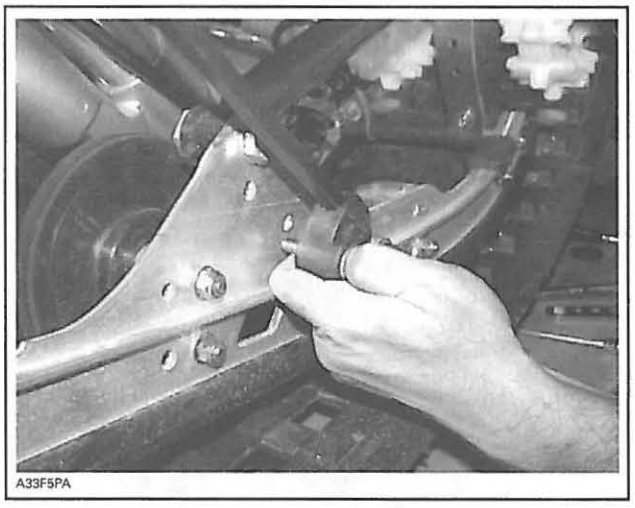


1. *Loosen rear arm top axle from chassis*
2. *Remove idler wheels*

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



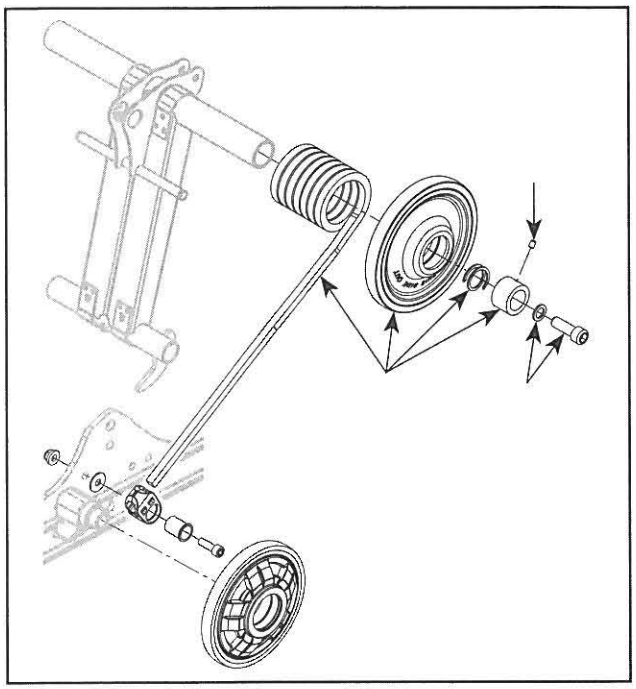
TYPICAL

Remove screws and washers from rear arm top axle.

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring
– axle spring
– top idler wheel
– rear spring.



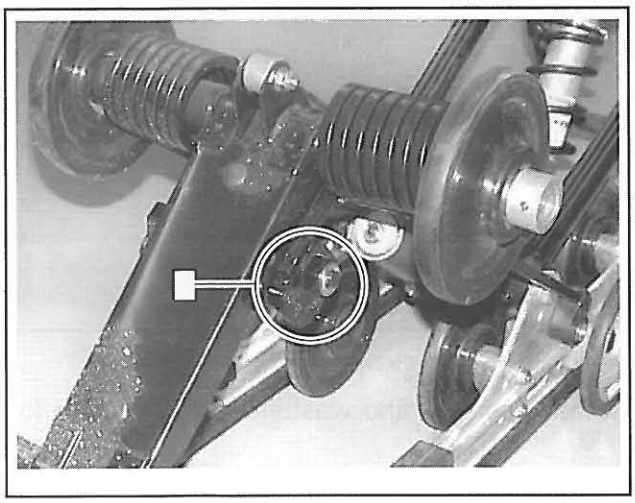
ON BOTH SIDES
1. *Remove screws*
2. *Loosen set screw*
3. *Remove the following*

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

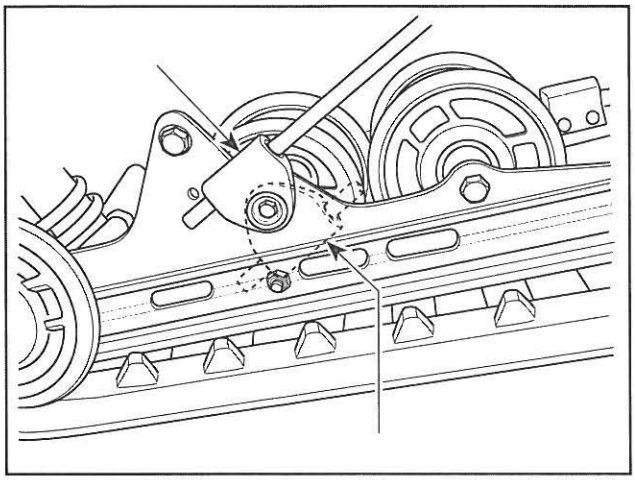
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



ON BOTH SIDES
1. *Spring end in cam adjuster*

CAUTION: To avoid track damage, spring supports must be mounted upward.

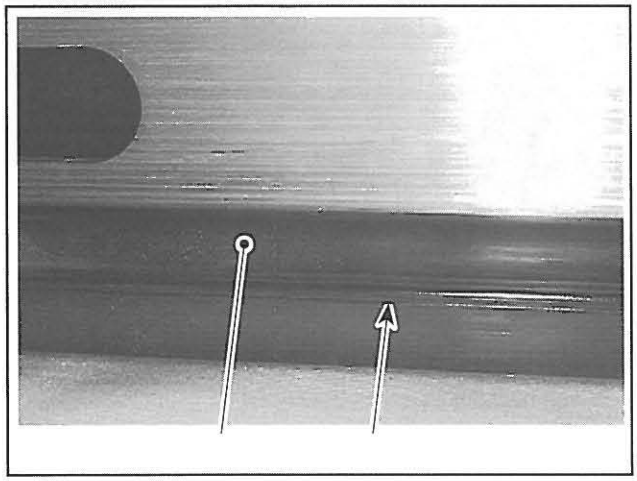


TYPICAL — RIGHT SIDE SHOWN
1. *Right position: upward*
2. *Wrong position*

SLIDER SHOE

Inspection

Replace slider shoes when the wear reach 1 - 2 mm (.040 - .079 in) beyond the moulding line.



TYPICAL
1. *Slider shoe*
2. *Molding line*

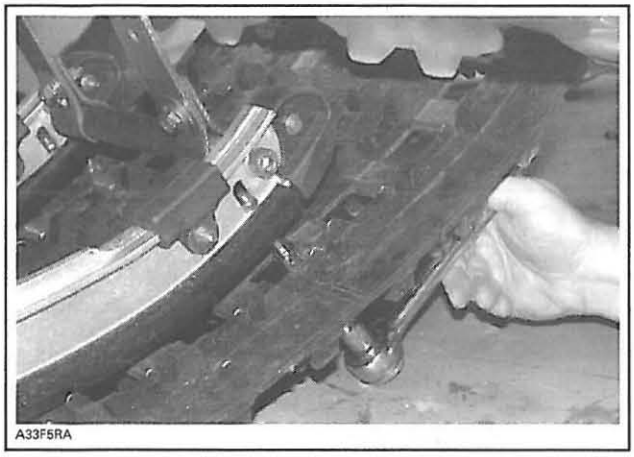
CAUTION: Slider shoes must always be replaced in pairs.

Removal

Lift rear of vehicle and support it off the ground.

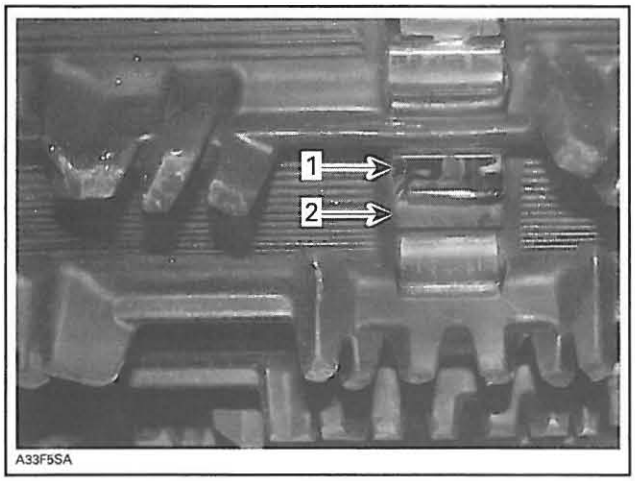
Completely loosen track tension.

Remove nut and screw of each runner.



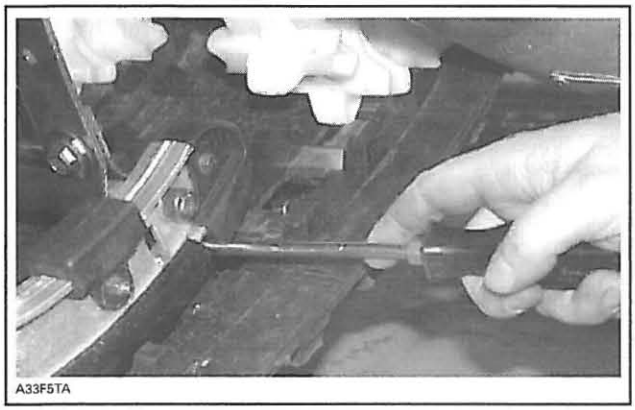
REMOVE NUT AND SCREW OF EACH RUNNER

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

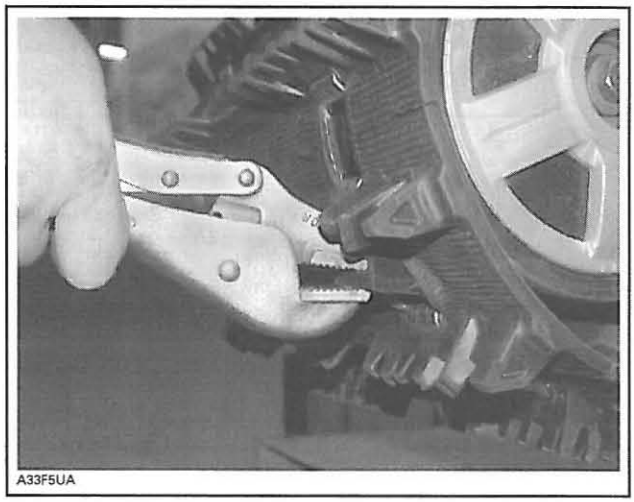
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe through track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



PULL ON SLIDER SHOE TO REMOVE

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

FRONT ARM

Removal

Lift rear of vehicle and support it off the ground.

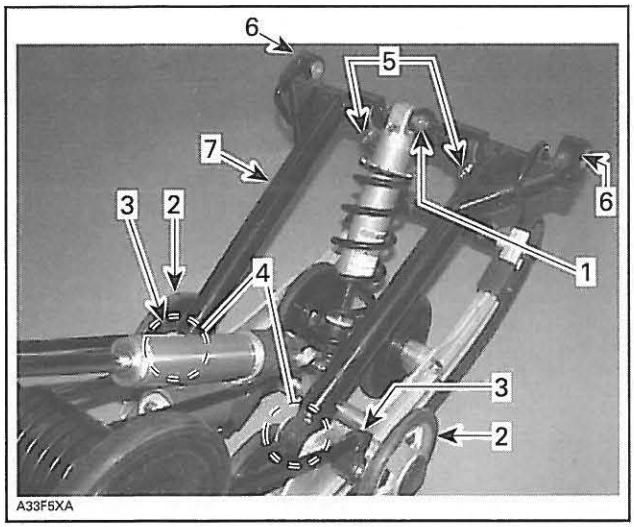
Remove the following:
- shock upper bolt and nut
- front idler wheels
- spring supports (to gain access to front arm lower bolts)

⚠ WARNING

Supports are spring loaded.

- front arm lower bolts and washers
- unfasten one end of stopper straps
- remove front arm upper bolts, nuts and washers.

Remove front arm.



SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *Front idler wheels*
3. *Spring supports*
4. *Front arm lower bolts and washers*
5. *Unfasten one end of stopper straps*
6. *Front arm upper bolts, nuts and washers*
7. *Front arm*

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

To properly hold front arm axles when applying tightening torque to front arm lower bolts, it may be necessary to remove idle wheels.

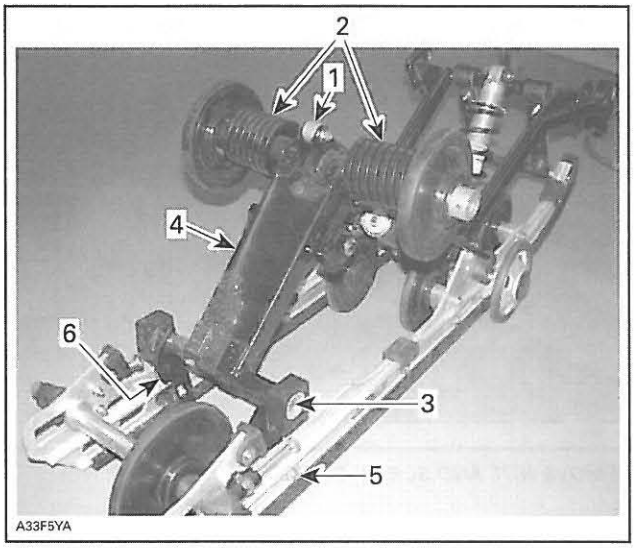
REAR ARM

Removal

NOTE: Rear arm can be removed with suspension assembly in place.

For rear arm removal, remove the following:
- shock upper bolt and nut
- rear springs (refer to procedure above in this section)
- screws and washers holding rear arm to pivot arm.

For pivot arm removal, remove bolts, nuts and washers holding pivot arm to runners.



SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *Rear springs*
3. *Rear arm/pivot arm screws and washers*
4. *Rear arm*
5. *Pivot arm/runner bolts, nuts and washers*
6. *Pivot arm*

Installation

Installation is reverse of removal procedure. Pay attention to the following details.

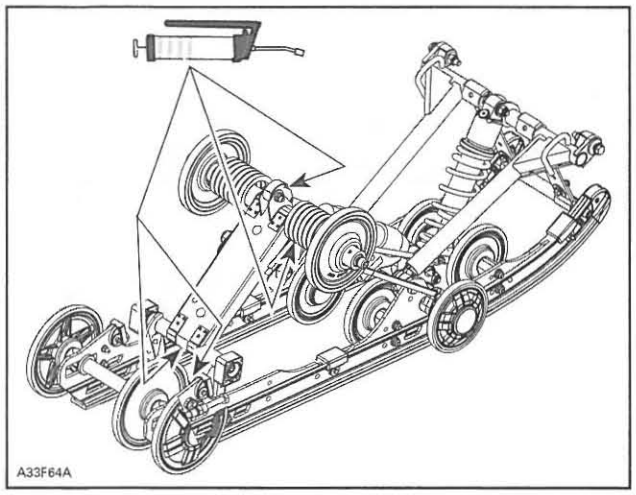
Pivot arm grease fitting must be towards the front of the vehicle.

At installation, rear arm stroke limiter must be on rear side.

Insert dowel pin into pivot arm hole, dowel pin must exceed block guide by 2 to 2.3 mm (.079 to .091 in).

Lubrication

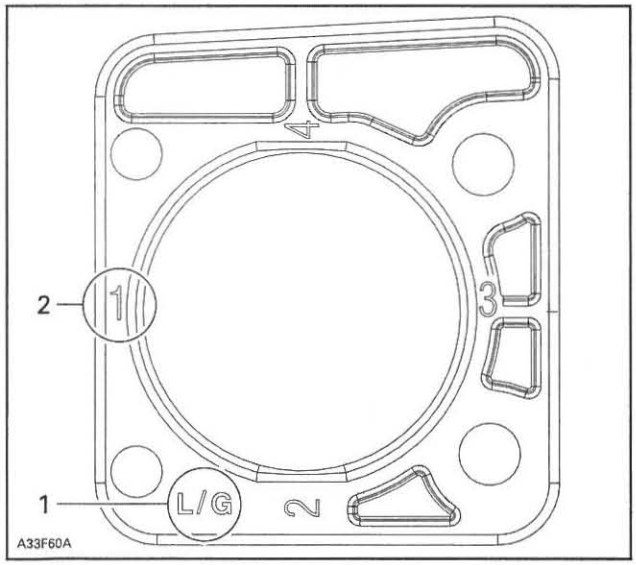
Lubricate pivot arm and rear arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



TYPICAL

BLOCK INSTALLATION

Both blocks are identified R or L (right or left) and have position number (from 1 to 4). At installation make sure to install proper block on proper side with the same adjustment position on both sides.

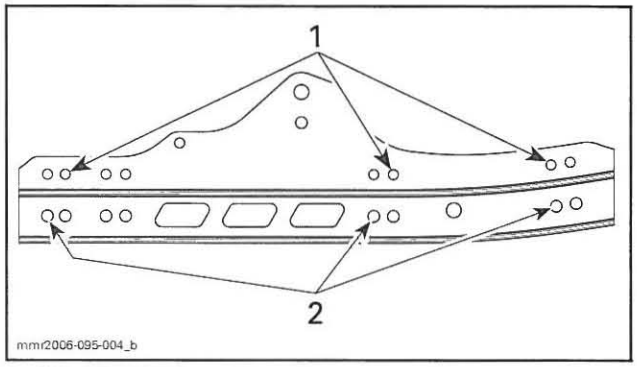


TYPICAL
1. *Blocks are identified R or L (right or left)*
2. *Blocks position number (from 1 to 4)*

IDLER WHEELS INSTALLATION

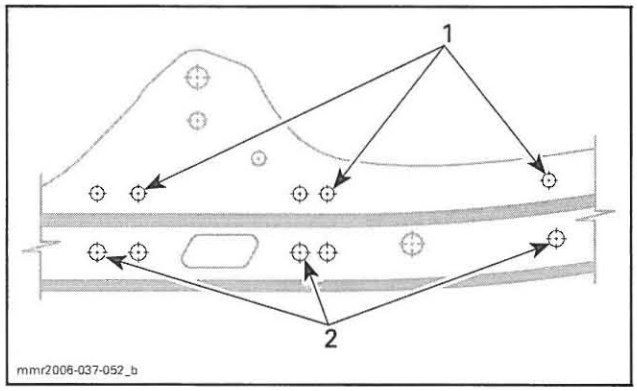
Refer to illustration for idler wheels position at installation.

MX Z Renegade X Models



1. *RH side wheels position*
2. *LH side wheels position*

All MACH Z Models



1. *RH side wheels position*
2. *LH side wheels position*

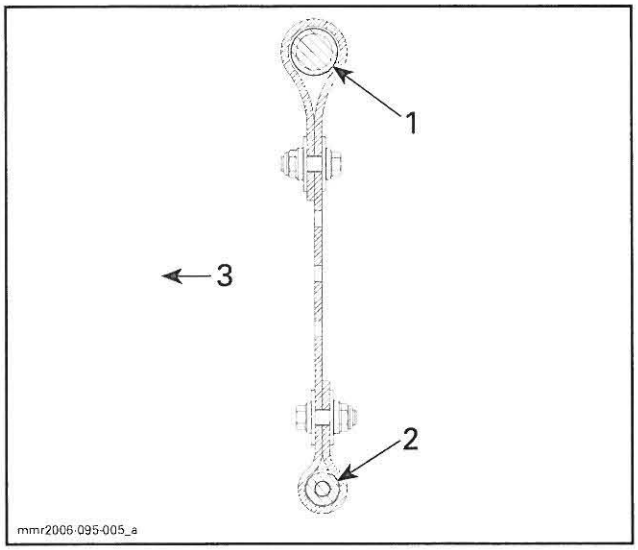
STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace stopper strap as required.

Make sure it is attached through proper hole from the end.

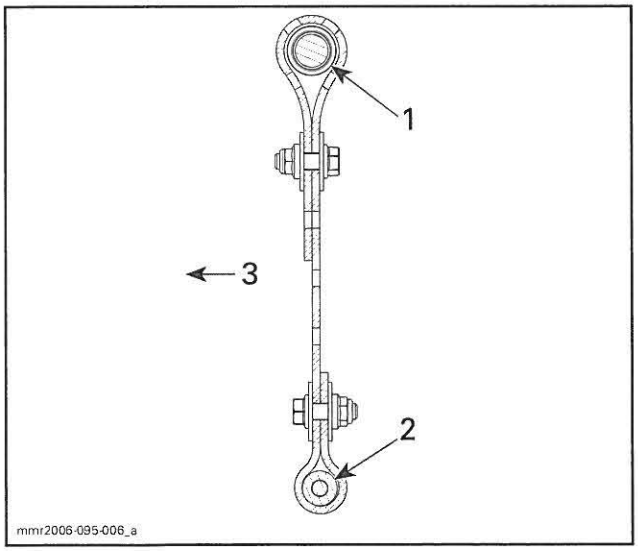
Torque nut to 11 N•m (97 lbf•**in**).

MX Z Renegade X (Canada and United States)



POSITION 4-1
1. *Front arm (top)*
2. *Front axle*
3. *Rear of vehicle*

All MACH Z and MX Z Renegade X (Europe)



POSITION 4-2
1. *Front arm (top)*
2. *Front axle*
3. *Rear of vehicle*

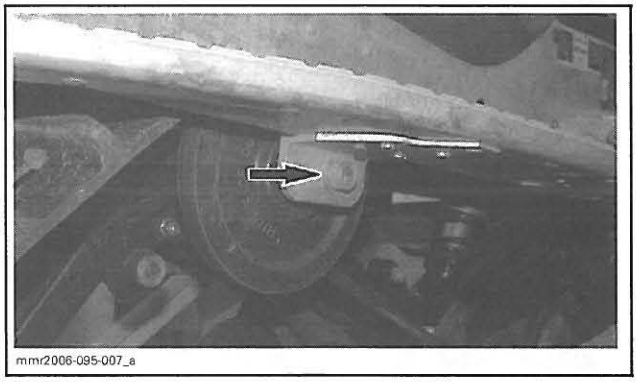
SUSPENSION ASSEMBLY

Removal

Lift rear of vehicle and support it off the ground.

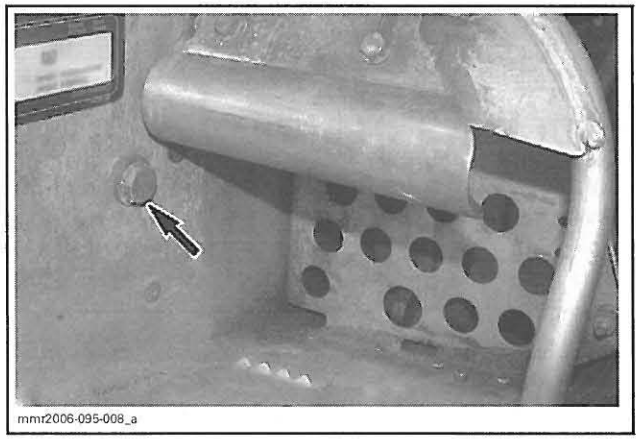
Completely loosen track tension.

Remove rear arm top axle bolts from chassis.



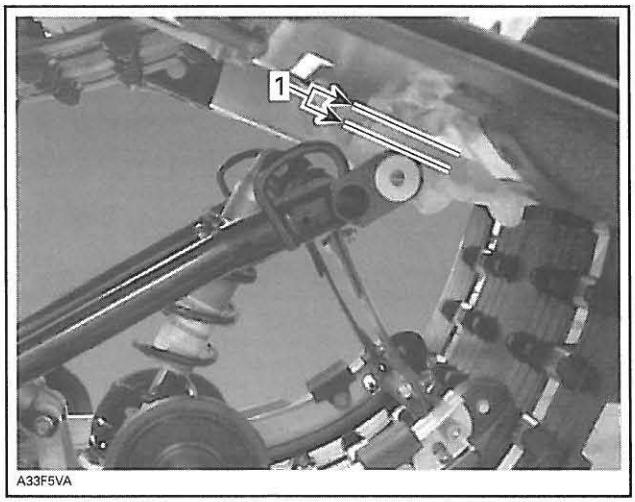
TYPICAL

Remove bolts retaining front arm to tunnel.

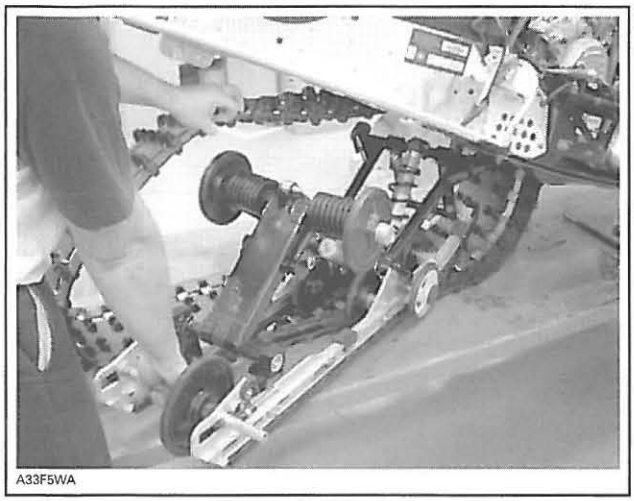


TYPICAL

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. *Enough clearance*



TYPICAL — REMOVE SUSPENSION

Installation

Installation is the reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to *TRACK*.

Install suspension into track with front portion first.

Adjust track tension.

SHOCK ABSORBER INSPECTION AND SERVICING

SERVICE TOOLS

Description	Part Number	Page
floating piston remover tool	529 035 907	315
gas fill tool kit (needle type)	503 190 102	314, 320
gas shock valve tool (tire valve type)	529 035 570	320
HPG shock holding tool	529 035 769	314
shock wrench	529 035 727	314

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier HPG shock oil	293 600 035	318
Loctite 271	293 800 005	317
Molykote G-n	420 297 433	317–318

SPRING REMOVAL

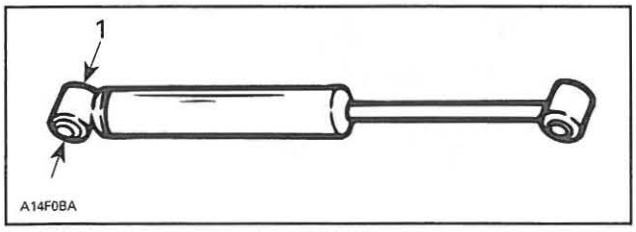
Remove shock absorber from vehicle. Refer to the appropriate subsection.

SHOCK ABSORBER INSPECTION

Hydraulic Shock

Secure the shock body end in a vise with its rod upward.

CAUTION: Do not clamp directly on shock body.



1. Clamp

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with its rod upward.

After at least 5 complete strokes, pay attention to the following conditions that will denote a defective shock:

NOTE: The first 5 complete strokes in upwards position can be not uniform.

- A skip or a hang back when reversing stroke at mid travel.
- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

Gas Shock except Variable Rate

Because of gas pressure, strong resistance is felt when compressing shock.

For the verification of stroke, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the stroke compression when the rod is fully extended.

Completely push down the shock rod then release.

The shock should extend unassisted. Rod must come out at a steady speed. If speed suddenly increases particularly at end of extension, replace shock.

Variable Rate Gas Shock

Because of gas pressure, strong resistance is felt when compressing shock.

For the verification of stroke, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the stroke compression when the rod is fully extended.

Push down the shock rod. The feeling will be stiff for around first 25 mm (1 in), soft up to 25 to 50 mm (1 to 2 in) and stiff after that. This stiff, soft and stiff phenomenon shows the normal operation of shock.

When released, the shock should extend unassisted. The rod speed coming out will go slow – faster and slow again due to the VR zone.

All Gas Shock

If suspecting a frozen shock proceed as follows:

Place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.

Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than for the new one.

DISASSEMBLY AND ASSEMBLY

High Pressure Gas Take Apart Shock (HPG T/A)

There are two types of high pressure gas take apart (HPG T/A) shock. One type has a tire valve and the other has a needle valve.

SHOCK TYPE	INFLATION TOOL
Tire valve type	529 035 570
Needle valve type	503 190 102

HPG T/A shocks come in two sizes. C-36 shock is 36 mm (1.417 in) in diameter and C-46 shock is 46 mm (1.811 in).

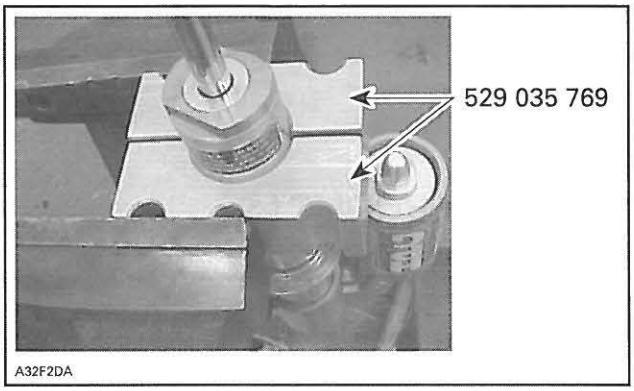
SHOCK SIZE	SERVICING TOOL	P/N
C-36	Piston guide	529 026 600
	Seal guide	529 026 500
	Shock wrench	529 035 727
C-46	Piston guide	529 035 608
	Seal guide	529 035 728
	Shock wrench	529 035 727

Release nitrogen (N) pressure on any HPG T/A shock with internal floating piston (IFP).

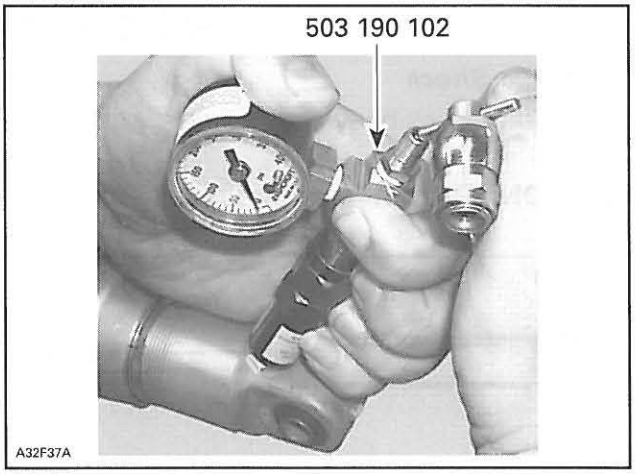
⚠ WARNING

Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.

Mount shock in a vise with HPG shock holding tool (P/N 529 035 769).



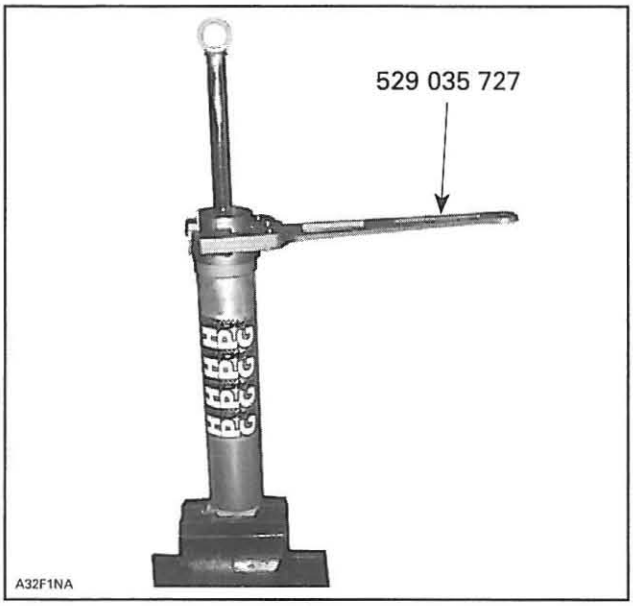
Remove screw on top of valve. Place the needle guide of gas fill tool kit (needle type) (P/N 503 190 102) on the shock valve. Press the detent pin and push forward the needle assembly very slowly towards rubber of needle valve. Push on shock tool valve center rod to release gas pressure.



Remove tool from shock.

Screw Cap Type HPG T/A Shock

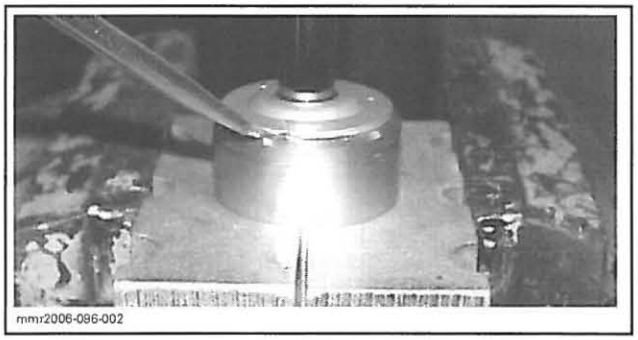
Using appropriate size of shock wrench (P/N 529 035 727) unscrew seal carrier.



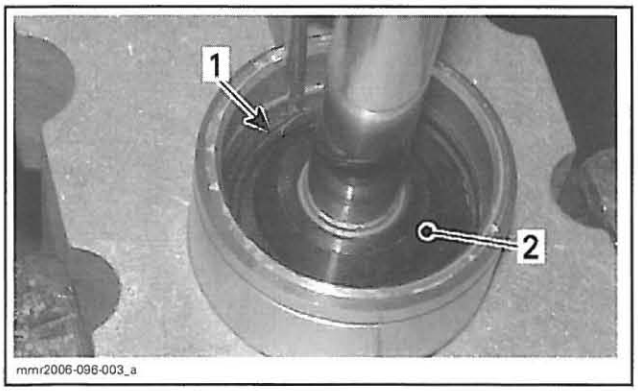
TYPICAL

Snap Ring Cap Type HPG T/A Shock

Using a flat tool (small screwdriver or small chisel), pop-out the cap.



Compress the carrier to access and using a pick, remove the snap ring.

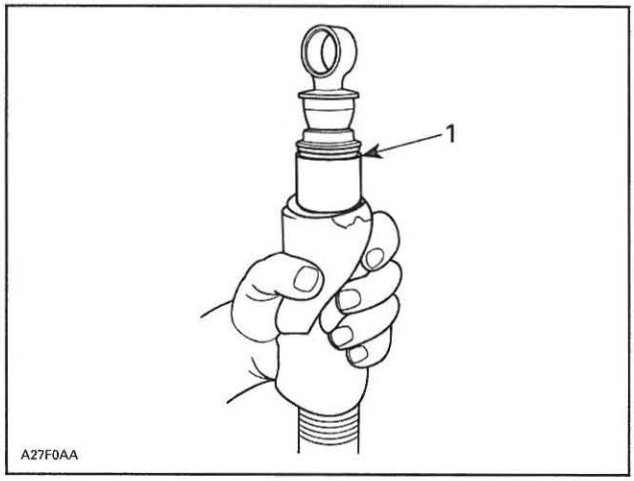


1. *Snap ring*
2. *Carrier*

All HPG T/A Shocks

With the seal carrier removed, slowly lift and remove damper rod assembly from the damper body.

NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.

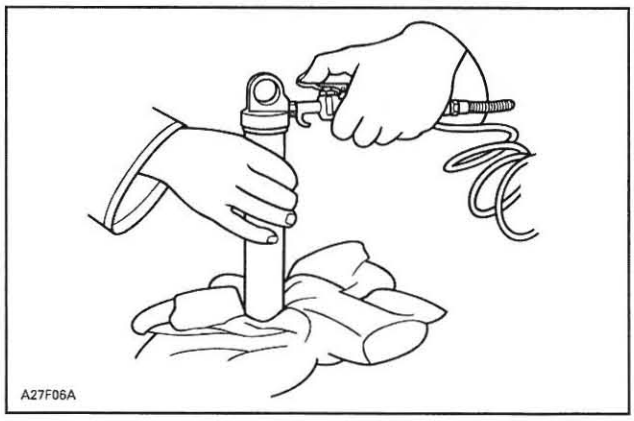


1. *Oil flows*

Discard old oil into storage container. Never reuse damper oil during shock rebuild.

HPG T/A Shocks except with External Reservoir

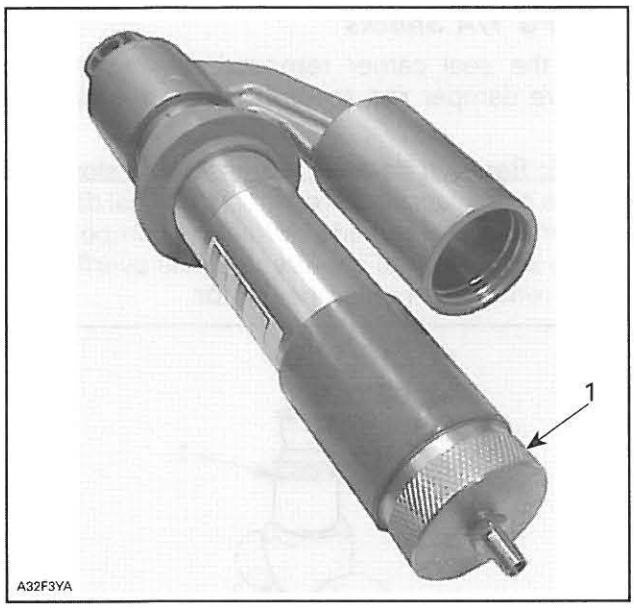
Remove valve core. Using compressed air pressure, carefully remove floating piston from damper body. Hold shop cloth over damper body opening to catch released floating piston. Allow room for floating piston to leave damper body.



TYPICAL

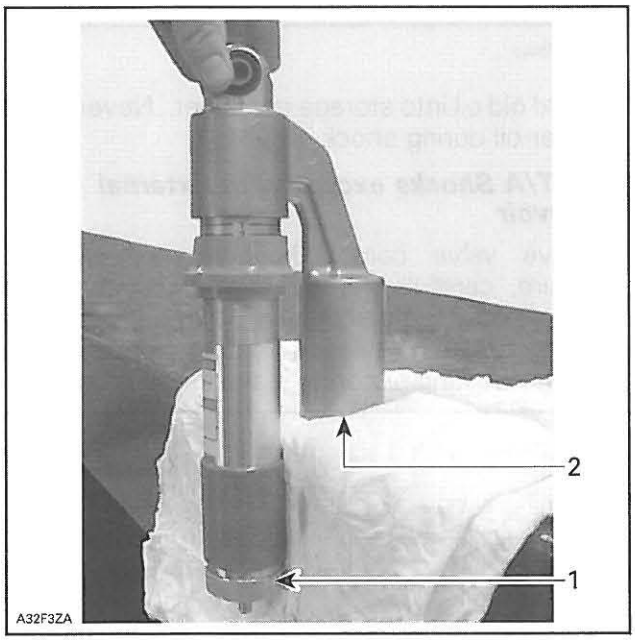
HPG T/A Shocks with External Reservoir

Install floating piston remover tool (P/N 529 035 907) on shock absorber, as shown below.



1. Floating piston remover tool

Place shock absorber in a position where external gas reservoir opened extremity is blocked. Refer to following photo.



1. Tool
2. Reservoir opened extremity blocked by leaning on work bench

With a low pressure hand pump, pressurize shock absorber until external reservoir piston pops-out.

NOTE: Use towels to prevent damaging external reservoir piston when it pops-out.

⚠ WARNING

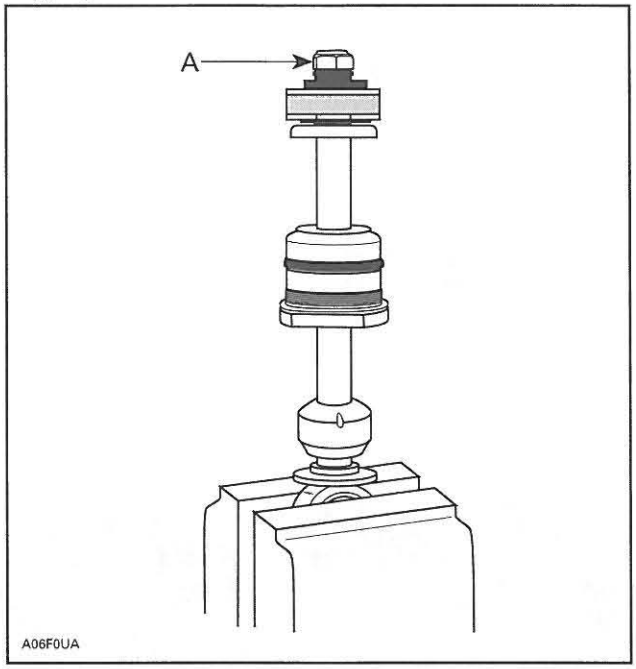
Whenever using compressed air, use an O.S.H.A. approved air gun and wear protective eye wear.

Thoroughly clean, with a typical cleaning solution, and blow dry using low pressure air. Carefully inspect the damper body for any imperfections or signs of wear in the damper bore.

Replace damper body if wear is identified.

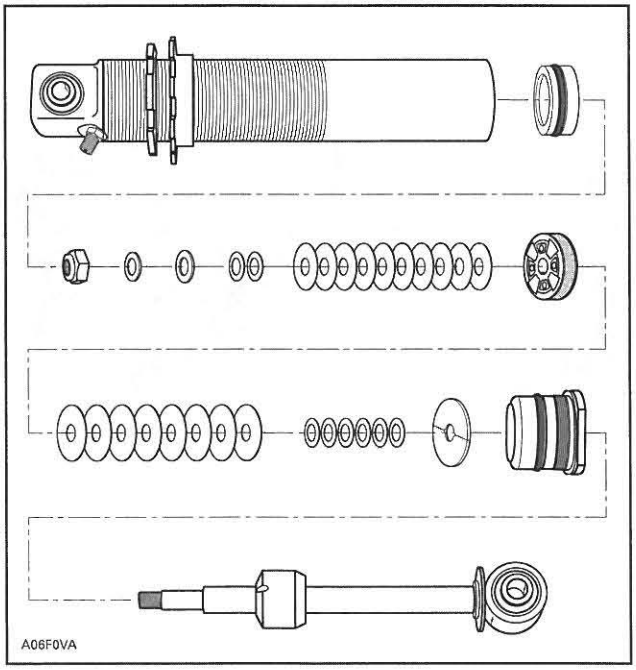
All HPG T/A Shocks

Holding the damper rod assembly in a bench vise, begin piston and valve removal.



A. Remove damper nut

Always arrange parts removed in the sequence of disassembly.



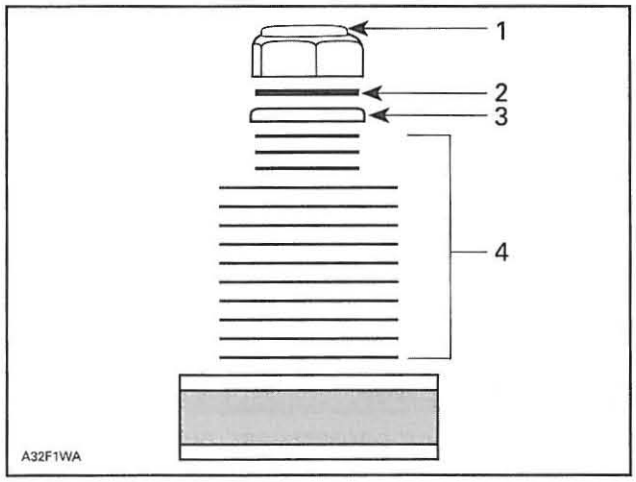
NOTE: As a general rule we suggest replacing the damper rod lock-nut after 4 rebuilds to ensure good locking friction and use Loctite 271 (P/N 293 800 005) each time.

NOTE: If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). There is no need to remove seal carrier if only revalving is to be done.

Shims can be measured by using a vernier caliper or a micrometer.

NOTE: All shims should be carefully inspected and any bent or broken shims must be replaced for the shock to function properly.

After the new or replacement shim pack has been selected, reassemble in the reverse order of disassembly. Torque piston nut to 18 N•m (159 lbf•**in**).



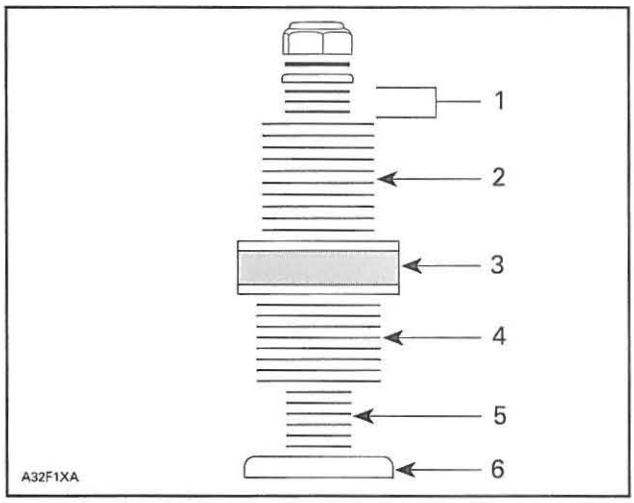
1. Damper nut
2. Spacer
3. Stopper with its round edge facing nut
4. Shim pack

CAUTION: The damper rod nut can only be reused 4 times, then, must be replaced. Do not substitute this part for non – O.E.M. Use Loctite 271 on nut each time.

This (these) spacer washer(s) must be used as shown to ensure damper rod nut does not bottom out or contact shaft threads.

Rebound valve stopper with round edge facing nut.

NOTE: Rebound shim stack must not reach into threads of damper shaft. Spacer under damper shaft nut is used to prevent damper shaft nut from bottoming on threads.

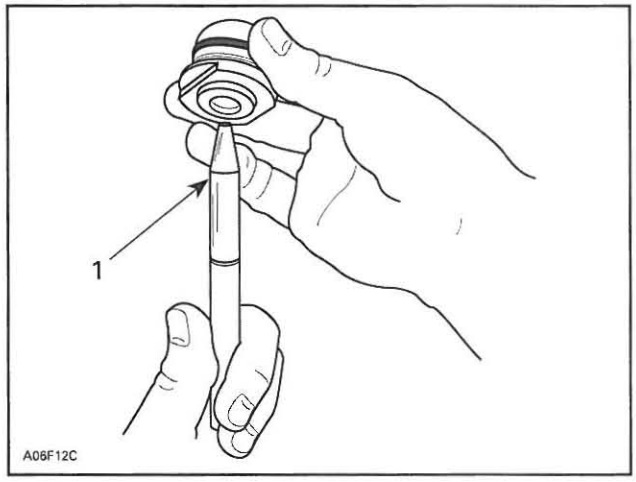


1. Rebound dampening shim pack
2. Rebound dampening shim pack
3. Piston
4. Compression dampening shim pack
5. Compression dampening shim pack
6. Stopper

If the seal carrier assembly is replaced, use seal pilot to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

CAUTION: Failure to use seal pilot will result in seal damage.

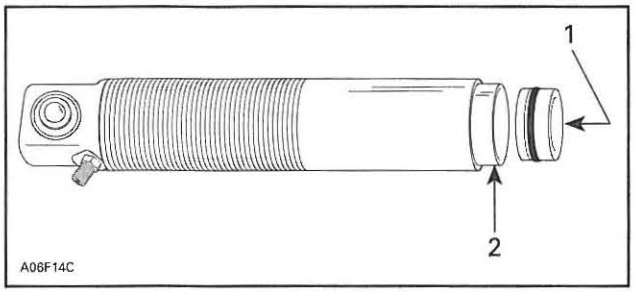
Reassemble damper rod assembly, taking care to properly assemble shim packs as required for your dampening needs. Ensure that the shaft piston is installed with the slits/larger intake holes facing the rebound shim stack.



1. Seal guide

If internal floating piston has been removed, reinstall it into damper body (ensure that valve core has been removed). Use Molykote G-n (P/N 420 297 433) to ease O-ring past damper body threads with floating piston guide.

CAUTION: Failure to install internal floating piston correctly could result in shock damage.

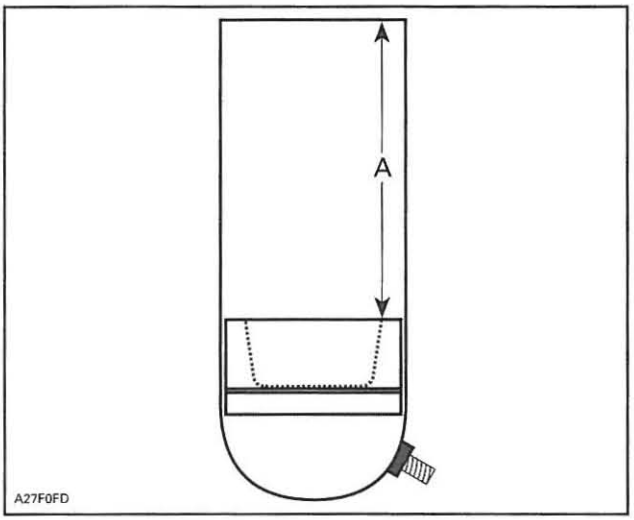


1. Push (slowly) by hand
2. Floating piston guide

NOTE: Lubricate inside of piston guide with Molykote G-n (P/N 420 297 433).

Install floating piston to the proper depth refer to following the table.

On all HPG T/A shocks, the floating piston is installed hollow side up.



A. Installation distance for floating piston installation

SHOCK P/N	INSTALLATION DISTANCE OF FLOATING PISTON mm (in)
503 190 729	54.5 (2-9/64)
503 190 847	
503 191 204	
503 191 221	
505 191 203	119.5 (4-45/64)
505 191 220	
503 190 662	121.5 (4-25/32)
503 190 975	
503 190 834	134 (5-9/32)
505 071 457	167 (6-37/64)
505 071 644	
503 190 978	171.5 (6-3/4)
503 190 990	
503 190 994	
503 191 222	

NOTE: If the floating piston is installed too far into the damper body, light air pressure through valve (with core removed) will move piston outward.

NOTE: Reinstall tire valve core after internal floating piston has been installed at correct height and before adding oil.

⚠ WARNING

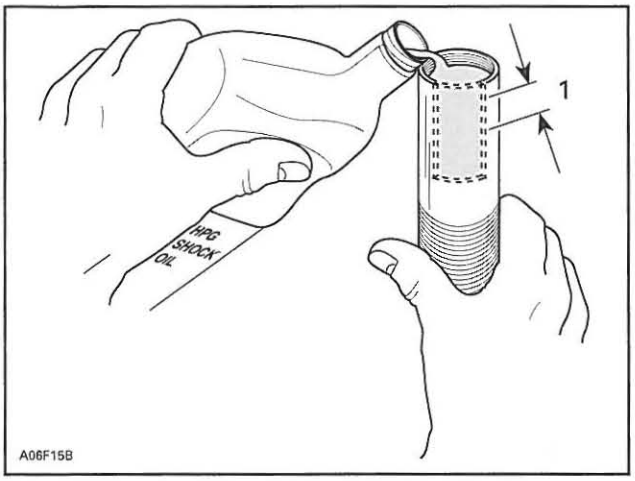
Whenever using compressed air exercise extreme caution, cover damper opening with shop cloth to reduce chance of possible injury.

CAUTION: Moisture laden compressed air will contaminate the gas chamber and rust floating piston.

⚠ WARNING

Always wear protective eye wear whenever using compressed air.

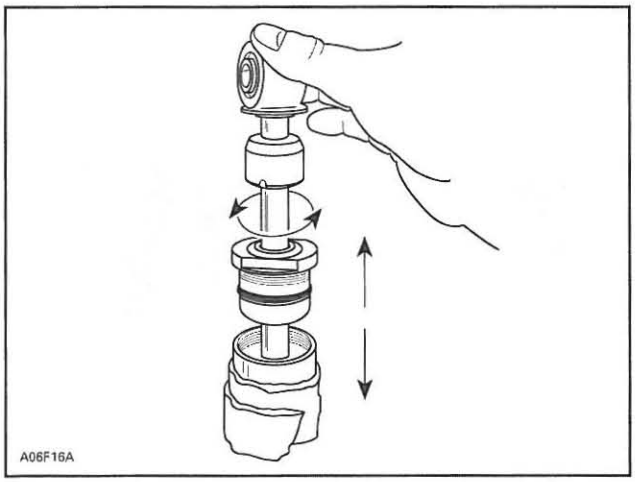
Fill the shock with Bombardier HPG shock oil (P/N 293 600 035) to approximately 10 mm (.393 in), from the base of seal carrier threads.



1. Fill to 10 mm (.393 in)

NOTE: Although we do not measure the exact amount of oil added to the damper, approximately 252 mL (8.52 oz. U.S.) will be used.

Carefully insert damper rod into the damper body. Lightly oil damper piston seal ring with shock oil to ease installation.



NOTE: Some shock oil will overflow when installing damper. Wrap damper with shop cloth to catch possible overflow oil.

CAUTION: Use care when passing piston into damper body at damper body threads.

Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement may be required on short stroke to allow all air to pass through piston assembly. The gentle tapping of a small wrench, on the shock eye, may help dislodge air trapped in the submersed piston. Be careful not to drive the shaft any deeper into the oil than is necessary to just cover the shim stack.

NOTE: Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

With damper rod piston into oil, TOP OFF damper oil volume. Oil level should be to damper body thread base.

Screw Cap Type HPG T/A Shock

Seal carrier assembly can now be threaded into damper body. This should be done slowly to allow weapage of oil and to minimize internal floating piston displacement. Torque seal carrier to 95 N•m (70 lbf•ft).

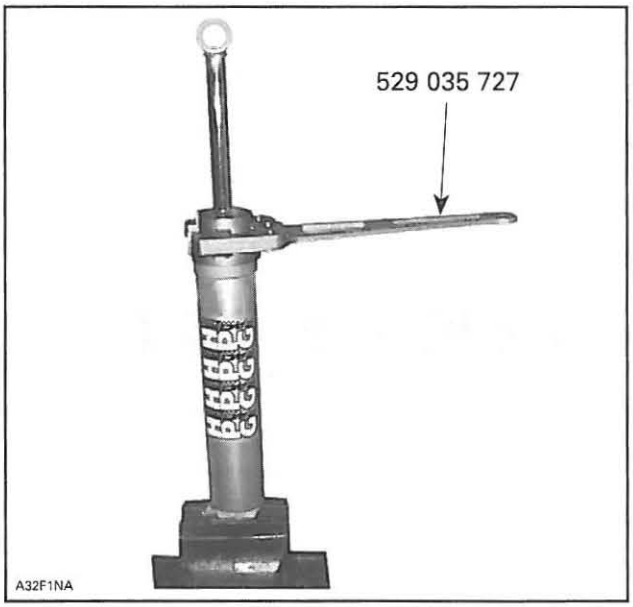
Snap Ring Cap Type HPG T/A Shock

Seal carrier assembly can now be pushed into damper body to pass snap ring grove. Install snap ring into groove.

Tap the cap on the shock body.

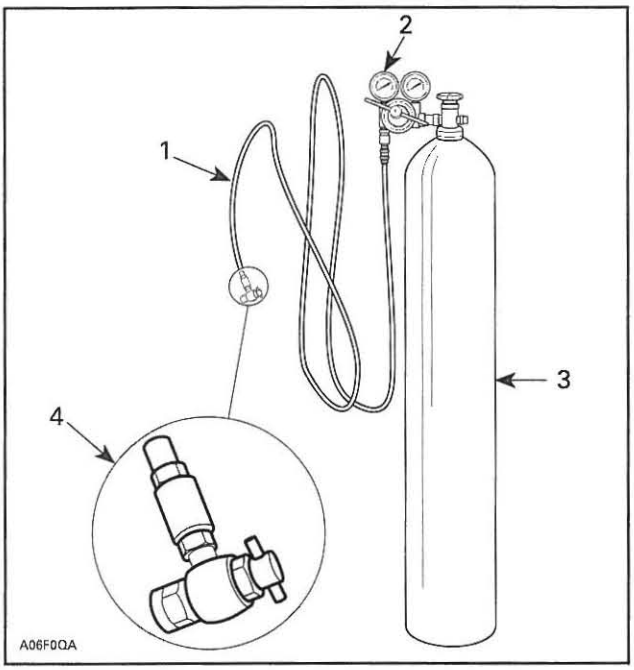
All HPG T/A Shocks

After the seal carrier is fully in place avoid pushing the shaft into the body until the nitrogen charge is added.



When removing and retightening the tire valve acorn nut use minimal torque. When the cap is over tightened and subsequently removed it may prematurely break the seal of the tire valve to the shock body and cause a loss of nitrogen charge without being noticed. If you suspect this has happened then recharge the shock as a precaution. Inspect the tire valve cap before installation to ensure that the internal rubber gasket is in its proper position.

Nitrogen (N) can now be added to damper body.



1. *High pressure hose*
2. *Stage regulator, delivery pressure range 2070 kPa (300 PSI)*
3. *High pressure cylinder filled with industrial grade nitrogen*
4. *Valve tip (P/N 529 035 570) permanently installed*

NOTE: Never substitute another gas for nitrogen. Nitrogen has been selected for its inert qualities and will not contaminate the gas chamber of the shock.

Preset your pressure regulator to 2070 kPa (300 PSI) nitrogen (N), this gas pressure will restore the correct pressure for your damper.

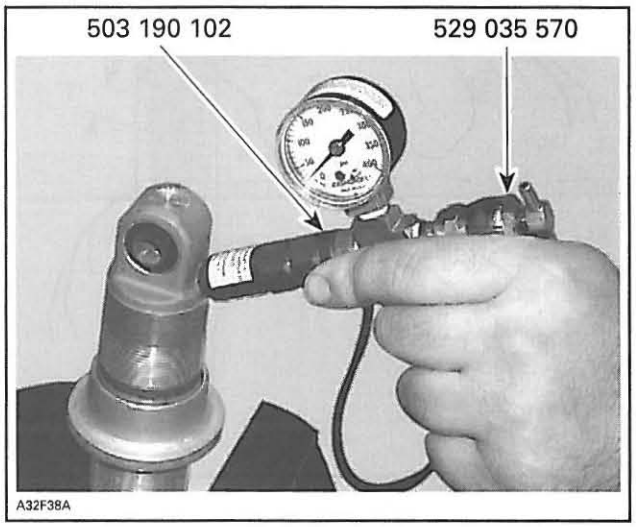
CAUTION: Do not exceed the recommended pressure values.

⚠ WARNING

Whenever working with high pressure gas, use eye wear protection. Never direct gas pressure toward anybody.

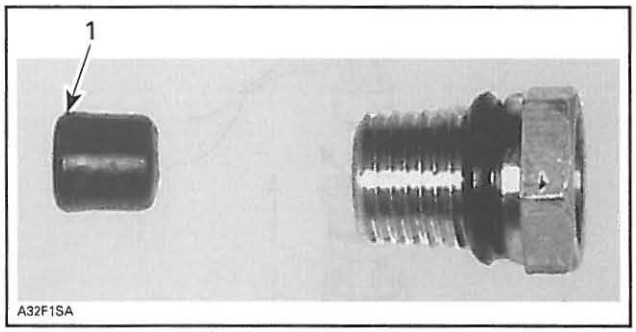
Install the gas fill tool kit (needle type) (P/N 503 190 102) on gas shock valve tool (tire valve type) (P/N 529 035 570). Set the regulator pressure on the nitrogen cylinder as per the shock requirement.

Mount the shock on vise. Remove screw on top of valve. Place the needle guide of gas refill tool on the shock valve. While depressing the detent pin of the gas refill tool and pushing forward the needle assembly, insert the needle through the rubber core of the pressure valve assembly of the shock.



NOTE: For replacement of the needle or filling the shock, carefully follow the instructions provided with the gas fill tool kit (needle type) (P/N 503 190 102).

On some models, rubber may pop out of needle valve when inserting tool needle. If so, remove valve core and rubber then, reinstall rubber with its larger diameter last.



1. *Larger diameter*

When the shock is filled with gas, install back the screw on top of the valve.

NOTE: Carefully inspect damper for gas or oil leaks. Any leaks must be corrected before continuing.

Damper gas pressure cannot be confirmed by using a pressure gauge. The volume of gas in the shock is very small, and the amount lost during gauge installation will lower the pressure too much and require refilling.

After recharging is complete the rebuilt shock should be bench-tested. Stroke the shock to ensure full travel and smooth compression and rebound action. If the shaft moves in or out erratically this could indicate too much air is trapped inside. If the shaft will not move or has partial travel then it may be hydraulically locked. In either event the shock must be rebuilt again. Pay particular attention to the placement of the IFP, quantity of oil and shim stack/piston assembly.

SHOCK CALIBRATION CHARTS

NOTE: The following charts cover the T/A shock specifications.

MACH Z X (Canada and United States)

FRONT	CENTER	REAR
BRP part number		
505 071 470 and 505 071 471 (Kayaba shock)	503 191 203 (C-36 Kayaba shock)	503 190 847 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
140 mm (5-33/64 in)	119.5 mm (4-45/64 in)	54.5 mm (2-9/64 in)
Compression		
1 x 30 x .152	1 x 30 x .203	1 x 30 x .203
1 x 14 x .152	1 x 15 x .152	1 x 14 x .152
4 x 30 x .152	5 x 30 x .152	3 x 30 x .152
1 x 15 x .152	1 x 20 x .114	1 x 19 x .114
Rebound		
1 x 26 x .203	1 x 26 x .254	3 x 26 x .203
1 x 15 x .114	1 x 15 x .114	1 x 17 x .254
2 x 26 x .152	4 x 26 x .254	—
2 x 15 x .203	1 x 16 x .203	—
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

MACH Z X (Europe)

FRONT	CENTER	REAR
BRP part number		
505 071 949 and 505 071 950 (Kayaba shock)	503 191 220 (C-36 Kayaba shock)	503 191 221 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
54 mm (2-1/8 in)	119.5 mm (4-45/64 in)	54.5 mm (2-9/64 in)
Compression		
1 x 30 x .203	1 x 30 x .203	1 x 30 x .203
1 x 14 x .152	1 x 19 x .152	1 x 17 x .152
6 x 30 x .152	5 x 30 x .203	5 x 30 x .203
1 x 17 x .152	1 x 24 x .114	1 x 24 x .114
Rebound		
1 x 26 x .203	1 x 26 x .254	4 x 26 x .254
1 x 16 x .114	1 x 19 x .114	1 x 17 x .254
6 x 26 x .152	4 x 26 x .254	—
1 x 16 x .254	2 x 17 x .203	—
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

MX Z Renegade X (Canada and United States)

FRONT	CENTER	REAR
BRP part number		
505 071 204 and 505 071 205 (Kayaba shock)	503 191 203 (C-36 Kayaba shock)	503 190 729 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
54 mm (2-1/8 in)	119.5 mm (4-45/64 in)	54.5 mm (2-9/64 in)
Compression		
1 x 30 x .152	1 x 30 x .203	1 x 30 x .203
1 x 14 x .152	1 x 15 x .152	1 x 17 x .152
5 x 30 x .152	5 x 30 x .152	5 x 30 x .203
1 x 15 x .152	1 x 20 x .114	1 x 24 x .114
Rebound		
1 x 26 x .203	1 x 26 x .254	4 x 26 x .203
1 x 15 x .114	1 x 15 x .114	1 x 17 x .254
2 x 26 x .152	4 x 26 x .254	—
1 x 15 x .254	1 x 16 x .203	—
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

MX Z Renegade X (Europe)

FRONT	CENTER	REAR
BRP part number		
505 071 949 and 505 071 950 (Kayaba shock)	503 191 220 (C-36 Kayaba shock)	503 190 729 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
54 mm (2-1/8 in)	119.5 mm (4-45/64 in)	54.5 mm (2-9/64 in)
Compression		
1 x 30 x .203	1 x 30 x .203	1 x 30 x .203
1 x 14 x .152	1 x 19 x .152	1 x 17 x .152
6 x 30 x .152	5 x 30 x .203	5 x 30 x .203
1 x 17 x .152	1 x 24 x .114	1 x 24 x .114
Rebound		
1 x 26 x .203	1 x 26 x .254	4 x 26 x .203
1 x 16 x .114	1 x 19 x .114	1 x 17 x .254
6 x 26 x .152	4 x 26 x .254	—
1 x 16 x .254	2 x 17 x .203	—
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

SUMMIT Highmark 151 (Europe)

FRONT	CENTER	REAR
BRP part number		
505 071 457 (Kayaba shock)	503 190 662 (C-36 Kayaba shock)	503 190 990 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
176 mm (6-15/16 in)	121.5 mm (4-25/32 in)	171.5 mm (6-3/4 in)
Compression		
1 x 30 x .152	1 x 30 x .203	1 x 30 x .203
1 x 15 x .152	1 x 15 x .152	1 x 15 x .152
5 x 30 x .152	10 x 30 x .152	5 x 30 x .203
1 x 15 x .203	1 x 22 x .114	1 x 22 x .152
Rebound		
1 x 26 x .203	1 x 26 x .254	1 x 26 x .254
1 x 15 x .114	1 x 15 x .114	1 x 15 x .114
2 x 26 x .152	4 x 26 x .254	4 x 26 x .254
2 x 15 x .203	2 x 16 x .203	1 x 16 x .203
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

SUMMIT Highmark X 151 and 162

FRONT	CENTER	REAR
BRP part number		
505 071 457 (Kayaba shock)	503 190 662 (C-36 Kayaba shock)	503 190 990 (C-36 Kayaba shock)
Installation Distance of Floating Piston (IFP)		
176 mm (6-15/16 in)	121.5 mm (4-25/32 in)	171.5 mm (6-3/4 in)
Compression		
1 x 30 x .152	1 x 30 x .203	1 x 30 x .203
1 x 15 x .152	1 x 15 x .152	1 x 15 x .152
5 x 30 x .152	10 x 30 x .152	5 x 30 x .203
1 x 15 x .203	1 x 22 x .114	1 x 22 x .152
Rebound		
1 x 26 x .203	1 x 26 x .254	1 x 26 x .254
1 x 15 x .114	1 x 15 x .114	1 x 15 x .114
2 x 26 x .152	4 x 26 x .254	4 x 26 x .254
2 x 15 x .203	2 x 16 x .203	1 x 16 x .203
Slit piston		
1	1	1
Pressure		
2070 kPa (300 PSI)	2070 kPa (300 PSI)	2070 kPa (300 PSI)

STEERING AND HANDLEBAR

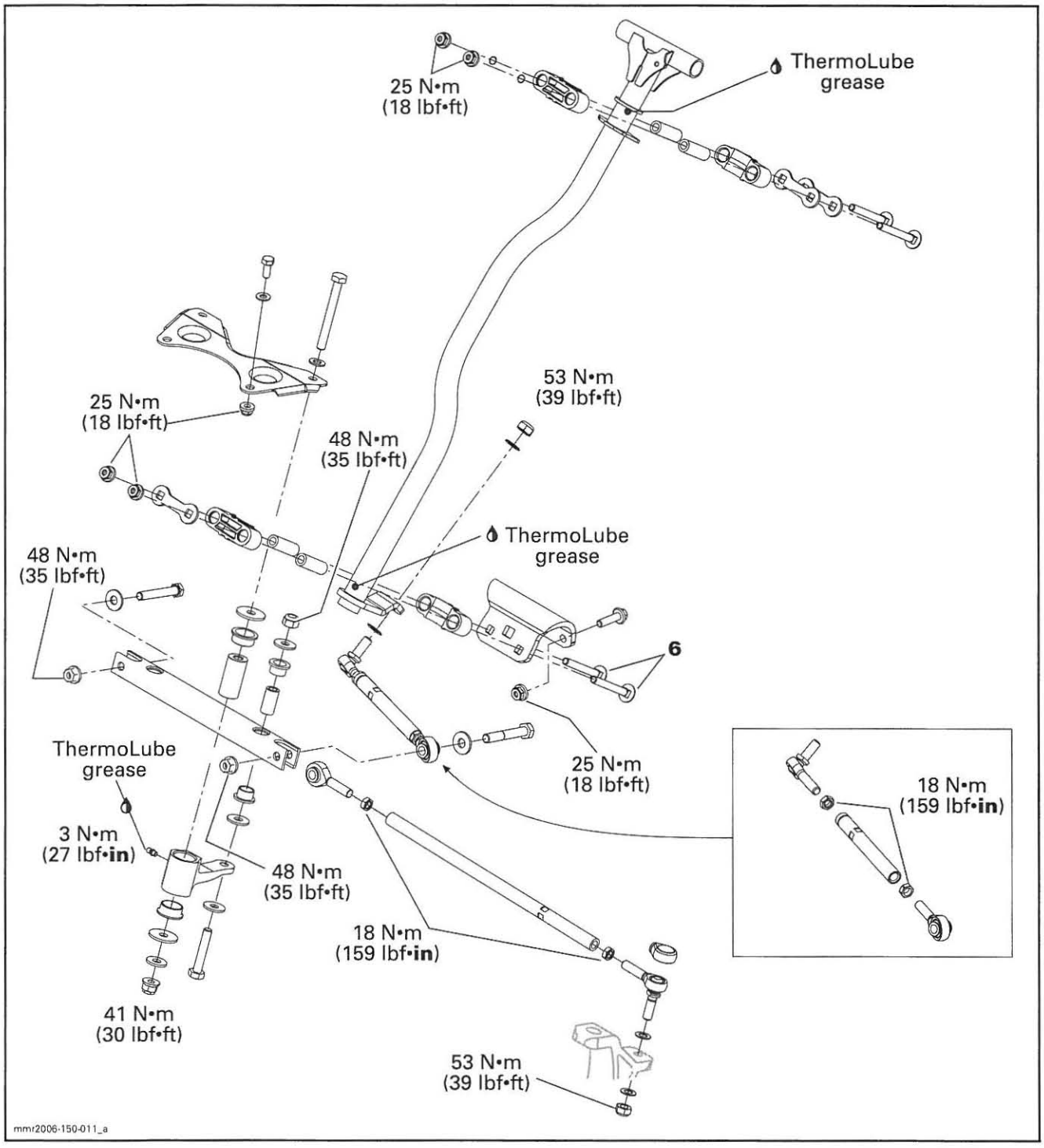
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
multilock-terminal housing extraction tool AMP	755430-2	329

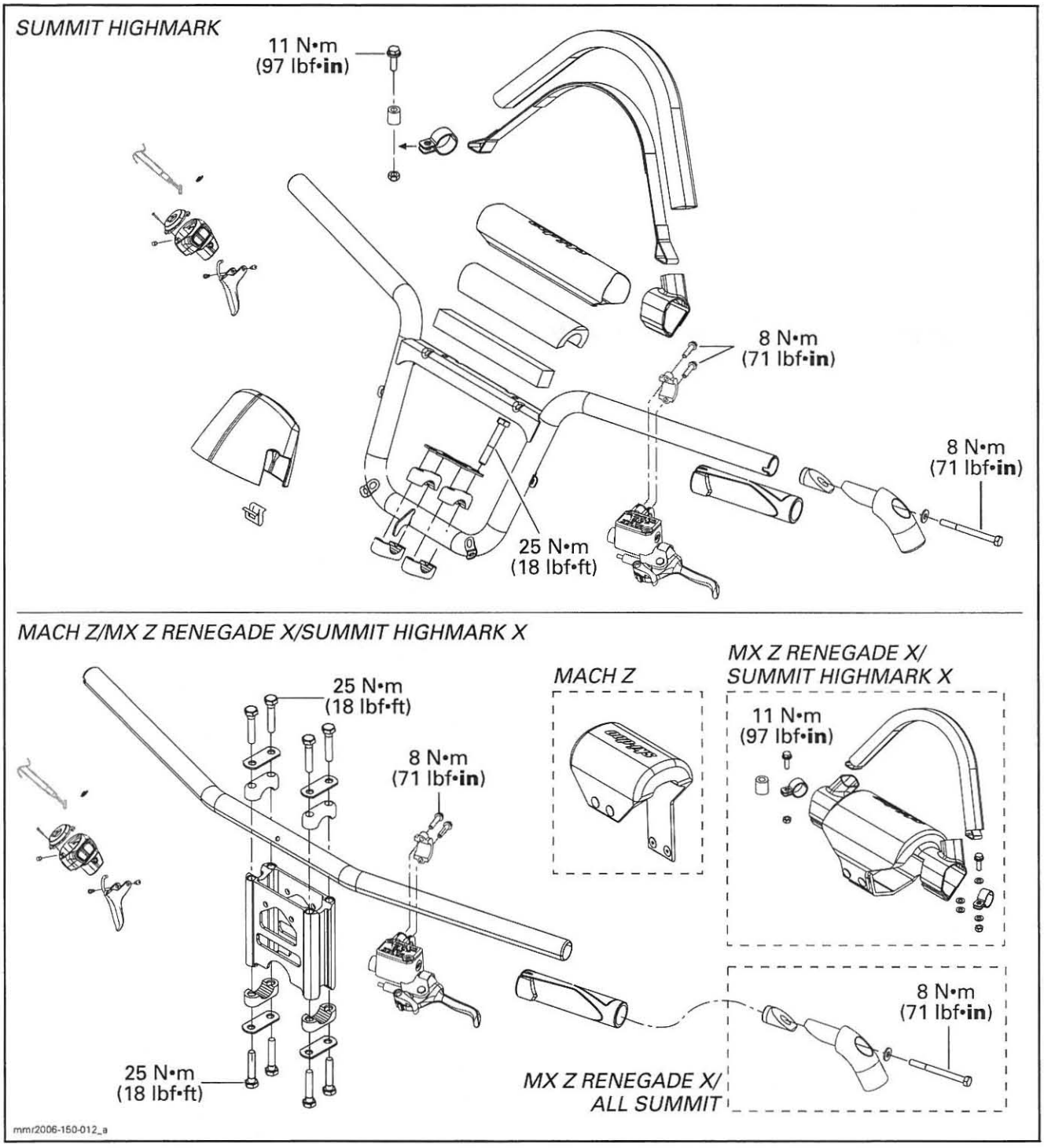
SERVICE PRODUCTS

Description	Part Number	Page
ThermoLube grease	219 700 417	335, 338

Linkage Arrangement



Handlebar Arrangement



GENERAL

When removing or replacing a part of steering system (except handle grips and handlebar), perform the steering alignment, refer to *SKI AND STEERING ALIGNMENT*.

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

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with a new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

HANDLEBAR GRIP

NOTE: To verify heating elements, refer to *LIGHTS, INSTRUMENTS AND ACCESSORIES*.

Removal

NOTE: These models feature an integrated heating element in the grip. If heating grip does not work and needs to be replaced, the grip can be cut with a knife to ease removal.

CAUTION: Removing grip from handlebar might damage the heating element. Do not remove needlessly.

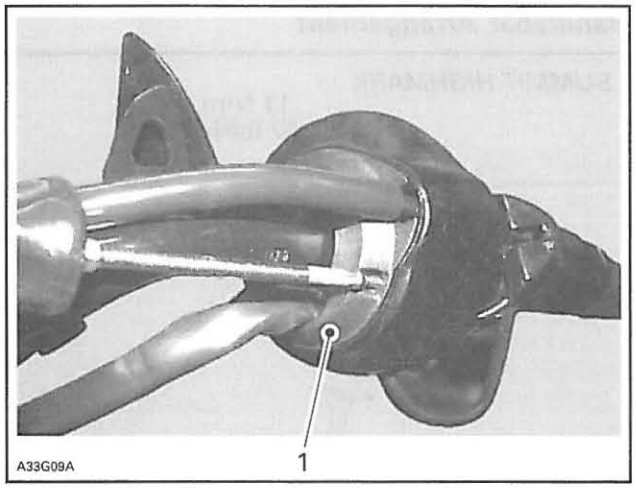
Throttle Side:

Unfasten windshield (if necessary).

Remove handlebar cap or steering padding according to model.

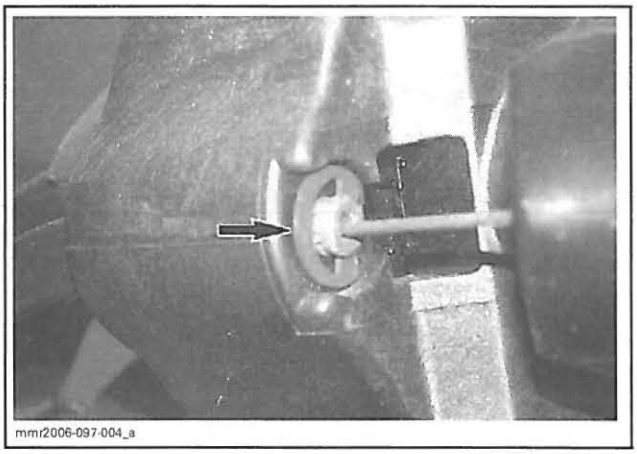
Unplug RH harness on top of steering column. Cut locking ties retaining RH harness to handlebar.

Remove throttle lever housing cover.



TYPICAL
1. Throttle lever housing cover

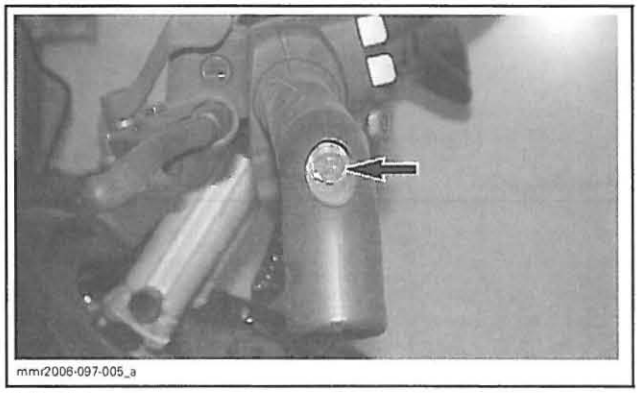
Remove circlip from throttle cable.



TYPICAL

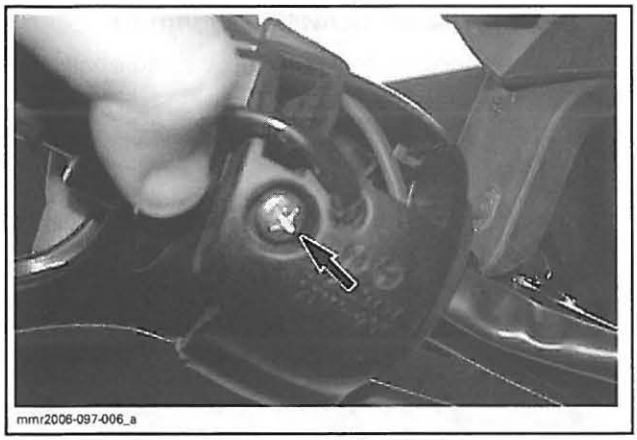
Unfasten throttle cable from throttle lever, then pull out throttle cable housing from throttle lever housing.

Remove J-hook from end of grip on so equipped models.



TYPICAL

Loosen screw retaining throttle lever housing to handlebar.



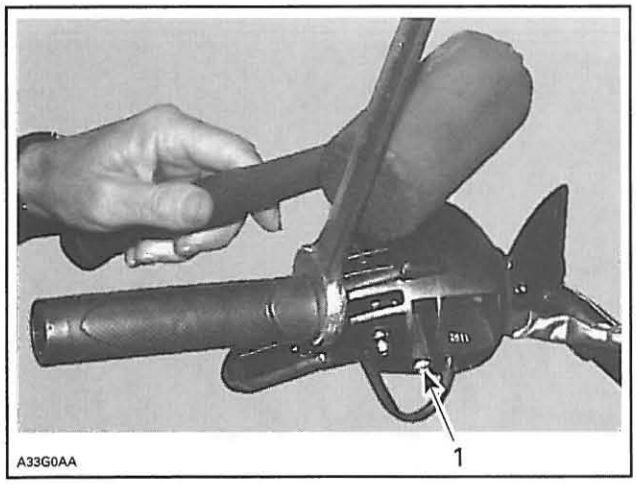
TYPICAL

Move throttle housing to create a gap with grip.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

CAUTION: Pay attention not to damage wires with the wrench.

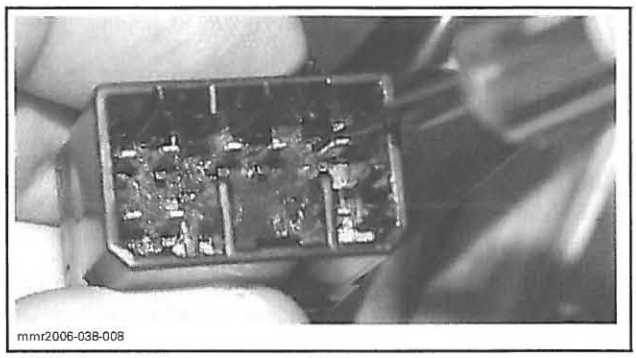
Using a plastic hammer, tap on the side of the wrench end to make the grip slide out.



TYPICAL
1. Screw retaining throttle lever housing

Cut locking ties on harness.

Using a tool such as the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the grip harness out of connector housing. Note the position of the wires for reinstallation.



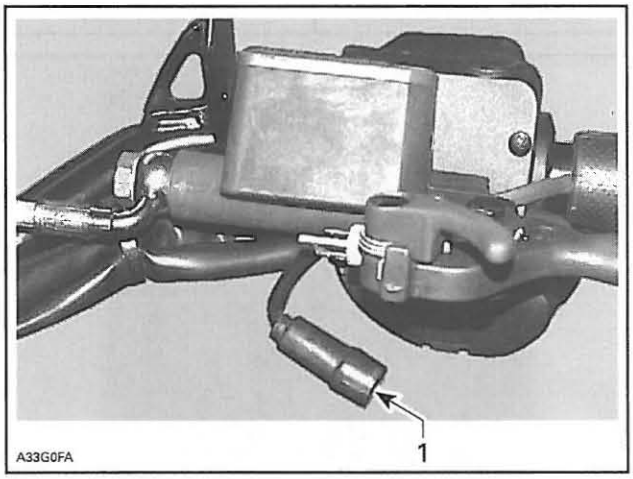
TYPICAL

Pull grip harness out of throttle lever housing.

Brake Side:

Unfasten windshield (if necessary).

Unplug connectors from brake light switch located on master cylinder.



TYPICAL
1. Connectors unplugged

Remove handlebar cap or steering padding according to model and unplug LH harness on top of steering column. Cut locking ties retaining brake light switch/grip harness to handlebar.

Using a tool such as the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the heating grip harness out of connector housing. Note the position of the wires for reinstallation.

Pull grip wires out of brake light switch/grip harness.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

CAUTION: Pay attention not to damage wires with the wrench.

Using a plastic hammer, tap on the side of the wrench end to make the grip sliding out.

Installation

Installation is the opposite procedure of the removal but pay attention to the following.

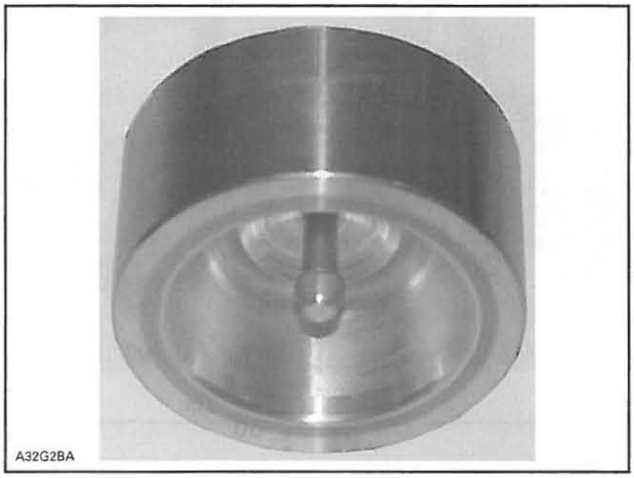
NOTE: The last 25.4 mm (1 in) at the end of handlebar must be kept free of paint to ease grips installation and reduce possibility of element damage.

Clean handlebar ends and inside of grip with isopropyl alcohol. Let dry before installation.

CAUTION: Handlebar end and inside of heating grip must be clean and dry before installing heating grip to ensure proper adhesion.

Use the appropriate insertion tool to properly install grip.

MODEL	TOOL PART NUMBER
Models with straight grips	529 035 897
Models with J-hooks	529 035 936



CAUTION: Installing grip without the insertion tool is likely to damage its heating element.

Position the insertion tool at the outside end of grip.

Using a plastic hammer, tap on tool to push grip on. Continue to tap until grip bottoms.

Properly route harness then reinstall removed parts.

Reinstall terminals and replug connectors. Test grips to ensure they heat properly.

HANDLEBAR

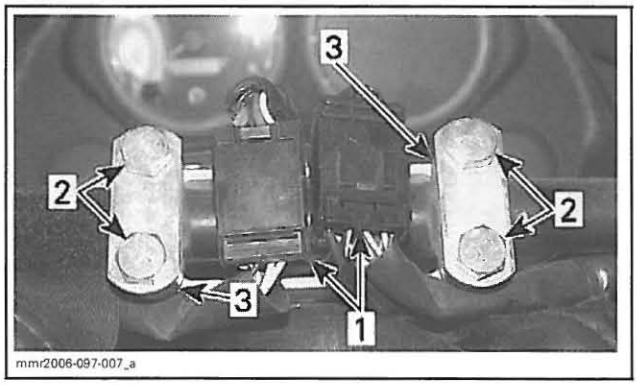
Removal

NOTE: If the handlebar must be changed, remove all components (handle grip, throttle lever housing, etc.) before removing it from vehicle.

Remove handlebar cap or steering padding according to model

All Models except SUMMIT Highmark

Unplug connectors then unscrew handlebar bolts and remove handlebar clamps.



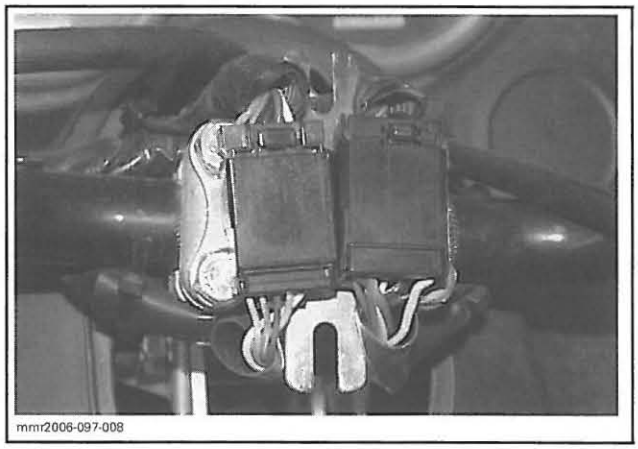
1. Connectors
2. Handlebar bolts
3. Handlebar clamps

Cut all locking ties retaining harness to handlebar.

Remove handlebar from handlebar extension.

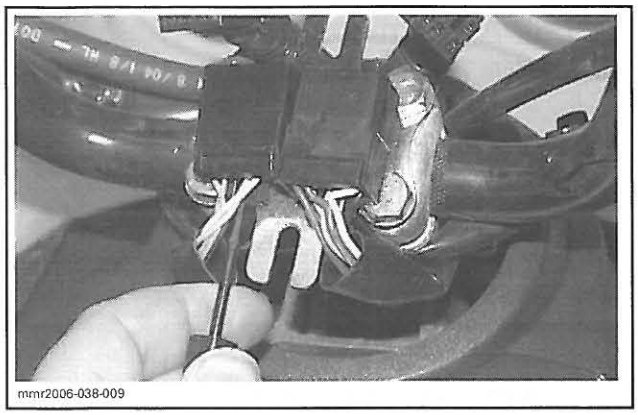
SUMMIT Highmark Models

Unplug connectors.



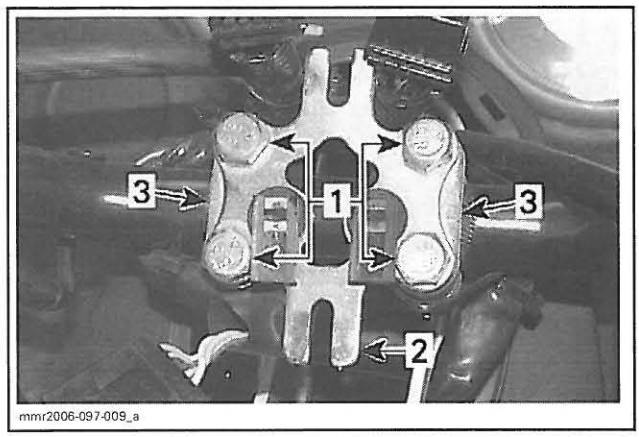
TYPICAL

Using a small tool, unclip connector housings from the reinforcement plate.



TYPICAL

Remove handlebar bolts, reinforcement plate and handlebar clamps. Cut locking ties retaining harness to handlebar.



1. *Handlebar bolts*
2. *Reinforcement plate*
3. *Handlebar clamps*

Remove handlebar from steering column.

Inspection

Inspect the handlebar for damage, cracks or bending, replace if any of these problems is detected.

⚠ WARNING

Do not try to repair a defective handlebar.

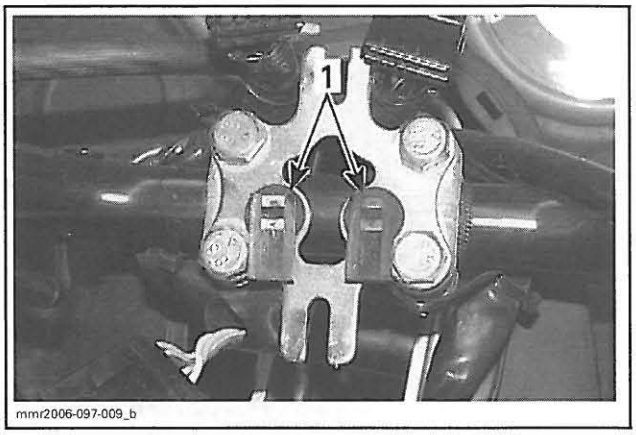
Check handlebar clamps for cracks or distortion, replace if necessary.

Installation

The installation is the reverse of the removal procedure. However pay attention to the following.

Install all handlebar bolts before torquing them. Torque to 25 N•m (18 lbf•ft).

NOTE: When installing the reinforcement plate, position its holes or the connector supports rearward.

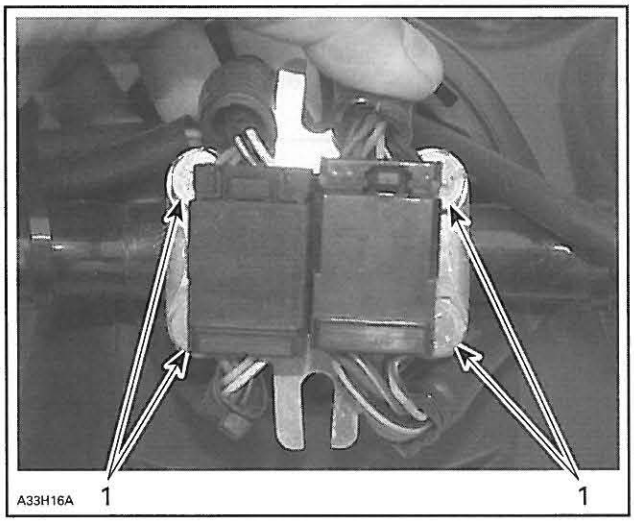


1. *Pointing toward rear of vehicle*

Adjustment

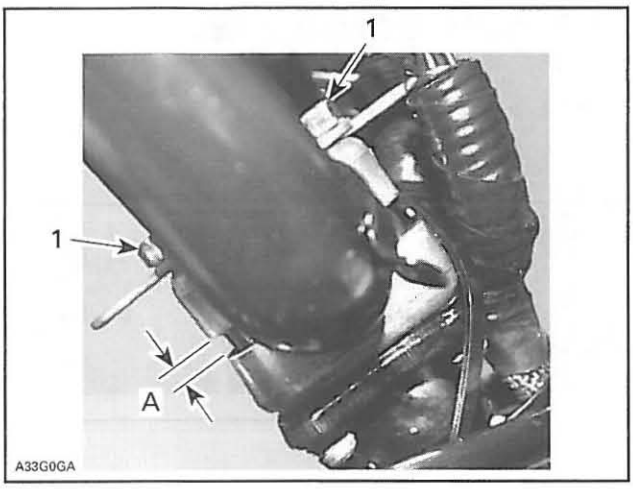
The handlebar position can be adjusted to suit driver's preferences.

Loosen all 4 bolts retaining handlebar to steering column.



1. *Four bolts*

Move handlebar to the desired position. Torque all 4 bolts to 25 N•m (18 lbf•ft).



1. Torque to 25 N•m (18 lbf•ft)
A. Equal gap all around

CAUTION: Tighten the bolts equally in a criss-cross sequence and ensure there is an equal gap on each side of the clamps.

⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Readjust throttle lever housing and switch housing accordingly to optimal angle so that you will not need to release your grip to operate levers.

⚠ WARNING

Adjust with vehicle at rest in a safe place. Securely retighten all fasteners. Never rotate throttle lever to operate with fingers instead of thumb.

Readjust windshield for proper fit with console. Refer to *BODY*.

Handlebar Strap

All Models except MACH Z

Ensure to position strap symmetrically each side of steering support and so that its rubber band is on the inner side. Tilt strap 5° towards driver relative to steering column axis or relative to handlebar extension on so equipped models.

Retaining clip and hardware must be installed in the same position on both strap ends.

Position strap between rubber band and screw end to protect the rubber band.

J-Hook Adjustment

All Models except MACH Z

Position J-hook so that its curved end is pointing downward and is roughly vertical. Ensure to adjust J-hooks at the same position each side.

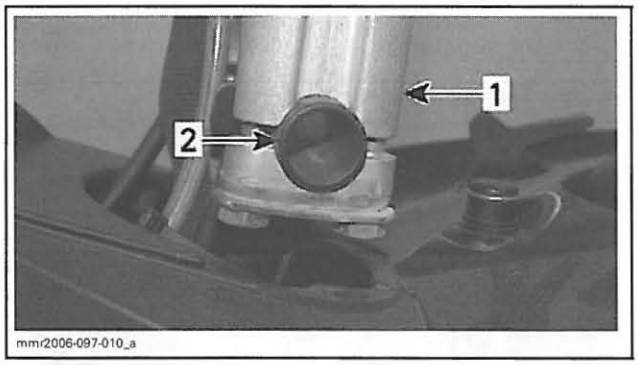
HANDLEBAR EXTENSION

All Models except SUMMIT Highmark

Removal

Remove handlebar from handlebar extension.

Unscrew bolts retaining the extension to steering column.



TYPICAL
1. Handlebar extension
2. Steering column

Remove handlebar extension from vehicle.

Inspection

Check handlebar extension for cracks, bend or other damages. Replace defective parts.

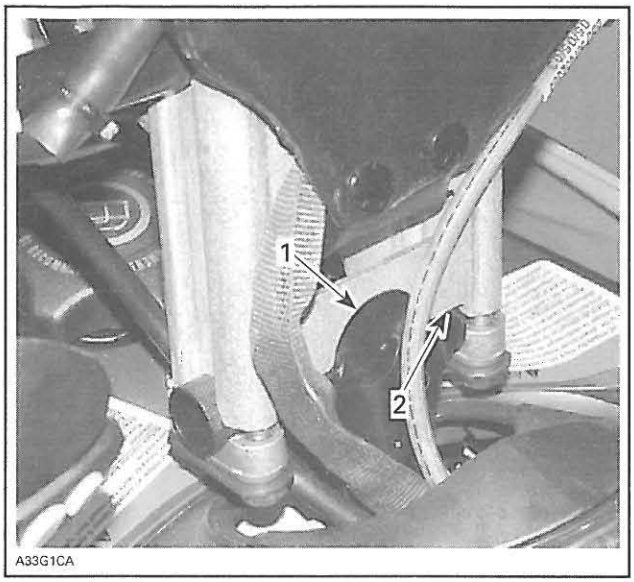
⚠ WARNING

Do not try to repair a defective handlebar extension.

Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

When installing handlebar extension, ensure to position the rounded opening at the bottom and to tilt the extension so that it rests against steering support stopper.



1. Opening here
2. Extension against stopper

TIE-ROD

NOTE: Use same procedure for RH and LH side.

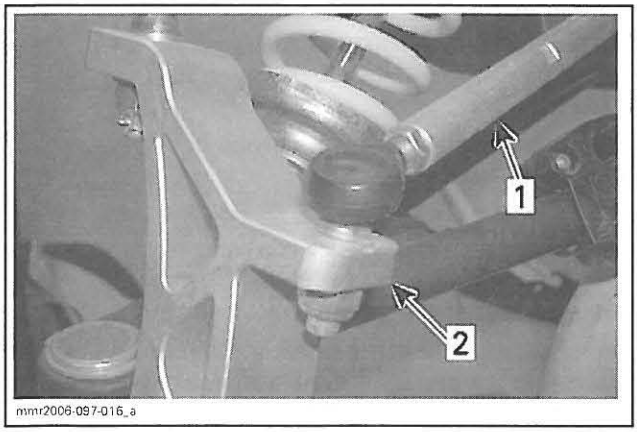
Inspection

Check tie-rod ends for looseness. If play is excessive, replace tie-rod.

Check if the tie-rod is bend, crack or otherwise damage. Replace if necessary.

Removal

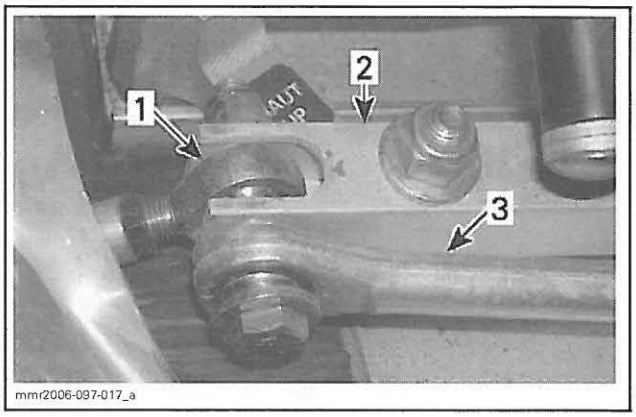
Separate the tie-rod end from ski leg.



1. Tie-rod
2. Ski leg

Open hood and remove tuned pipe.

Then separate the other end of tie-rod from swivel bar.



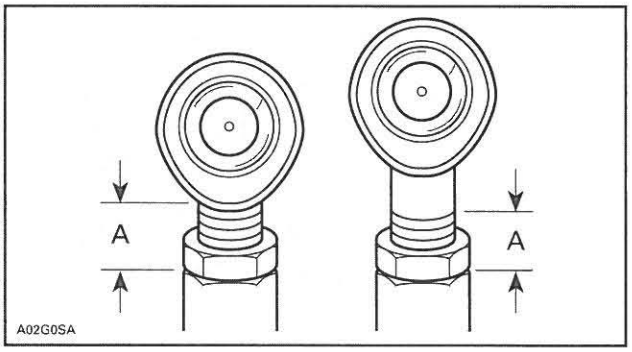
1. End of tie-rod
2. Swivel bar
3. Link rod

Move tie-rod through tie-rod boot to remove it from vehicle.

Installation

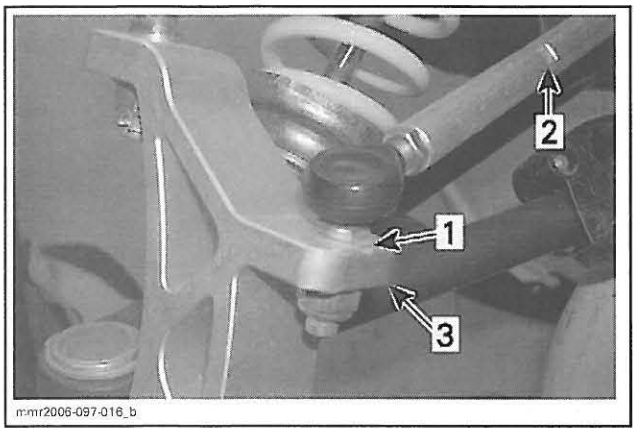
The installation is the reverse of the removal procedure. However, pay attention to the following.

The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).



A. 20 mm (25/32 in)

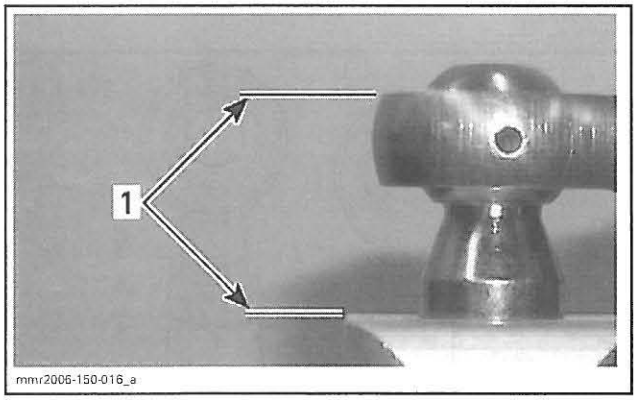
Install tie-rod with the groove on ski leg side. Do not forget to place a hardened washer between tie-rod end and ski leg.



1. Hardened washer
2. Tie-rod groove
3. Ski leg

Install nuts retaining tie-rod. Torque them to 52 N•m (38 lbf•ft).

NOTE: The ball joint of tie-rod end should be restrained when tightening the tie rod end lock nut. Align the tie rod end in a parallel to the ski leg or swivel bar when assembled on the vehicle, refer to the following illustration.



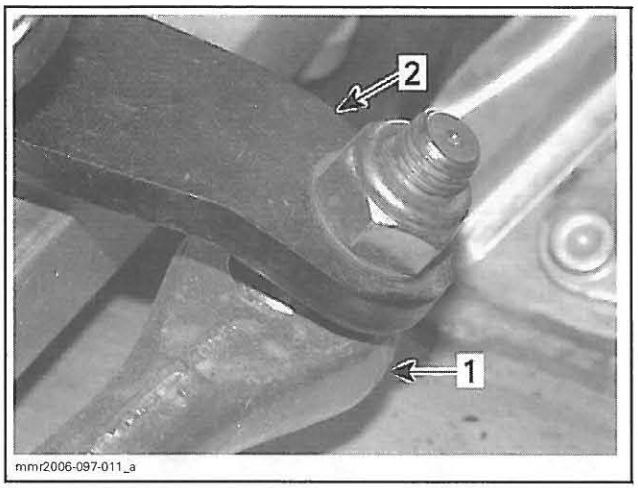
1. Parallel

LINK ROD

Removal

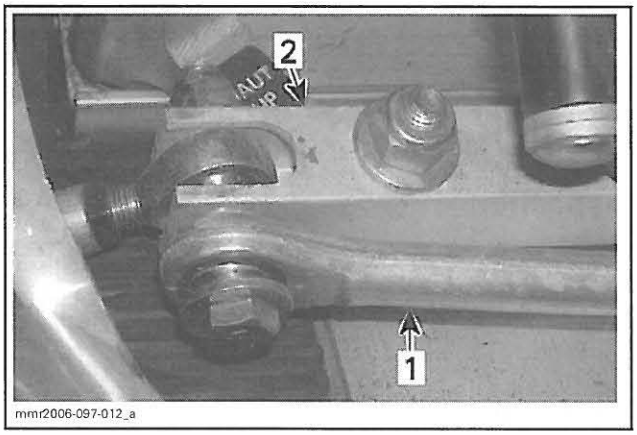
Open hood and remove tuned pipe.

Unscrew nut retaining link rod to steering column.



1. Link rod
2. Steering column

Remove bolt that attach the other end of link rod to swivel bar.



1. Link rod
2. Swivel bar

Remove link rod from vehicle.

Inspection

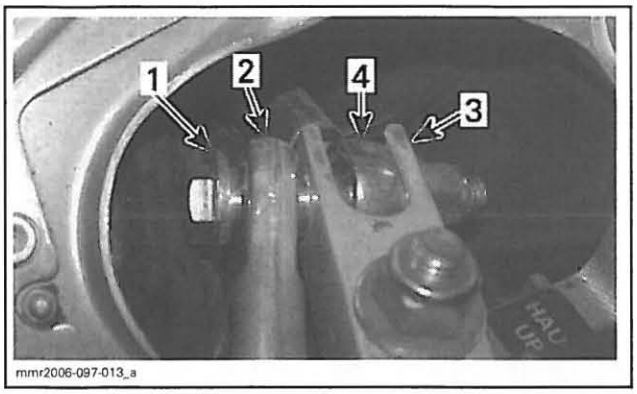
Check each ball joints for wear or looseness, if excessive, replace link rod.

Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

On steering column side, install an hardened washer between ball joint and steering column. Torque nut to 52 N•m (38 lbf•ft).

Install a washer between bolt head and link rod as per following picture.

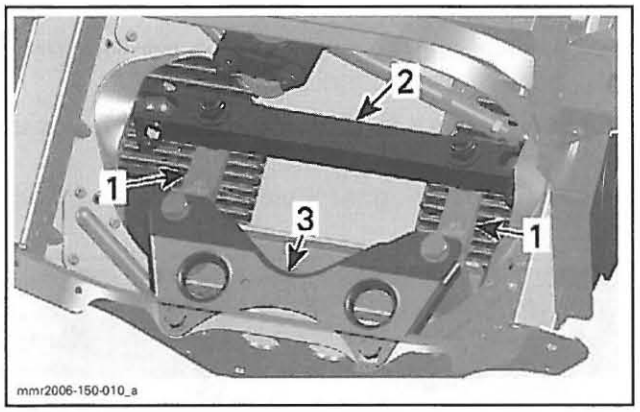


1. *Washer*
2. *Link rod*
3. *Swivel bar*
4. *LH tie-rod*

Torque nut to 48 N•m (35 lbf•ft).

Reinstall all other removed parts.

SWIVEL ARM



1. *Swivel arms*
2. *Swivel bar*
3. *Pivot support*

Removal

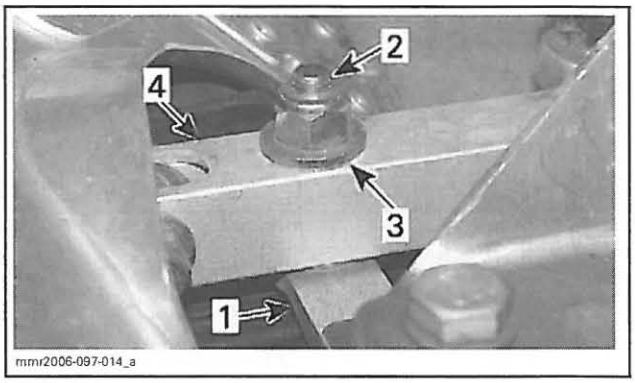
Open hood and remove tuned pipe.

Swivel Bar Side

Unscrew nut retaining swivel arm to swivel bar.

Remove bolt, washer, both hardened washers.

NOTE: To remove LH bolt, turn handlebar fully right to align bolt with the tie-rod boot hole. Turn handlebar fully left to remove the RH bolt.

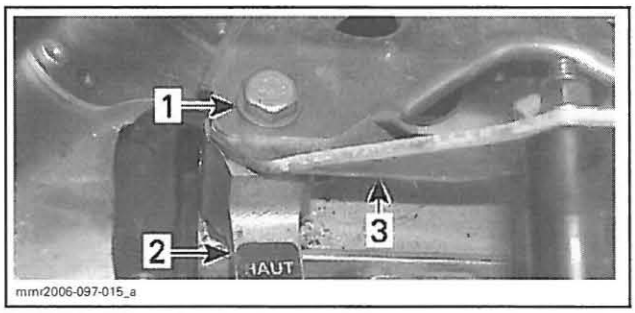


1. *Swivel arm*
2. *Swivel arm bolt*
3. *Hardened washer*
4. *Swivel bar*

Remove both swivel bushings and both pivot bar from swivel bar.

Pivot Support Side

Remove bolt, nut, hardened washers and large washers.



1. *Hardened washers*
2. *Swivel arm*
3. *Pivot support*

Remove swivel arm then remove both cushions and swivel pivot.

Inspection

Check swivel arms for cracks or folding. Replace if necessary.

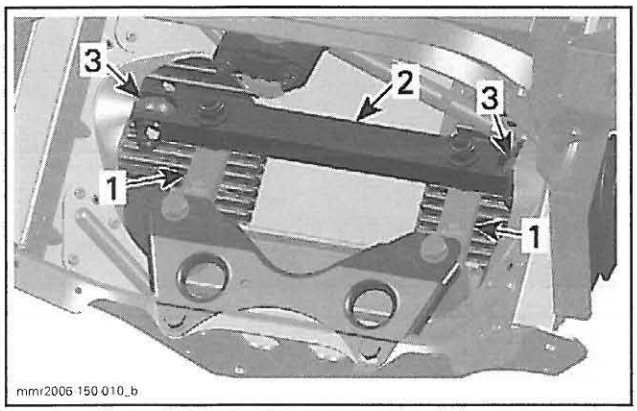
Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

Install swivel arm with the grease fitting toward inside the vehicle and the up mention on top.

Lubricate swivel arms with the ThermoLube grease (P/N 219 700 417).

SWIVEL BAR



1. Swivel arms
2. Swivel bar
3. Tie-rod ends

Removal

Open hood and remove tuned pipe.

Detach both swivel arms and both tie-rods from swivel bar. See above in this section.

Inspection

Check if swivel bar is bent or cracked. Replace if necessary.

Installation

The installation is the reverse of the removal procedure.

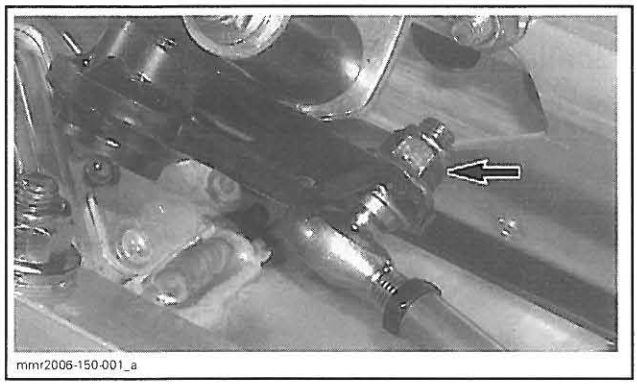
STEERING COLUMN

Removal

Bottom Side

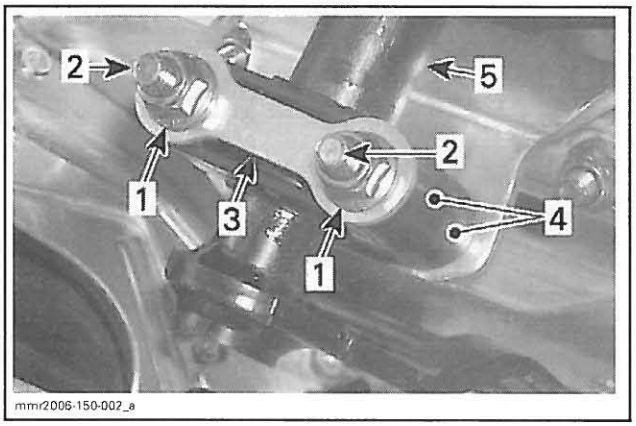
Open hood and remove tuned pipe.

Unscrew link rod nut.



Unscrew nuts that attach bottom of steering column to its support.

Remove stopper plate, half housings, housing bushings, carriage bolts and O-rings.



1. Nuts
2. Carriage bolts
3. Stopper plate
4. Half housings
5. Steering column

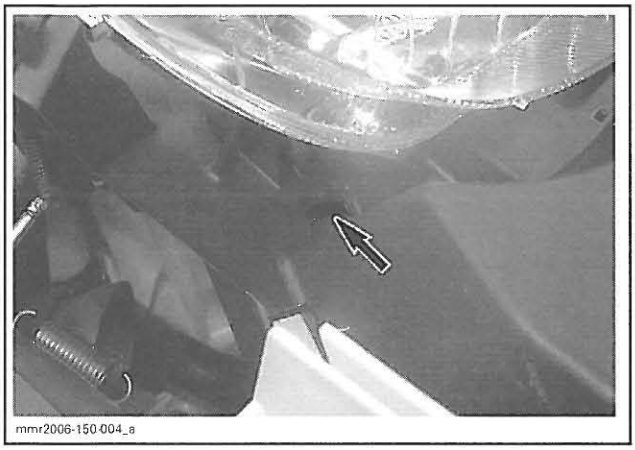
Top Side

Remove handlebar or handlebar extension from steering column and move it aside.

Remove indicator support and console. Refer to *BODY*.

Near muffler, unplug temperature sensor connector.

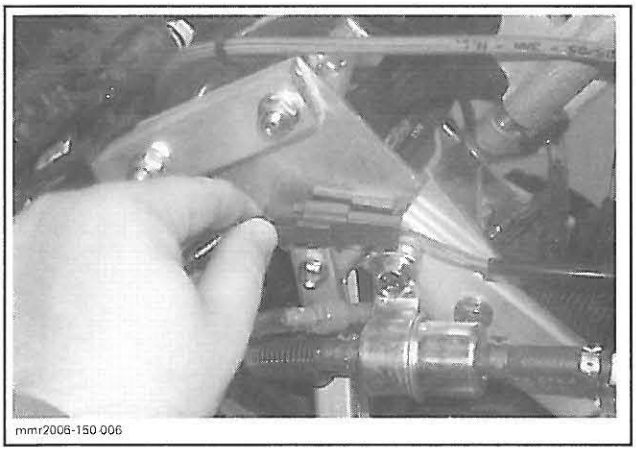
Cut locking tie located in front of headlight.


mmr2006-150-004_a

On primary air intake silencer, unplug air intake silencer connector.

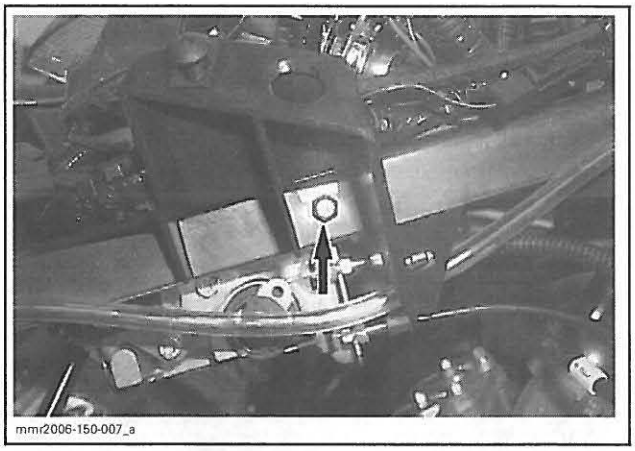

mmr2006-150-005

Then unplug connector of external electric fuel pump located over fuel filter.


mmr2006-150-006

Unplug spark plug cables.

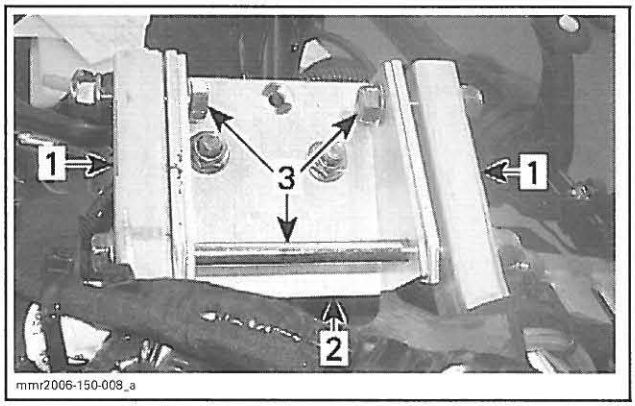
Remove both screws retaining multifunction plate (one on each sides).


mmr2006-150-007_a

On LH side, detach clear hose from multifunction plate.

Lift multifunction plate and move it toward the front of the vehicle.

Remove bolts retaining upper cross member arms to retaining block.



mmr2006-150-008_a

1. *Upper cross member arms*
2. *Retaining block*
3. *Bolts to remove*

Lift steering column and remove retaining block, half housings and housing bushings.

Pull steering column from top.

Inspection

Check if steering column is cracked, bent, twist or otherwise damaged. Replace steering column if necessary.

⚠ WARNING

Do not try to repair a defective steering column.

Installation

The installation is the reverse of the removal procedure.

Apply ThermoLube grease (P/N 219 700 417) on steering column before installing half housings at the top and at the bottom.

Insert steering column so that the throttle cable is located between the column and the steering bracket. Wiring harness and brake hose must be located outside of retaining block.

1. *Throttle cable*
2. *Steering column*
3. *Steering bracket*
4. *Wiring harness*
5. *Brake hose*

SKIS AND STEERING ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
A-arm nut wrench	529 035 876	341
ball joint lock tool	529 035 945	341
ball joint remover	529 035 827	341

GENERAL

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

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 strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with a new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

SKI RUNNER

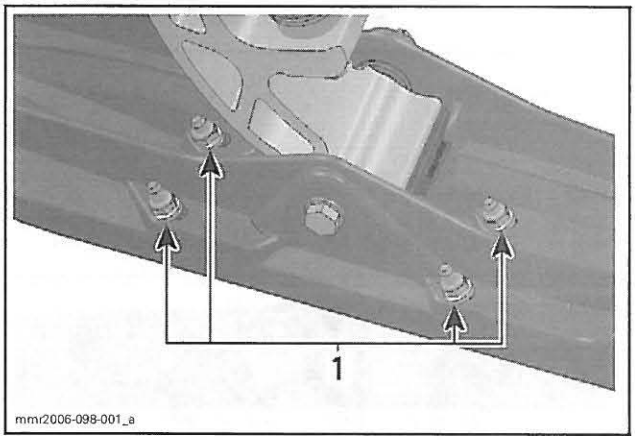
Inspection

Lift the front of vehicle and check ski runners for wear or damages (missing or broken carbide). Replace if necessary.

Removal

Lift the front of vehicle and support it off ground.

Unscrew the ski runner nuts then remove ski runners.



TYPICAL — SKI PILOT 5.7 (LEFT SIDE) SHOWN
1. Ski runner nuts

Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

Torque ski runner nuts to 8 N•m (71 lbf•**in**).

SKI

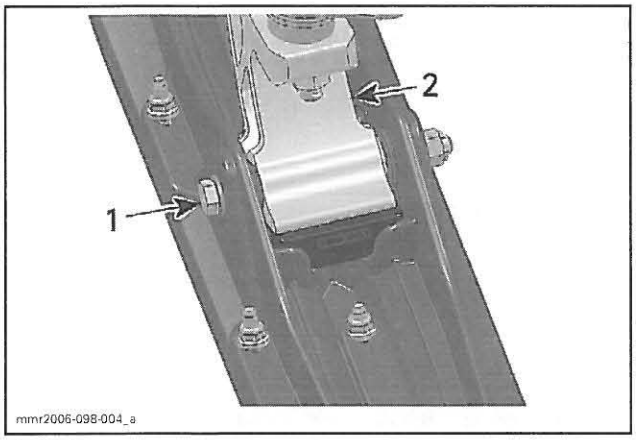
Inspection

Inspect ski for excessive wear or other damage. Replace if necessary.

Removal

Lift front of vehicle and support it off ground.

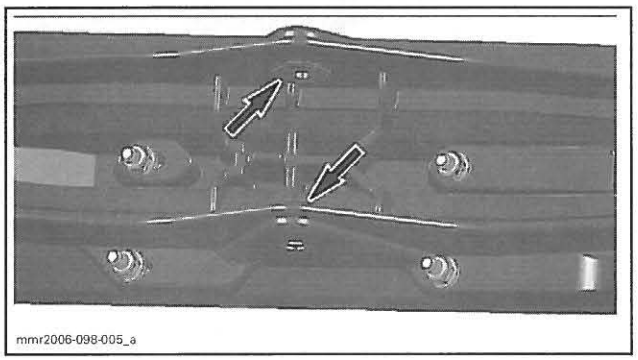
Unscrew nut then pull ski bolt out. Remove ski from vehicle.



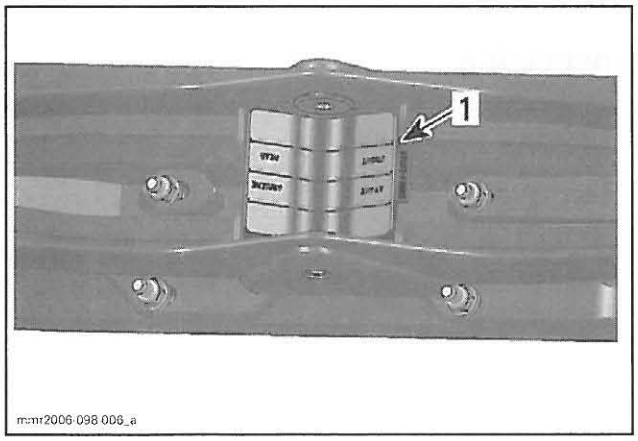
TYPICAL
1. Ski bolt
2. Ski leg

Installation

Make sure bushings are installed in ski holes.



Install ski stopper. Position indicator in front and make sure the bump in the ski is in the groove of the ski stopper.



TYPICAL — PILOT SKI
1. Ski stopper

Install ski bolt and torque it to 32 N•m (24 lbf•ft).

SKI HANDLE (for Pilot ski)

Removal

Remove ski from vehicle.

Using a 9 mm (3/8 in) drill bit, remove ski handle rivets.

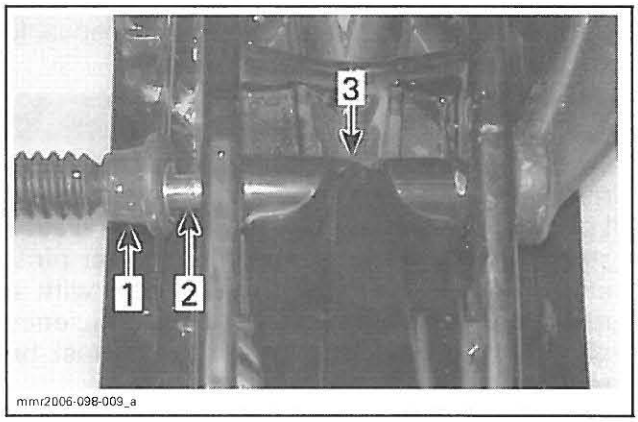
Remove handle from ski.

Place handle in hot water for 10 minutes then using a punch, drive the inner part of rivet out of handle.

Installation

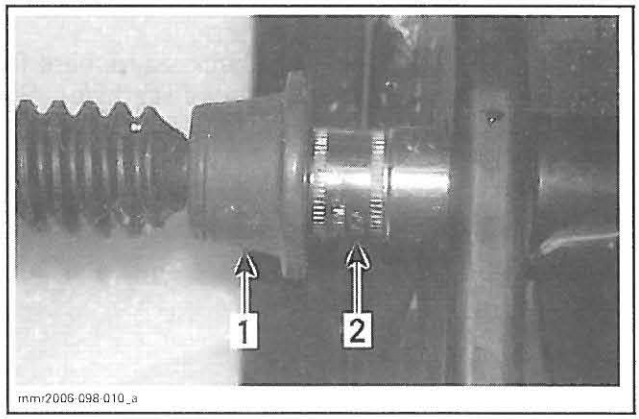
To install rivets, use a C-clamp and a short 10 mm socket.

– Place a rivet in position and insert it into ski and ski handle. Repeat the procedure for the other side.



1. C-clamp
2. Rivet
3. Handle

– When both rivets are installed, use a short 10 mm socket to push rivet heads against ski.



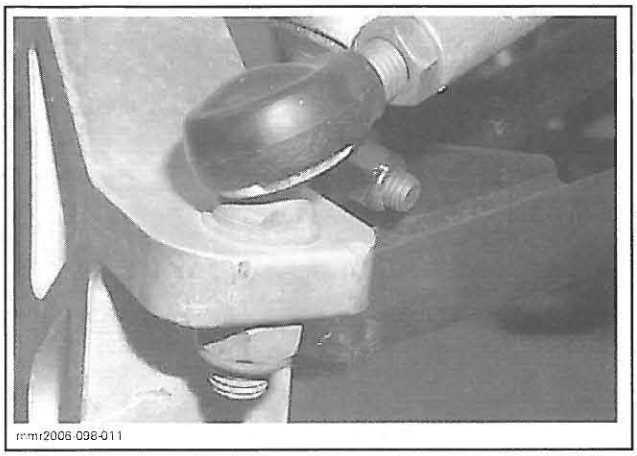
1. C-clamp
2. 10 mm socket

SKI LEG

Removal

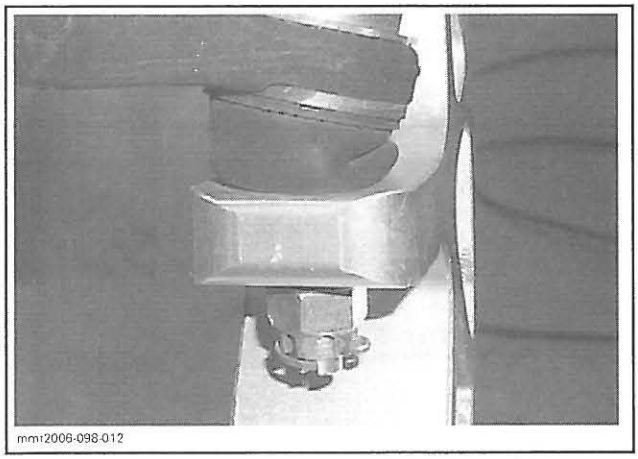
Remove ski from ski leg.

Detach tie-rod from ski leg by unscrewing tie-rod end nut.



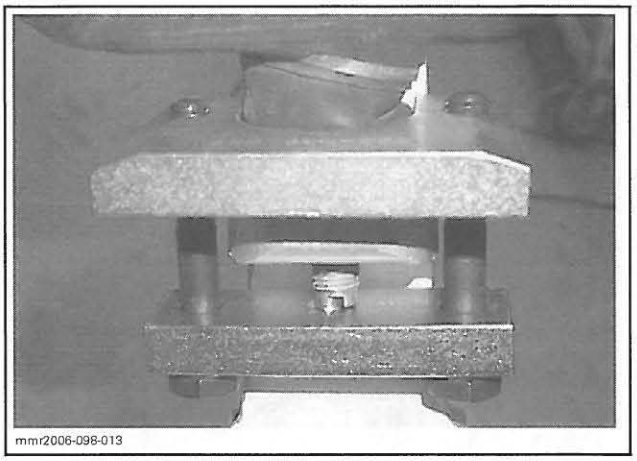
Lower Ball Joint

Remove cotter pin and unscrew ball joint nut. Discard cotter pin.



Raise lower arm so that ball joint becomes parallel with ski leg.

Install the ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.

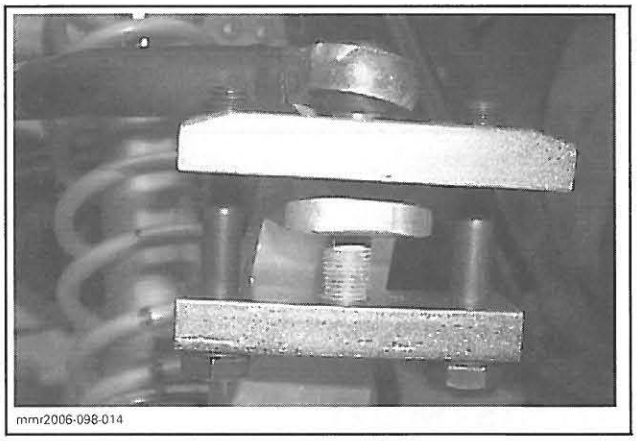


Upper Ball Joint

Remove cotter pin and unscrew ball joint nut. Discard cotter pin.

Position upper arm so that ball joint becomes parallel with ski leg.

Install the ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.



Inspection

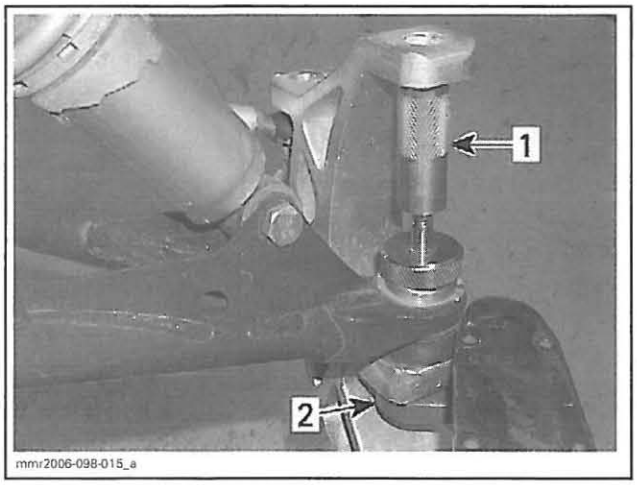
Check if ski leg is cracked, bent or otherwise damaged. Replace as necessary.

Installation

Install the lower ball joint first.

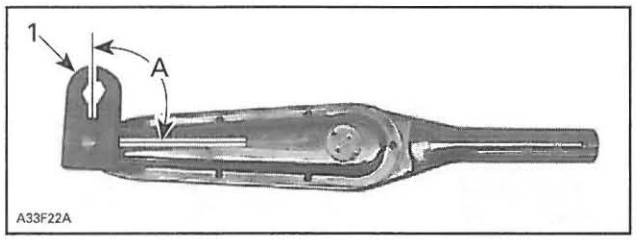
Install the ball joint lock tool (P/N 529 035 945) to restrain ball joint during nut tightening.

To properly torque ball joint nut, use the A-arm nut wrench (P/N 529 035 876).



1. Ball joint lock tool
2. A-arm nut wrench

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



1. A-arm nut wrench
A. 90°

Torque lower ball joint nut to 72 N•m (53 lbf•ft).

Reinstall all other removed parts.

Torque upper ball joint nut to 72 N•m (53 lbf•ft) and tie-rod nut to 52 N•m (38 lbf•ft).

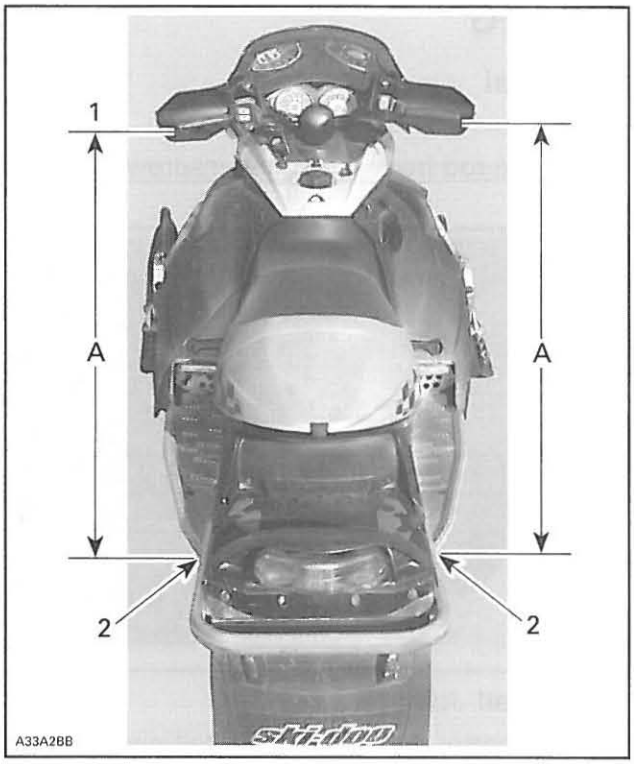
ADJUSTMENT

STEERING ALIGNMENT

Ski alignment is performed by adjusting length of left and right tie-rods. To do this, use the following procedure:

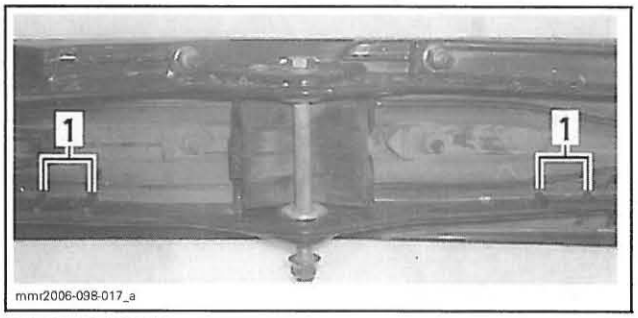
- Leave the vehicle on the ground on its own weight.
- Position handlebar so that it is straight ahead position by measuring from the extremities of the grips to the rear most edge of the tunnel, as shown.

NOTE: The reference point must be the same to each side.



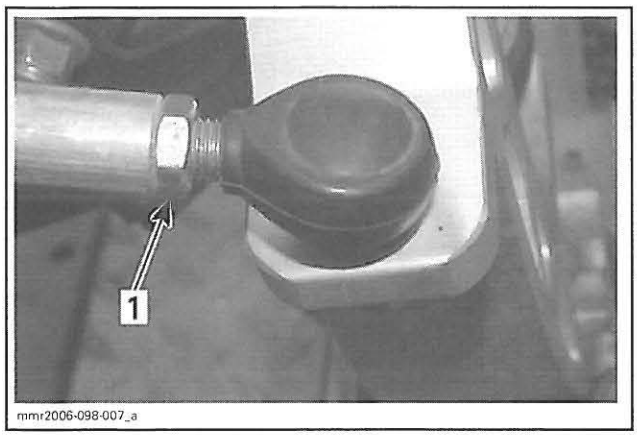
1. Equal distance "A" on each side
2. Same reference point

- Verify if skis are in straight-ahead position.
  - Use the recesses to align ski.



RH SKI SHOWN
1. Recesses

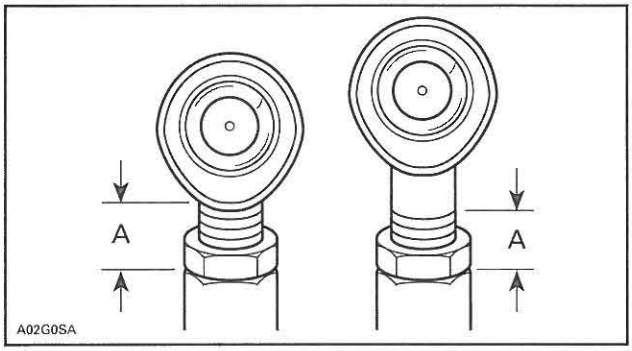
- To adjust ski, loosen jam nut at the end of tie-rod then turn to tie-rod to obtain proper alignment. Retighten jam nut to 18 N•m (159 lbf•**in**).



1. Jam nut

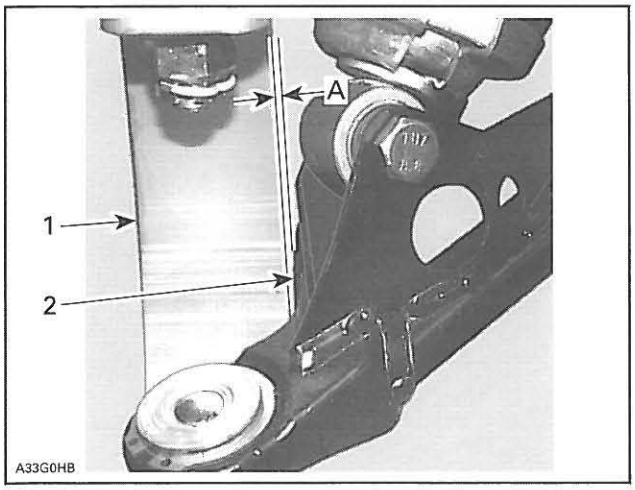
⚠ WARNING

Never lengthen tie-rod so that the external un-engaged threaded portion of tie-rod end exceeds 20 mm (25/32 in).



A. 20 mm (25/32 in) maximum

Once ski alignment is done, Check that ski leg rests against lower arm or is not more than 2 mm (5/64 in) from lower arm when handlebar is fully turned.



RH HAND SIDE SHOWN
1. Ski leg
2. Lower arm
A. 2 mm (5/64 in)

If the distance is more than the specified distance on one side, check for bent parts.

BODY

SERVICE TOOLS

Description	Part Number	Page
adjustment wrench	529 035 891	347–348
Supertanium™ drill bit	529 031 800	346

PARTS REPLACEMENT

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

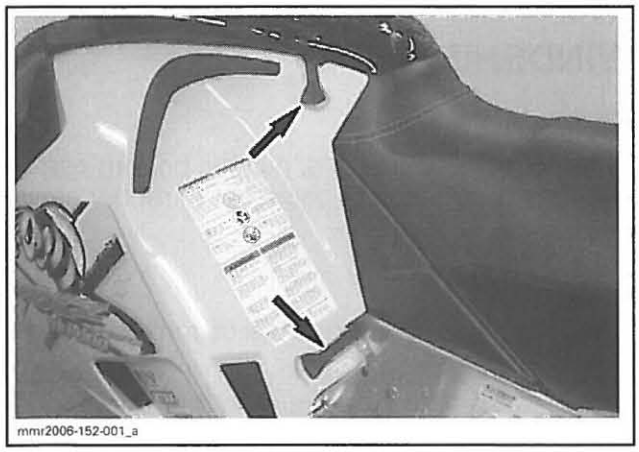
CAUTION: Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

SIDE PANEL

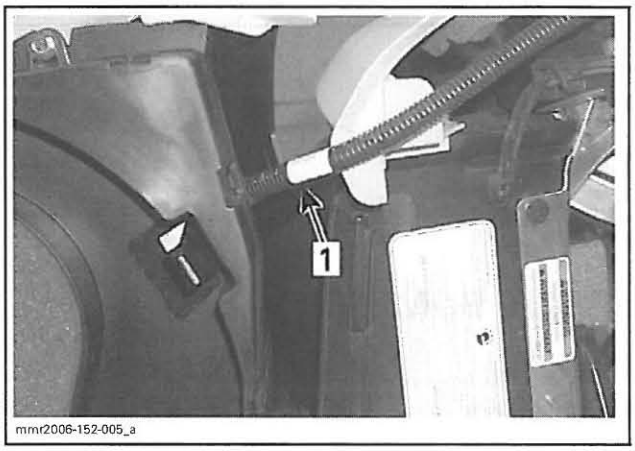
Removal

NOTE: Use same procedure for RH or LH side.

Unlatch side panel.

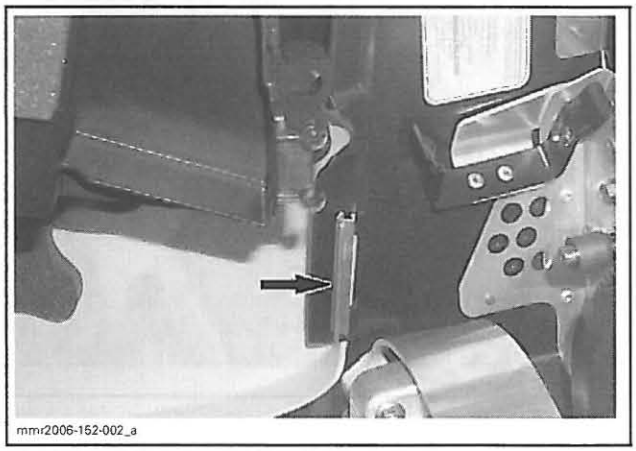


On LH side panel, unplug the air pressure sensor (APS) connector from the secondary air intake silencer.



1. APS harness

Remove lower hinge lock.



DRIVE BELT GUARD REMOVED FOR CLARITY

Get the lower hinge out of its notch then lower the side panel to extract the upper hinge.

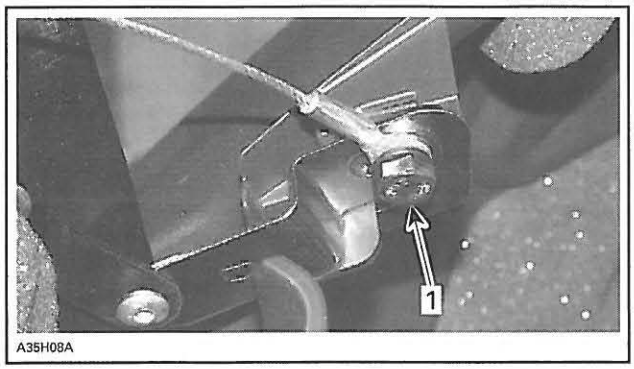
Installation

The installation is the reverse of the removal procedure.

HOOD

Removal

Remove bolts retaining hood hinge to front bumper.



1. Hinge bolt

Remove hood.

Installation

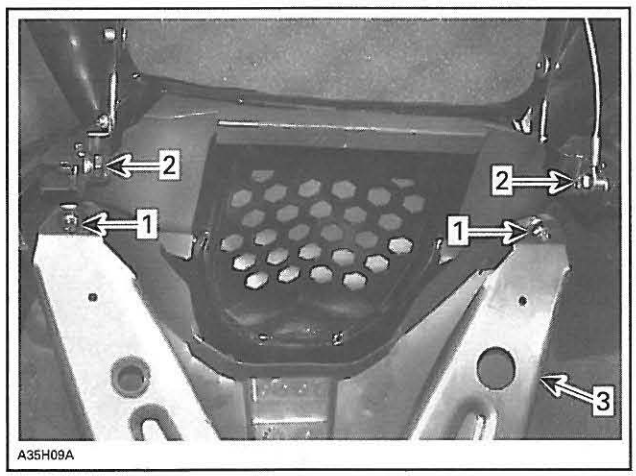
The installation is the reverse of removal procedure.

FRONT BUMPER

Removal

Remove hood.

Unscrew bolts retaining front bumper to frame.



1. Bumper bolts
2. Hinge bolts
3. Frame

Remove bolts near upper shock absorber brackets.

Remove front bumper.

Installation

The installation is the reverse of removal procedure.

BOTTOM PAN

Removal

Remove front bumper.

Using Supertanium™ drill bit (P/N 529 031 800), drill all rivets retaining bottom pan. Refer to *FRAME* for proper procedure when drilling rivets retaining plastic.

Remove bottom pan.

Installation

The installation is the reverse of removal procedure.

WINDSHIELD

Removal

To remove the windshield, pull the bottom part of windshield until its pins come out of rubber grommets.

Installation

The installation is the reverse of removal procedure.

NOTE: Make sure not to push in grommets.

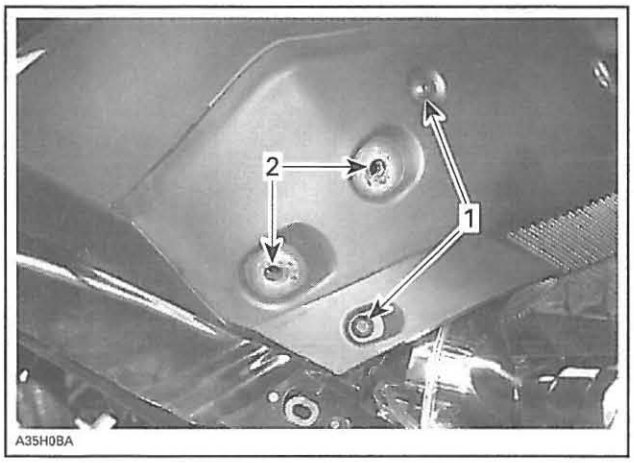
ACCESS PANEL

Removal

Open hood.

Remove windshield.

Remove retaining screws, one on each sides.



1. *Access panel screws*
2. *Rubber grommet for windshield*

Installation

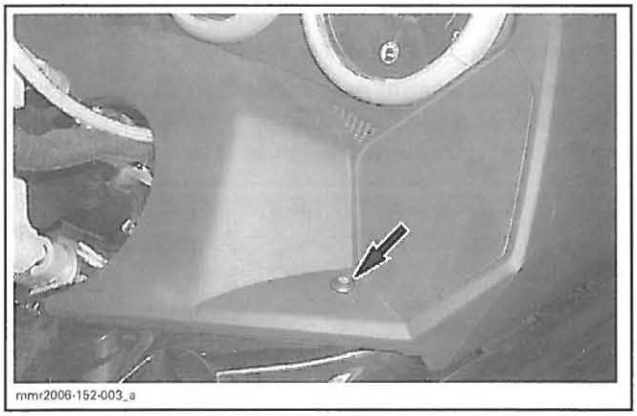
The installation is the reverse of removal procedure.

INDICATOR PANEL

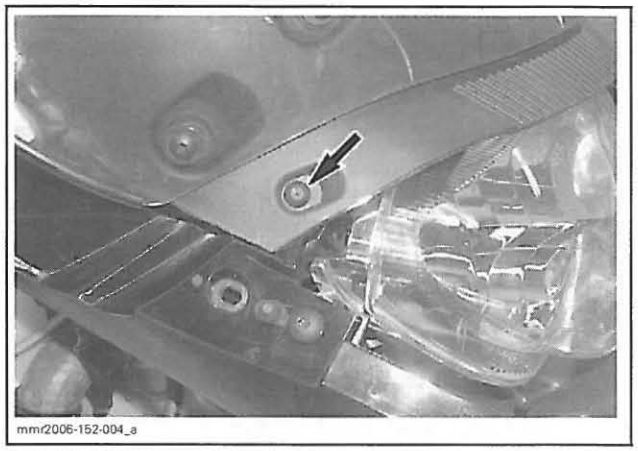
Removal

Open hood and remove the access panel.

Remove the indicator panel screws on the top of panel and under hood.



ON EACH SIDE OF STEERING COLUMN



UNDER HOOD

Lift indicator panel and unplug all connectors.

Installation

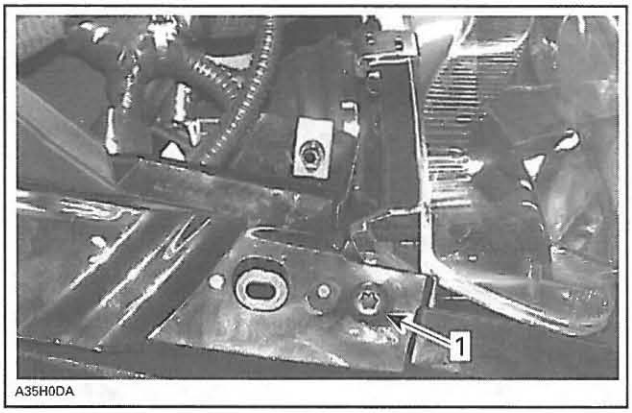
The installation is the reverse of removal procedure.

CONSOLE

Removal

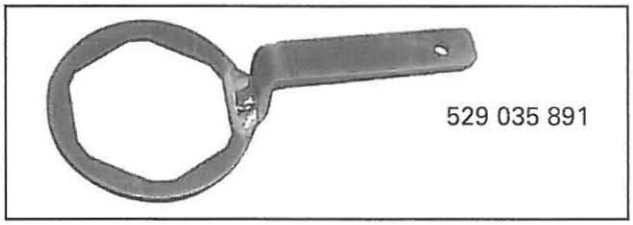
Remove the indicator panel.

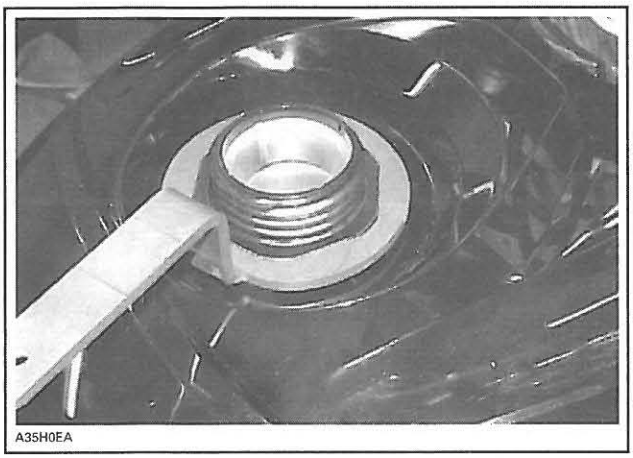
Remove the screws near headlamp. One on each side.



1. *Console screw*

Using the adjustment wrench (P/N 529 035 891), unscrew the fuel tank nut.




A35H0EA

TYPICAL

Lift up the console and unplug all connectors.

Install fuel tank cap.

Installation

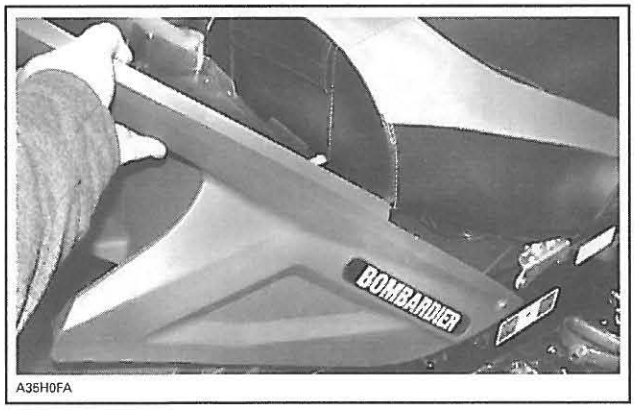
The installation is the reverse of removal procedure.

SEAT

Removal

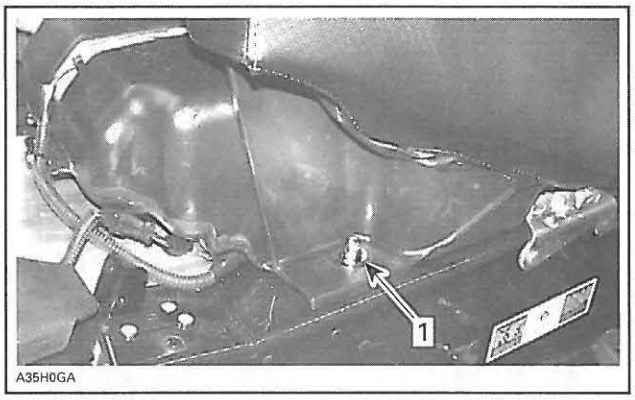
Loosen fuel tank nut by using the adjustment wrench (P/N 529 035 891).

Remove trunk behind seat.



A35H0FA

Remove both nuts retaining seat to frame.



A35H0GA

1. Seat nut (one on each side)

Lift the rear of seat then pull the seat backwards.

Installation

The installation is the reverse of removal procedure.

NOTE: The seat must be inserted under console.

SEAT COVER

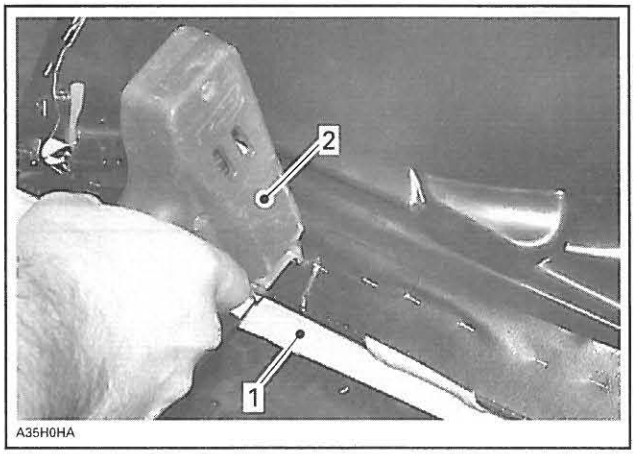
Cover Replacement

Remove the old seat cover. Check the foam and replace it if necessary.

Install staples with an electric tacker such as Arrow tacker ETN-50 or with a manual tacker such as Arrow tacker T-50.

NOTE: For an easier installation, it is highly recommended to use an electric tacker.

Ensure that the seat rest firmly against a hard surface such as a piece of wood. This is done to get the staples completely pushed in place.



A35H0HA

TYPICAL
1. Piece of wood
2. Tacker

After seat cover installation, cut all around the excess of material.

CLEANING

SEAT

It is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

PLASTIC

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

CAUTION: Do not apply isopropyl alcohol or acetone directly on decals.

CAUTION: The following products must not be used to clean or wax any of the plastic components used on the vehicles:

- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- varsol
- naphtha
- acetone
- strong detergents
- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

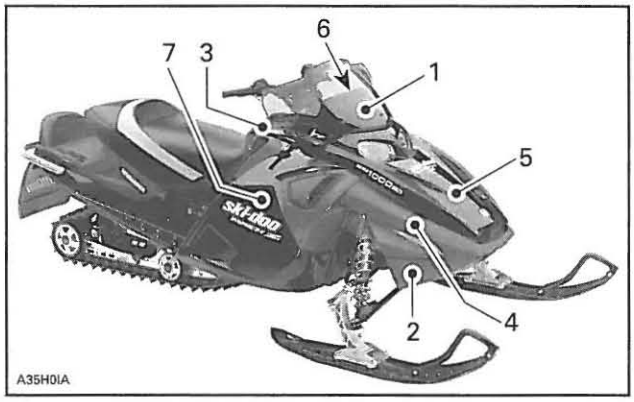
Apply wax on glossy finish only. Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: If for some reason the snowmobile has to be stored outside, it is preferable to cover it with an opaque tarpaulin. This will prevent the sun rays from affecting the plastic components and the vehicle finish.

REPAIR

BODY PARTS

The very first step before repairing plastic materials is to find out exactly which type of material is involved.



PLASTIC PARTS		
	PARTS	MATERIAL
1	Access panel	Polypropylene
2	Bottom pan	Polypropylene
3	Console	Surlyn
4	Front bumper	Polypropylene
5	Hood	Surlyn
6	Indicator panel	Polypropylene
7	Side panel	Surlyn

CAUTION: Some repair products are not compatible with certain plastics.

⚠ WARNING

Windshields must never be repaired by welding or otherwise.

For hood repair, refer to a specialized shop.

The following company provides a complete line of products to repair plastic materials:

CREST INDUSTRIES, INC.
Trenton, MI 48183
Phone: (734) 479-4141
Toll Free: 1 800 822-4100
Fax: (734) 479-4040
E-Mail: info@crestauto.com
www.crestauto.com

FRAME

SERVICE TOOLS

Description	Part Number	Page
Supertanium™ drill bit	529 031 800	351, 353

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic chaincase oil	413 803 300	351

GENERAL

FRAME

NOTE: For bare aluminum frames use only aluminum cleaner and follow instructions on container. (Dursol cleaner or equivalent).

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

CAUTION: Never direct high-pressure water jet towards decals. They will peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

RIVET DRILLING PROCEDURE

Use the Supertanium™ drill bit (P/N 529 031 800), available in a 5 mm (3/16 in) size and shipped in packs of 2.

For proper drilling instructions and to prevent premature wear, follow the procedure below.

Self-Piercing Rivet

- Always use a variable speed drill.
- Partially drill rivet end — **not the rivet head.**
- Maintain a slow to medium speed at all times when drilling. The proper speed is attained when a constant chip is ejected.

NOTE: To increase bit life, use XP-S synthetic chaincase oil (P/N 413 803 300) as a cutting oil.

CAUTION: High speed drilling will cause excessive heat which may destroy the cutting edge of the bit; therefore, avoid using pneumatic drills.

- Cut rivet using a chisel.
- Remove riveted part.
- Drive out remaining rivet head using a punch.

Pop Rivets

- Always use a variable speed drill.
- Always drill **rivet head.**
- Maintain a slow to medium speed at all times when drilling. The proper speed is attained when a constant chip is ejected.
- When rivet is located on plastic part, use pliers to avoid rivet turning and heating plastic.
- Use a small punch to push the rivet end.

WELDING

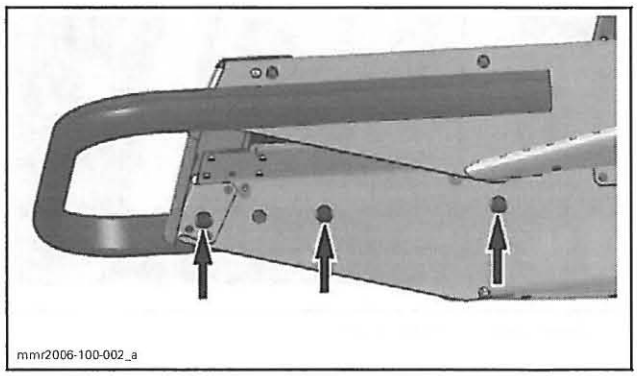
- No welds should be done on aluminum frame except if mentioned or required on a BRP bulletin.

PROCEDURES

REAR BUMPER

Removal

Underneath tunnel, remove bolts retaining rear bumper to chassis.



TYPICAL

Pull rear bumper to remove it from vehicle.

Installation

The installation is the reverse of the removal procedure.

NOTE: Install all bolts before torquing them.

UPPER CROSS MEMBER ARM

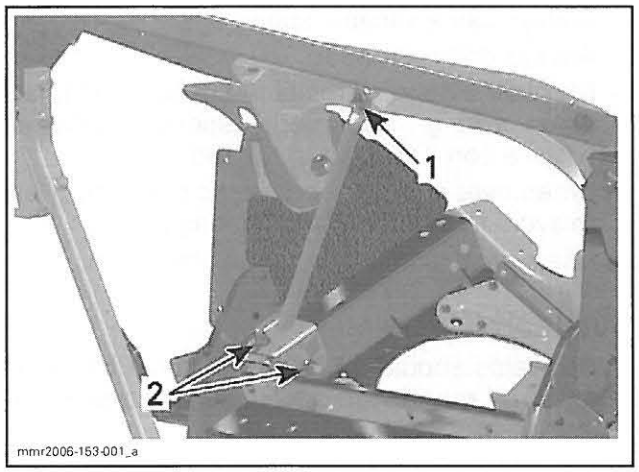
Removal

Remove side panels, console and indicator support. Refer to *BODY*.

Detach the multifunction plate from upper cross member arms.

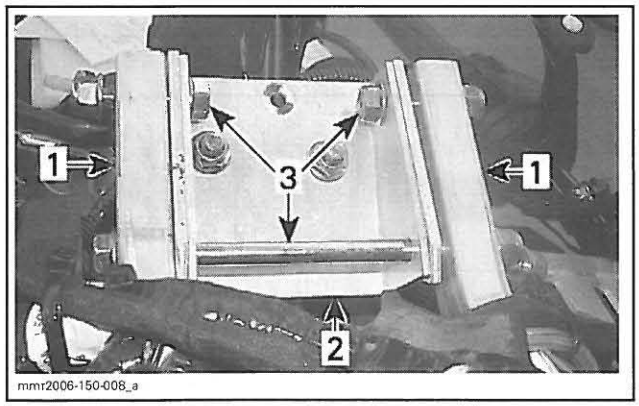
Remove both front shock absorbers. Refer to *R.A.S. FRONT SUSPENSION*.

Remove front member steel brace. Remove the upper bolt and loosen lower nuts.



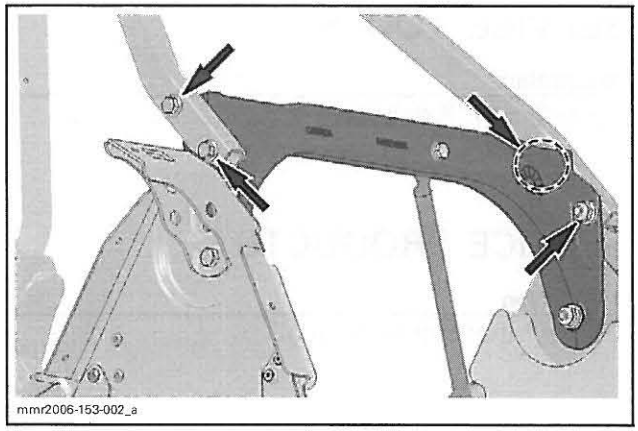
TYPICAL
1. *Upper bolt*
2. *Lower nuts*

Remove bolt that attach the top of upper cross member arm to retaining block.



1. *Upper cross member arms*
2. *Retaining block*
3. *Bolt to remove*

At the bottom of upper cross member arms, remove bolts holding upper cross member arms to upper cross member.



Remove upper cross member.

Installation

The installation is the reverse of the removal procedure.

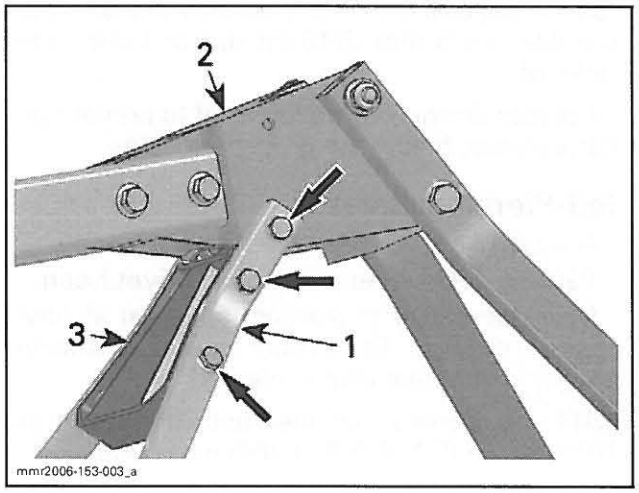
NOTE: Install all bolts before torquing them.

STEERING COLUMN SUPPORT ARM

Removal

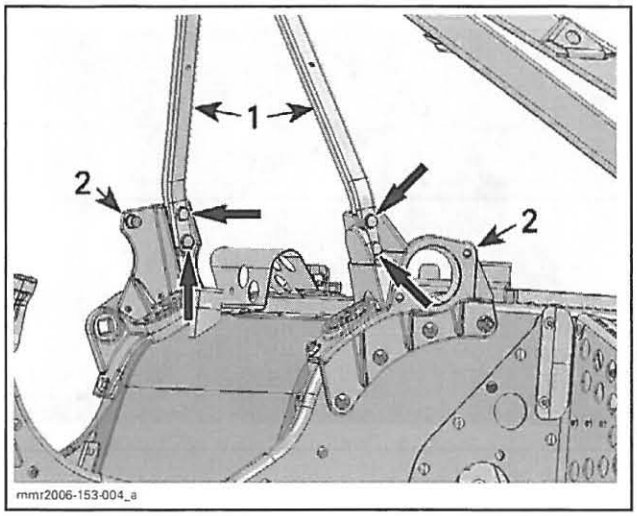
NOTE: The procedure is the same for both arms of steering column support.

Remove bolts retaining the top of support arm to the steering column support and to the steering bracket.



1. *Steering column support arm*
2. *Steering bracket*
3. *Steering column support*

At the bottom of support arm, remove the bolts holding support arm to countershaft support.



1. Support arm bolts
2. Countershaft support

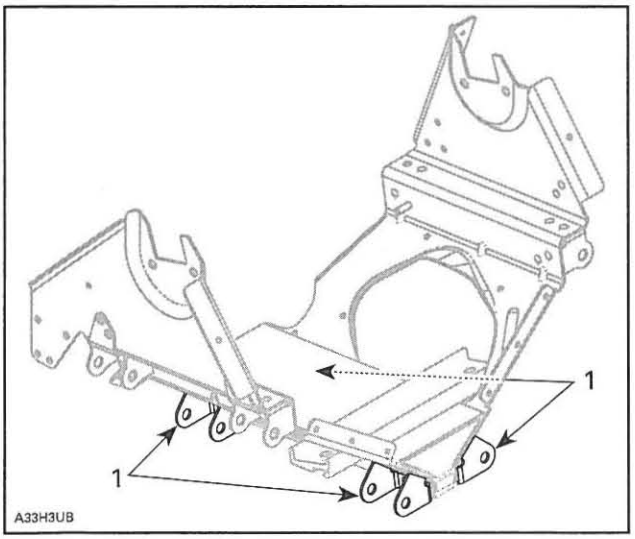
Remove support arm from vehicle.

Installation

The installation is the reverse of the removal procedure.

NOTE: Install all bolts before torquing them.

LOWER A-ARM BRACKET



1. Lower A-arm brackets

Removal

Remove:

- front shock absorbers
- bolts and nuts retaining lower A-arms to frame
- lower A-arms from their support brackets
- bolts and nuts holding brackets to frame. Discard bolts and nuts.

Using a Supertanium™ drill bit (P/N 529 031 800), drill rivets out.

Remove and discard lower brackets.

Installation

Secure the new lower brackets to frame using the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M8 x 55 (P/N 207 685 044)
2	Flanged nut M8 (P/N 233 081 416)

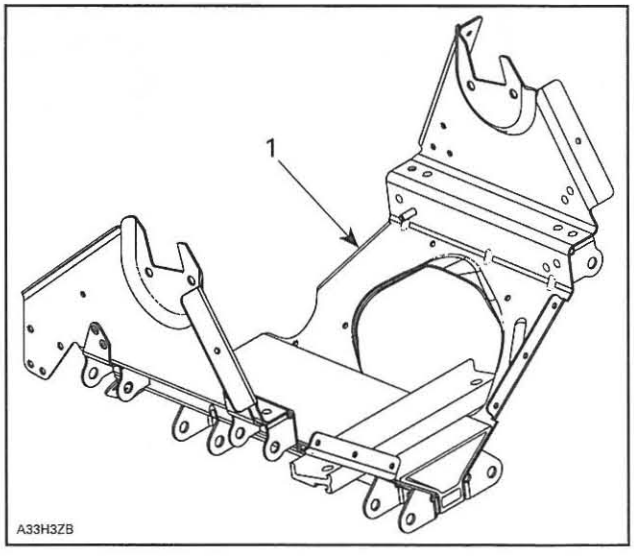
NOTE: Bolt head should be on the RH side of the vehicle.

Secure the lower A-arm with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M10 x 70 (grade 10.9) (P/N 207 607 046)
2	Elastic nut M10 (P/N 233 201 416)

NOTE: The head of bolts should be towards the front of the vehicle.

FRONT CROSS MEMBER



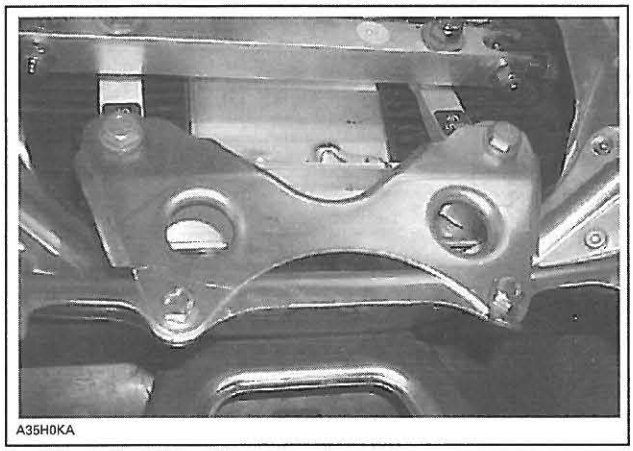
1. Front cross member

Removal

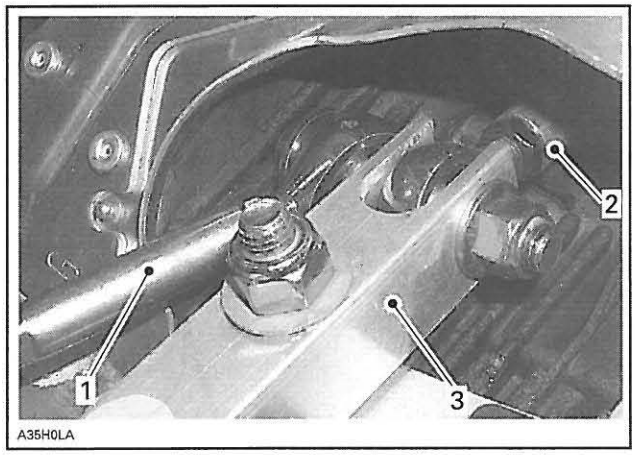
Remove:

- side panels

- hood
- muffler
- tuned pipe
- front bumper brace
- pivot support


A35H0KA

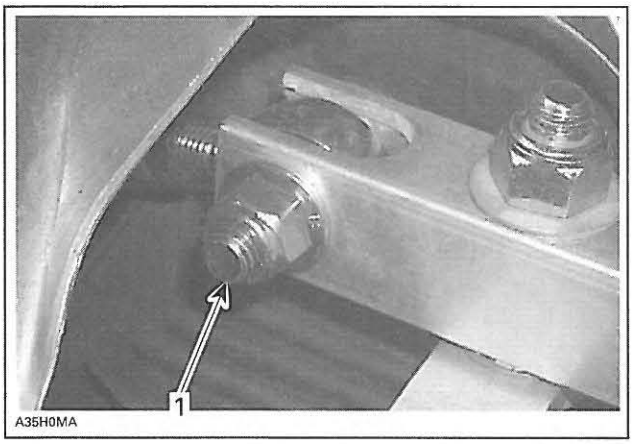
- bolt holding short tie-rod and LH tie-rod to swivel bar



A35H0LA

1. Short tie-rod
2. Tie-rod
3. Swivel bar

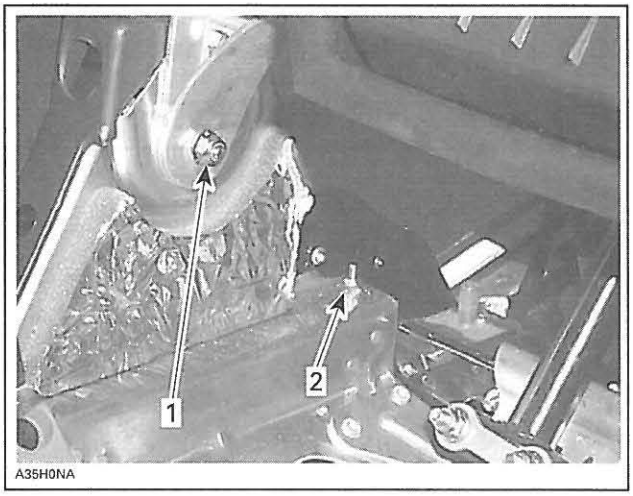
- bolt holding RH tie-rod to swivel bar



A35H0MA

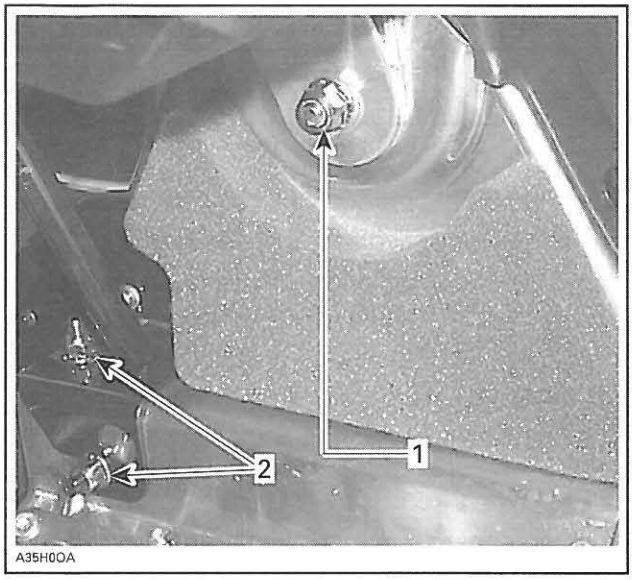
1. RH tie rod bolt

- swivel bar with swivel arms
- front shock absorbers
- upper and lower A-arms (with tie-rods and skis)
- bolts and nuts holding rear of lower cross member to frame
- upper cross member nuts (on RH and LH sides)



A35H0NA

RH SIDE OF VEHICLE
1. Upper cross member nuts
2. Lower cross member nuts



LH SIDE OF VEHICLE
1. *Upper cross member nuts*
2. *Lower cross member nuts*

- front bumper
- bottom pan.

Drill all rivets that attach the front cross member to frame.

NOTE: It may be necessary to grind some rivets out.

Remove front cross member.

Installation

Install and secure new or existing front plate and the front plate reinforcement to front cross member using:

QUANTITY	FASTENERS DESCRIPTION
6	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
6	Elastic flanged nut M5 (P/N 233 251 414)

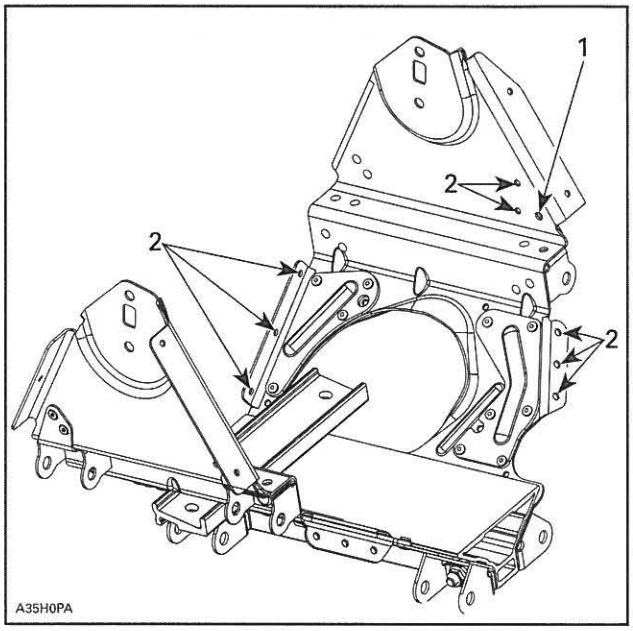
NOTE: Place head of bolts and washer towards the front of the vehicle.

Secure front cross member to frame. First reinstall nuts retaining upper and lower cross member. Do not torque yet.

Install bolts and nuts that attach rear of lower cross member to frame. Do not torque yet.

On each side, install the following fasteners instead of rivets.

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
2	Elastic flanged nut M6 (P/N 233 261 414)
4	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
4	Elastic flanged nut M5 (P/N 233 251 414)

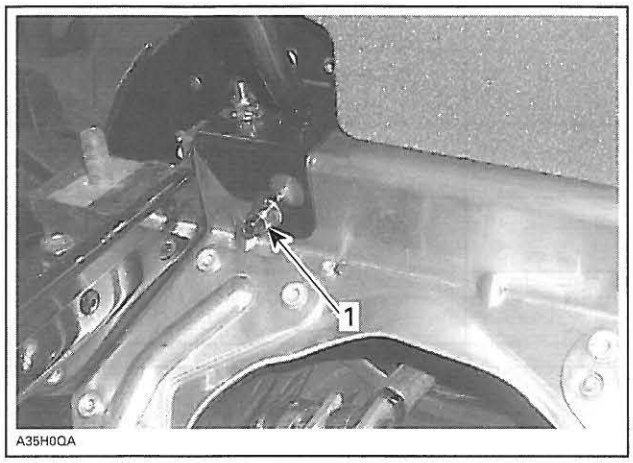


1. *M6 bolt*
2. *M5 bolts*

Under front cross member, replace rivets with the following fasteners.

QUANTITY	FASTENERS DESCRIPTION
6	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
6	Elastic flanged nut M5 (P/N 233 251 414)

Torque all bolts. Refer at the beginning of this manual for the tightening torque table. Use the standard torque except for one bolt. The lower bolt retaining the upper cross member brace to the frame must be torqued to 7.5 N•m (66 lbf•**in**).



*1. Torque to 7.5 N•m (66 lbf•**in**)*

Install all other removed parts. Refer to specific sections for inspection, installation and adjustment.

ENGINE SUPPORT

Removal

LH Support

Unscrew engine and lift it.

Remove the countershaft and its bearing. Refer to *CHAINCASE AND COUNTERSHAFT*.

Remove the LH support.

Drill rivets holding engine support to frame.

Unscrew both engine support bolts. Note bolts's location.

Remove engine support.

RH Support

Unscrew engine and lift it.

Remove the RH support.

Remove chaincase housing. Refer to *CHAINCASE AND COUNTERSHAFT*.

Drill all rivets holding engine support to frame.

Installation

LH Support

To install a new or existing engine support, reverse the removal procedure. However, pay attention to the following.

Install engine support bolts with heads inside.

Replace rivets with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
4	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
4	Elastic flanged nut M6 (P/N 233 261 414)

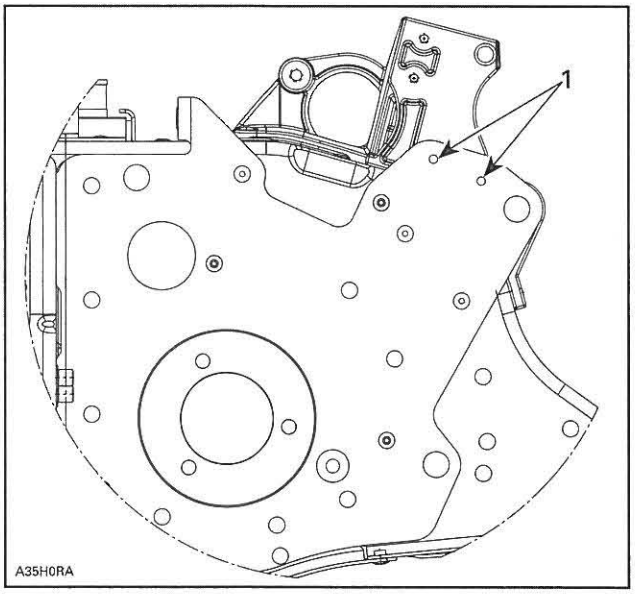
Install new bolts with their heads outside.

Install all removed parts. Refer to *CHAINCASE AND COUNTERSHAFT* to install and adjust countershaft properly.

RH Support

To install a new or existing engine support, reverse the removal procedure. However, pay attention to the following.

Position engine support by installing 2 pop rivets.



1. Pop rivets

Replace all other rivets with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
3	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
3	Elastic flanged nut M6 (P/N 233 261 414)

Install new bolts with the head inside.

Install all removed parts.

MACH Z/MX Z/SUMMIT 1000 SDI

MODEL			MACH Z ADRENALINE/X	MX Z RENEGADE X	SUMMIT HIGHMARK/ HIGHMARK X
ENGINE					
Engine			995 SDI		
Number of cylinders			2		
Bore	Standard	mm (in)	88 (3.465)		
Stroke		mm (in)	82 (3.228)		
Displacement		cm^3 (in^3)	997.47 (60.870)		
Compression ratio			12.20 ± 0.5		
Maximum power engine speed		± 100 RPM	7900		
Piston ring type		1st	Semi-trapezoidal		
		2nd	Semi-trapezoidal		
Ring end gap	New	mm (in)	0.55 to 0.70 (.0217 to .0276)		
	Wear limit	mm (in)	1.00 (.0394)		
Ring/piston groove clearance	New	mm (in)	0.45 to 0.090 (.0018 to .0035)		
	Wear limit	mm (in)	0.20 (.0079)		
Piston/cylinder wall clearance	New	mm (in)	0.112 to 0.152 (.0044 to .0060)		
	Wear limit	mm (in)	0.20 (.0079)		
Maximum crankshaft end play	New	mm (in)	0.30 (.0118)		
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.030 (.0012)		
Connecting rod big end axial play	New	mm (in)	0.23 to 0.62 (.0091 to .0244)		
	Wear limit	mm (in)	1.20 (.0472)		
ELECTRICAL					
Magneto generator output		W	480 @ 6000 RPM		
Ignition type			Inductive		
Spark plug	Make and type		NGK BR8ECS		
	Gap	mm (in)	0.8 (.0315)		
Ignition timing BTDC		mm (in)	7.87 (.310) @ 3500 RPM		
Trigger coil		Ω	190 to 300		
Lighting coil		Ω	0.145 to 0.185		
Battery		Manual start	12 V, 3 A•h		
		Electric start	12 V, 18 A•h		
Headlamp		W	60/55 (H4)		
Taillight and stoplight		W	8/26		Highmark: 8/26 Highmark X: 6/18
Tachometer and speedometer bulbs		W	N.A.		
Fuel and temperature gauge bulbs		W	2 x 3		N.A.
Fuse	Starter solenoid	A	30 (if applicable)		
	Fuel level sensor	A	0.25 (if applicable)		N.A.

MODEL			MACH Z	MX Z	SUMMIT
			ADRENALINE/X	RENEGADE X	HIGHMARK/ HIGHMARK X
FUEL SYSTEM					
Throttle body type			Dell'Orto		
Idle speed		± 200 RPM	1700		
Gas type			Premium unleaded		
Pump octane number	Inside North America	(R+M)/2	91		
	Outside North America	RON	95		
Gas/oil ratio			Injection		
Injection oil			XP-S 2-stroke synthetic blend		
COOLING SYSTEM					
Type			Liquid		
Coolant		Mixture	Bombardier premixed coolant (P/N 219 700 362) or Ethyl glycol/water mix (50% coolant, 50% distilled water) Use coolant specifically designed for aluminum engines		
Thermostat opening temperature		°C (°F)	N.A.		
Radiator cap opening pressure		kPa (PSI)	90 (13)		
DRIVE					
Chaincase oil			XP-S Synthetic chaincase oil		
Chain drive ratio			29/49	27/49 25/49 (models with 44.5 mm (1.75 in) track)	21/49 EUR: 22/49
Chain	Pitch	in	3/8		
	Type/links qty/plate qty		Silent 82/13		Silent 86/13
Drive pulley type			TRA V		
Drive pulley calibration	Clutch engagement	± 100 RPM	3000		3500
	Spring color		Pink/Pink		Pink/White EUR: Green/White
	Spring length	mm (in)	137.2 (5.402)		124.5 (4.90) EUR: 110.7 (4.36)
	Pin		Hollow (P/N 417 222 595)		Hollow (P/N 417 004 309)
	Ramp		434		433 EUR: 600
	Screw position		6		4 EUR: 3
Driven pulley type	Type		HPV Roller		HPV VSA
	Spring preload		0.0		
	Cam angle		44°/33°		44°/36°
Pulley distance	Z	mm (in)	27.5 (1.083)		
Offset	X	mm (in)	37.0 ± 0.5 (1.457 ± 0.2)		

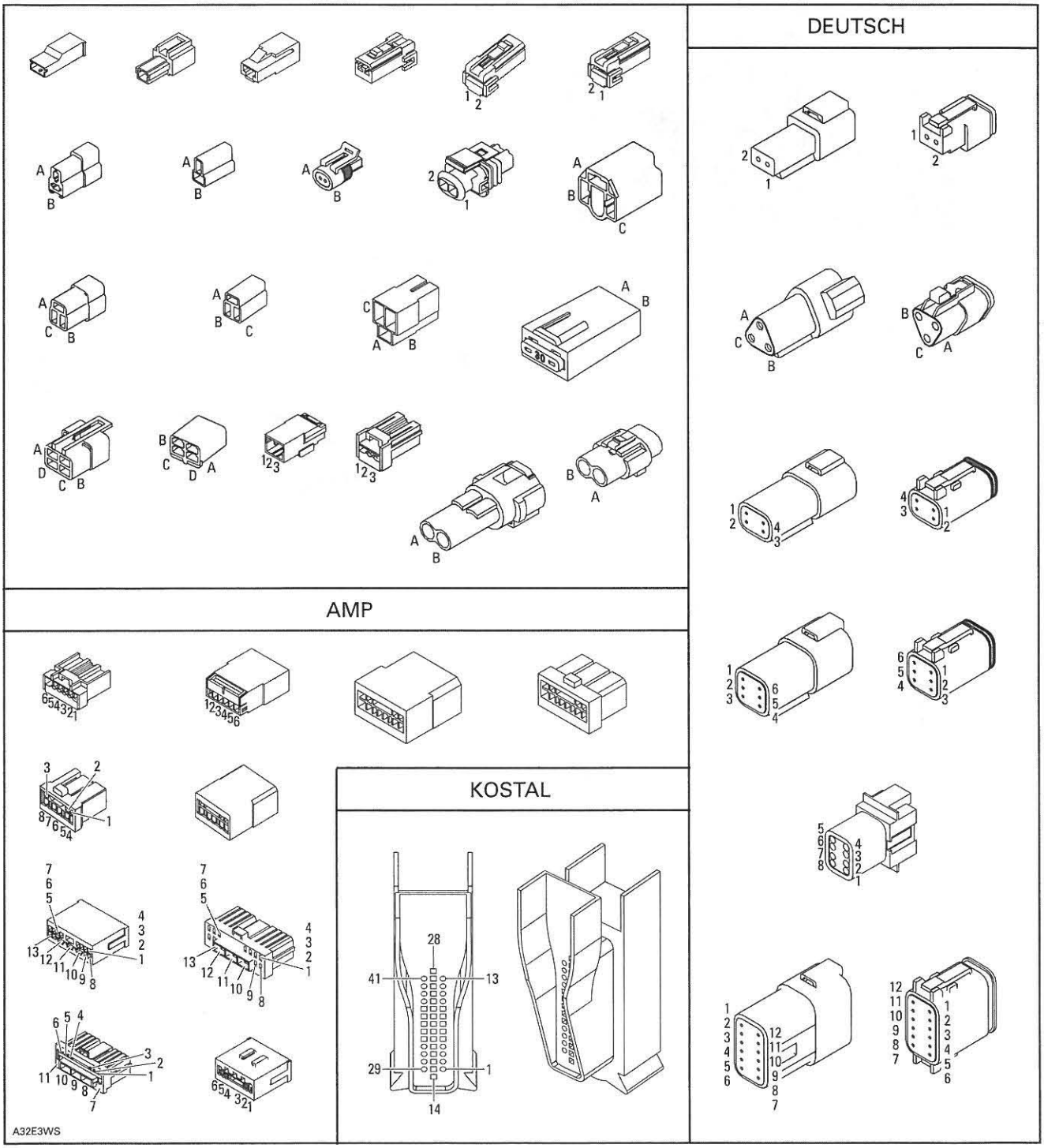
MODEL			MACH Z ADRENALINE/X	MX Z RENEGADE X	SUMMIT HIGHMARK/ HIGHMARK X
DRIVE (con'd)					
Drive belt part number			417 300 189		
Drive belt	Width	mm (in)	38.3 (1.51)		
	Wear limit	mm (in)	35.9 (1.41)		
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)		
	Force	kgf (lbf)	11.30 (24.91)		
Track	Width	mm (in)	381 (15)	406 (16)	406 (16)
	Length	mm (in)	3072 (121)	3456 (136)	3840 (151) 4096 (161)
	Profile height	mm (in)	25.4 (1.0)	31.8 (1.25)	50.8 (2.0)
			31.8 (1.25)	44.5 (1.75)	58.5 (2.303)
Track adjustment	Adjustment deflection	mm (in)	30 to 35 (1.181 to 1.378)		
	Force	kgf (lbf)	7.3 (16)		
Suspension type	Track		SC 4		SC 151 SC 162
	Ski		R.A.S. double A-arm		
BRAKE					
Brake lining thickness		mm (in)	1 (.039)		
Brake fluid (P/N)			GTLMA (DOT 4) (P/N 293 600 062) Racing brake fluid SRF (DOT 4) (P/N 293 600 063)		
VEHICLE INFORMATIONS					
Mass (dry)			240 kg (529 lb)	247 kg (545 lb)	**Highmark** 151": 249 kg (549 lb) 162": 252 kg (556 lb) **Highmark X** 151": 247 kg (545 lb) 162": 249 kg (549 lb)
Length		mm (in)	2930 (115)	3125 (115)123	151": 3295 (135)130 162": 3425 (135)
Width		mm (in)	1217 (48)	1217 (48) **European models:** 1252 (49)	1195 (47)
Height		mm (in)	1046 (41)		1125 (44)
Ski stance (carbide to carbide)		mm (in)	1195 (47)		1170 (46)
Toe-out		mm (in)	0.00		
Camber			0°		
MATERIAL					
Frame			Aluminum		
Bottom			Polypropylene		
Hood			Surlyn		
Side panel			Surlun		

MODEL		MACH Z	MX Z	SUMMIT
		ADRENALINE/X	RENEGADE X	HIGHMARK/ HIGHMARK X
CAPACITIES				
Fuel tank	L (U.S. gal)	40 (10.6)		
Chaincase	mL (U.S. oz)	250 (8.5)		
Cooling system	L (U.S. gal)	6.4 (1.69)	6.75 (1.78)	151": 7.3 (1.90) 162": 7.4 (1.96)
Injection oil reservoir	L (U.S. oz)	3.7 (125.112)		
Brake fluid reservoir	mL (U.S. oz)	60 (2.0)		

ELECTRICAL CONNECTORS

SERVICE TOOLS

Description	Part Number	Page
connector crimping tool	529 035 909	368
crimper die	529 035 906	368



GENERAL

UNPLUGING CONNECTORS

Always unplug connectors by pulling on housing not on wire.

TYPICAL

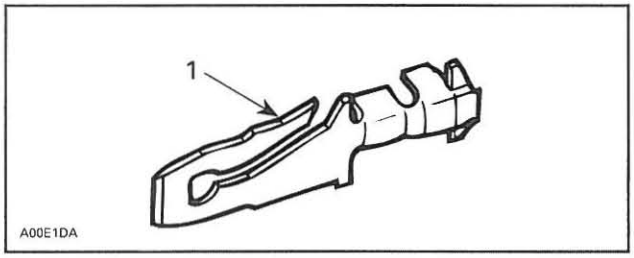
PROCEDURES

TAB AND RECEPTACLE CONNECTORS

Removal

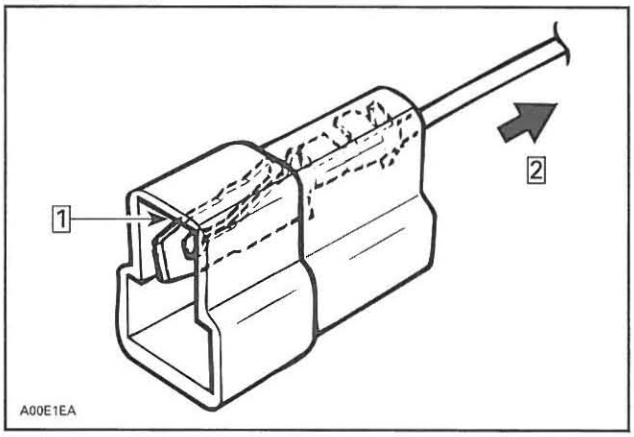
Tab Connector

It is locked in its housing by a spring tab on its side.



TAB CONNECTOR
1. Locking tab

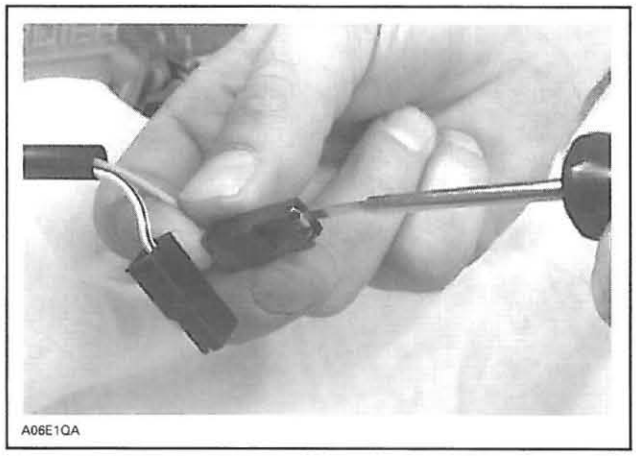
- Insert a screwdriver or Snap-on TT 600-5 from opposite side of wire and pry locking tab.
- While holding locking tab pried, pull connector toward wire side.



Step 1: Insert screwdriver here
Step 2: Pull this side

Receptacle Connector

- Insert tool Snap-on TT 600-5 in access opening then pull housing toward wire side.

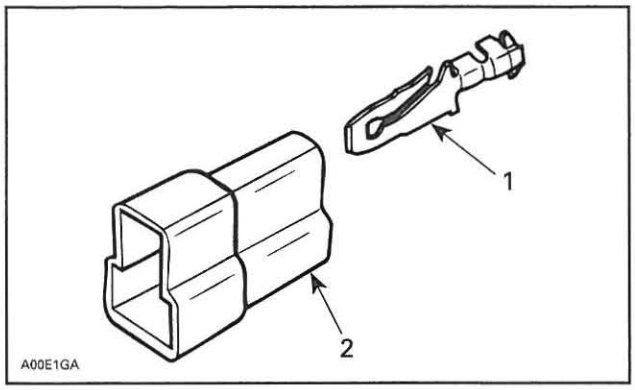


RECEPTACLE CONNECTOR

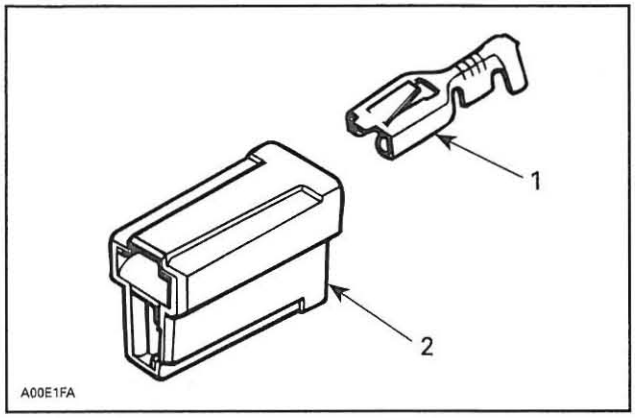
Installation

Prior to installing, make sure locking tab is sufficiently lifted to properly lock.

Insert tab and receptacle connectors in their respective housings as shown in following illustrations. Push sufficiently so that they snap. Try pulling wire to ensure they are properly locked.



1. Tab connector
2. Housing



TYPICAL
1. Receptacle
2. Housing

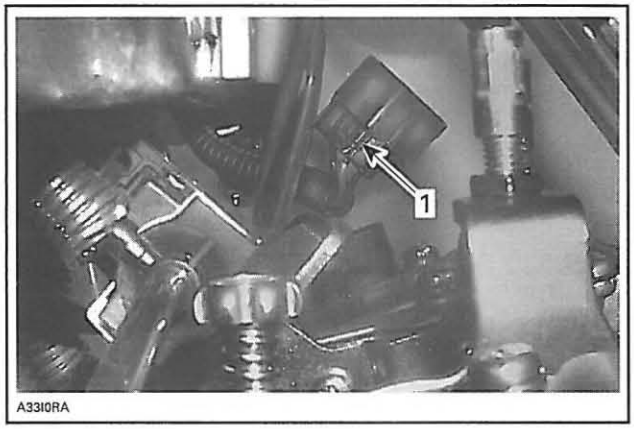
⚠ WARNING

Keep wires away from any rotating, moving, heating, vibrating or sharp edge. Use proper fastening devices as required.

SUMITOMO CONNECTOR

To disconnect the Sumitomo TPS connector from carburetor or throttle body, press the release button on the other side of the connector.

TPS CONNECTOR
1. Release button



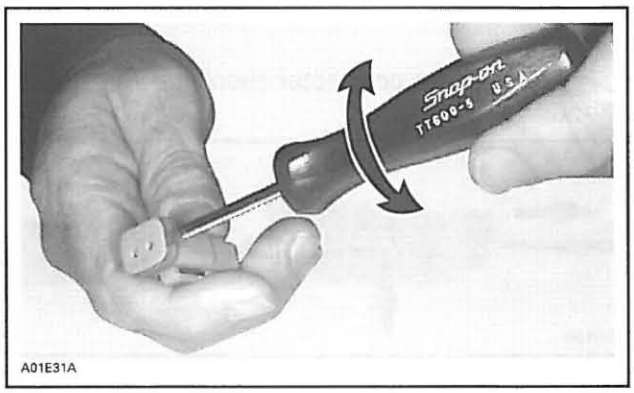
TPS CONNECTOR UNPLUGGED
1. Release button

DEUTSCH CONNECTORS

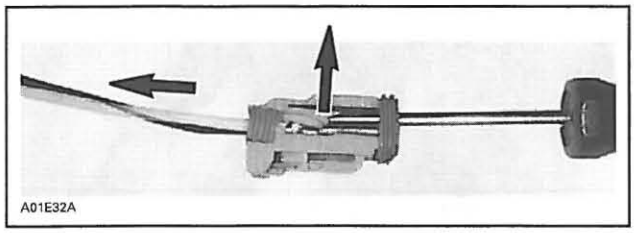
Female Housing

To remove:

– Insert tool Snap-on TT 600-5 under lock and twist to lift it.



– Pry tab to free connector then pull wire out of housing.

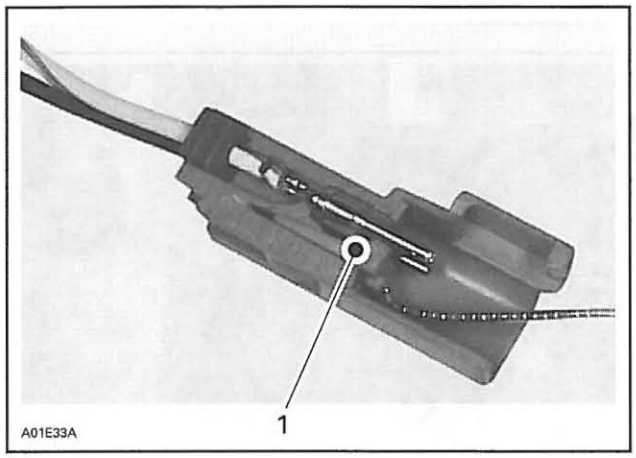


FEMALE CONNECTOR HOUSING — CUT-AWAY

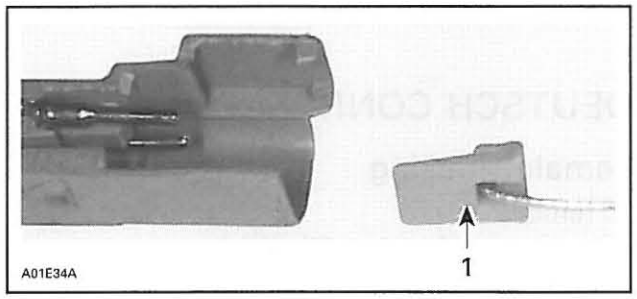
Male Housing

To remove:

– Using a small hook, pull out the lock.

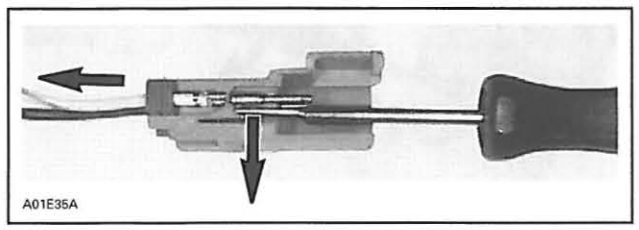


1. Lock



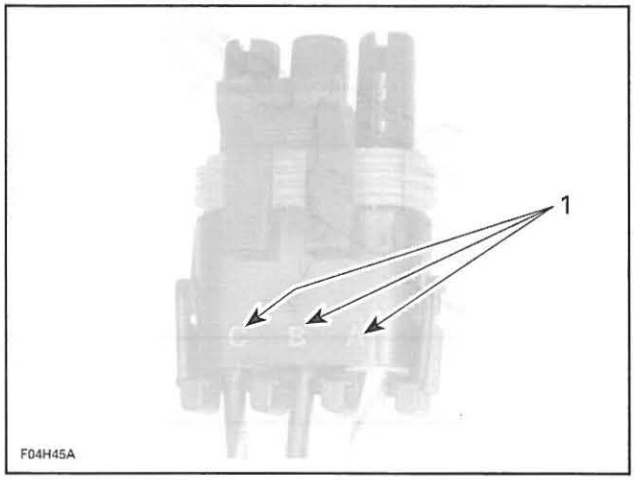
1. Lock

– Pry tab to free connector then pull wire out of housing.



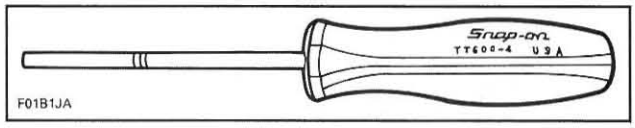
MALE CONNECTOR HOUSING — CUT-AWAY

PACKARD CONNECTOR



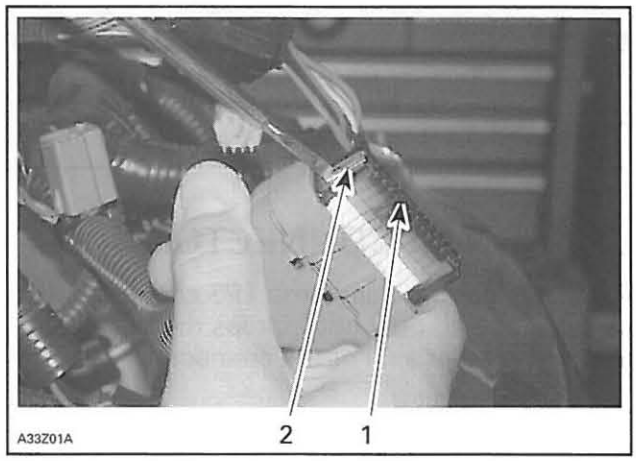
VIEW OF A 3-PIN PACKARD CONNECTOR
1. Identification letters

To remove terminal from Packard connector, use Snap-on TT600-4 tool.



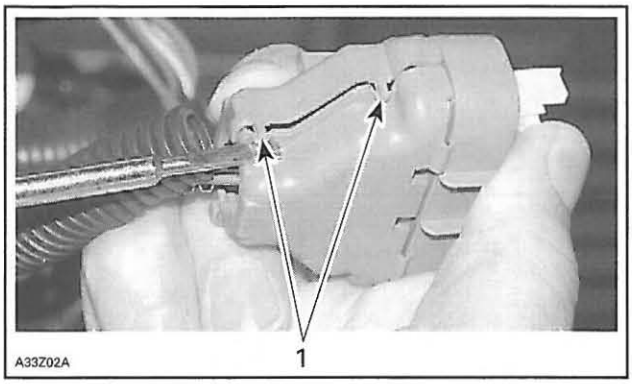
PACKARD 24-CIRCUIT AND 32-CIRCUIT CONNECTOR

Push on both tabs to remove retainer.



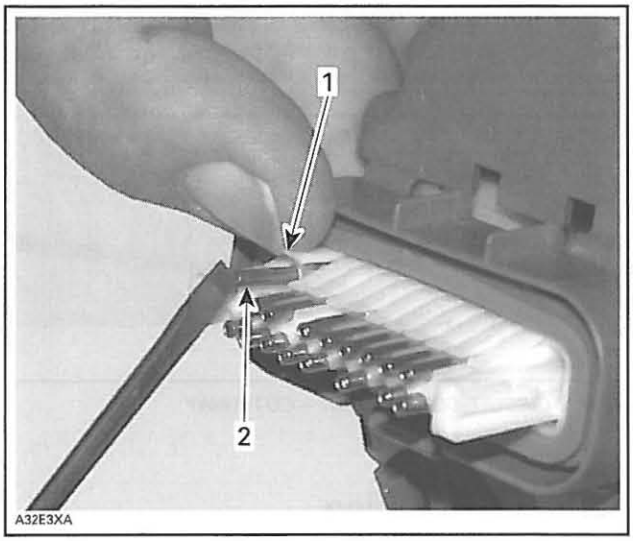
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



1. Tabs (2 on each side)

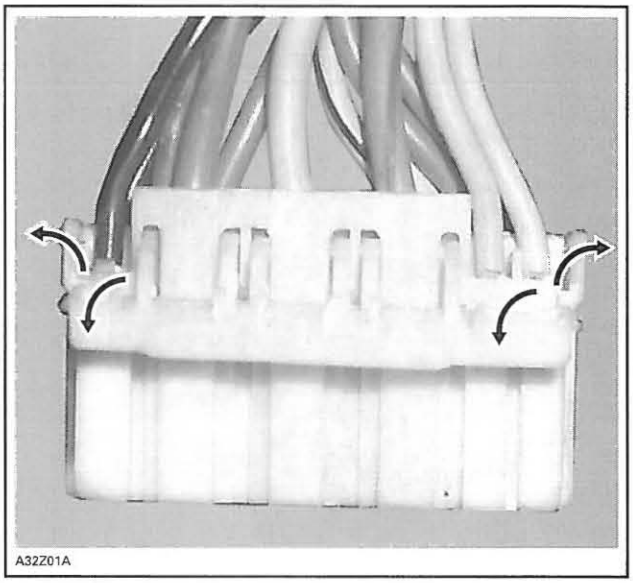
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. Lift and hold plastic lock
2. Lift to unlock and push out

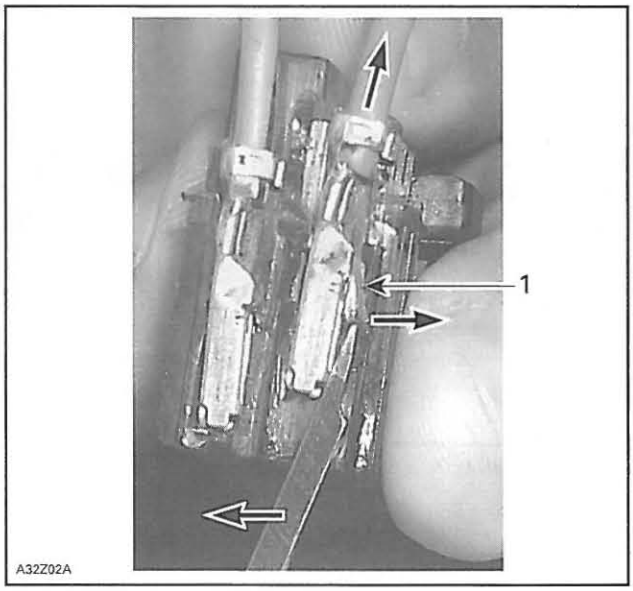
AMP MULTILOCK CONNECTOR

Female Terminal Housing



To remove:

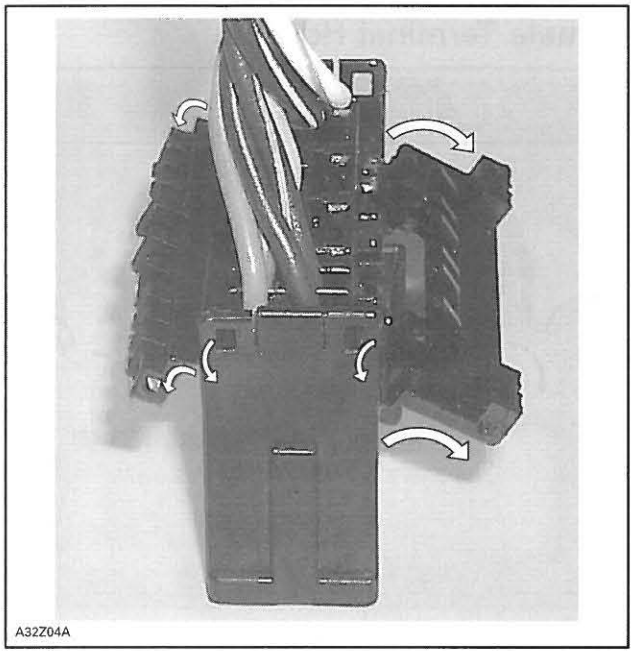
– Insert tool AMP-755430-2 under lock and twist to lift it.



FEMALE TERMINAL HOUSING — CUT-AWAY
1. Lock

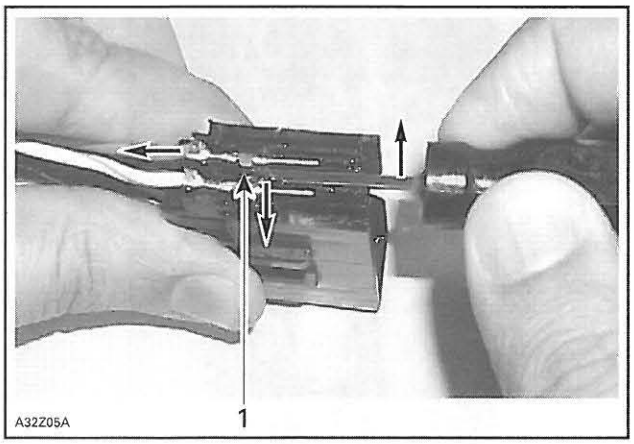
Female terminals can be removed from housing with sharp head pin.

Male Terminal Housing



To remove:

- Insert tool AMP-755430-2 under lock and twist to lift it.



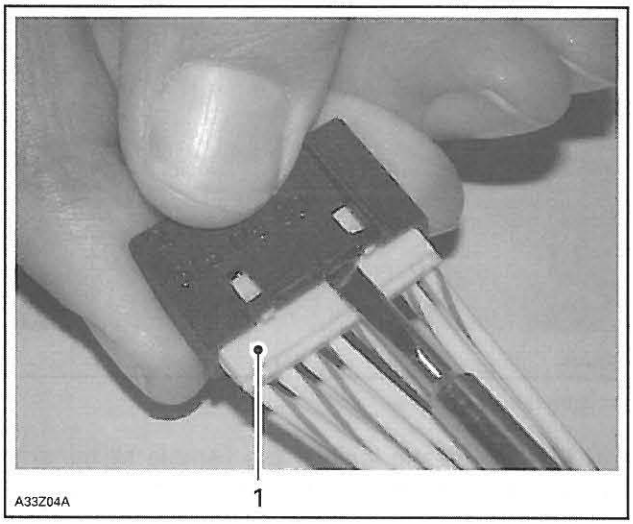
MALE TERMINAL HOUSING — CUT-AWAY
1. Lock

Terminal Crimping

Refer to *KOSTAL ECM CONNECTOR "A" AND "B"* for procedure.

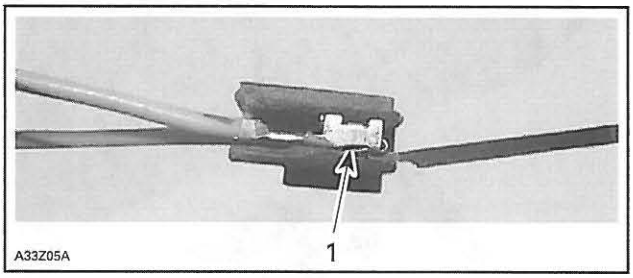
AMP 8-CIRCUIT CONNECTOR

Pry housing to release lock.



1. Lock

Insert tool AMP-755430-2 under tab and pry it to free connector. Pull on the female terminal wire to remove female terminal from housing.



AMP 8-CIRCUIT CONNECTOR — CUT-AWAY
1. Tab

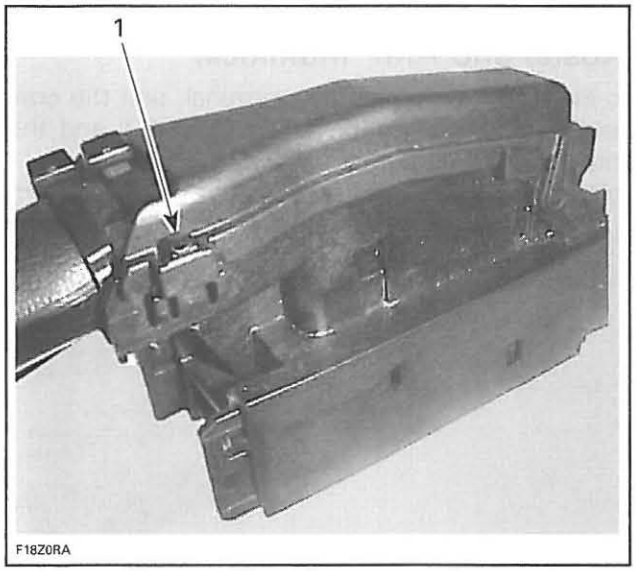
Terminal Crimping

Refer to *KOSTAL ECM CONNECTOR "A" AND "B"* for procedure.

KOSTAL ECM CONNECTOR "A" AND "B"

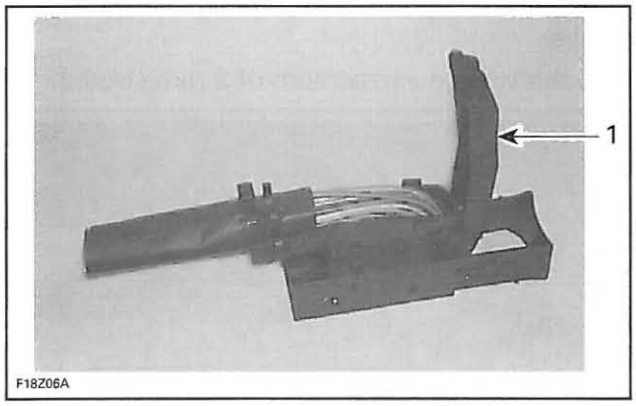
Terminal Removal

Unlock the connector housing cover by pushing in the tabs on top of the housing with a flat screwdriver to be able to flip the top cover up.



1. Push in tab

Lift the cover by pushing it forward.

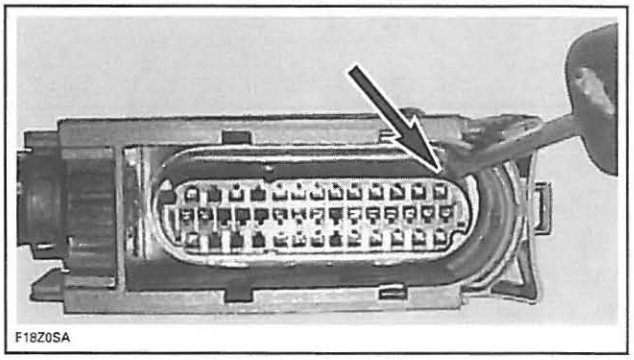


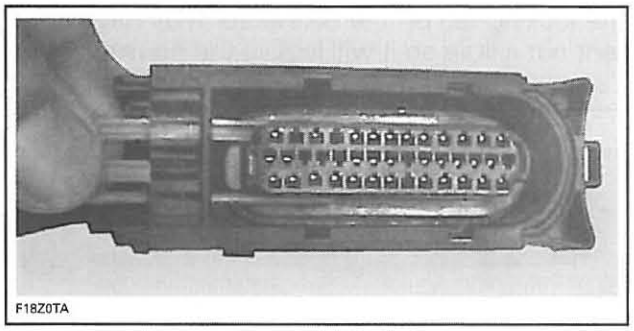
1. Cover

Cut both locking ties that secure the harness to the housing.

1. Locking ties

Turn the housing over and remove the lock by pushing and then pulling toward the wire harness.

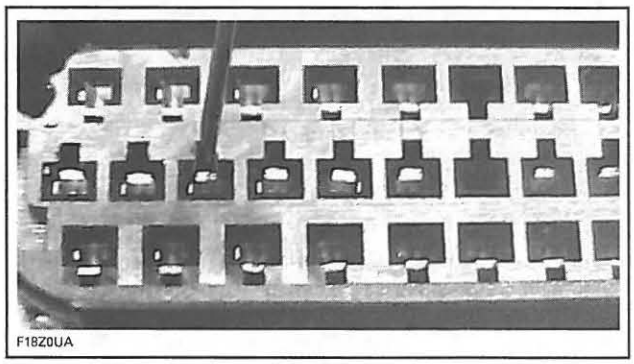


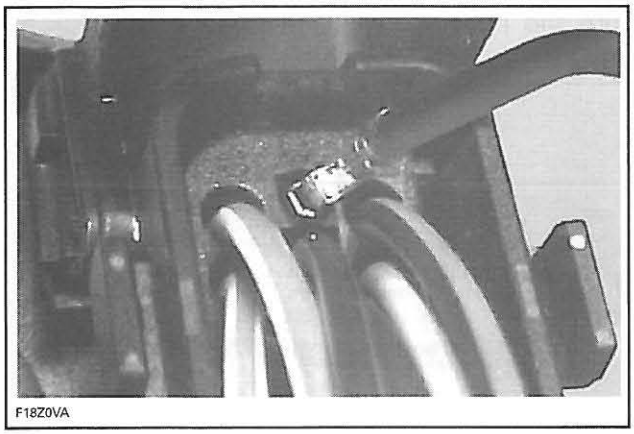


Use a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit inserted down into the housing to release the locking tab on the connector.

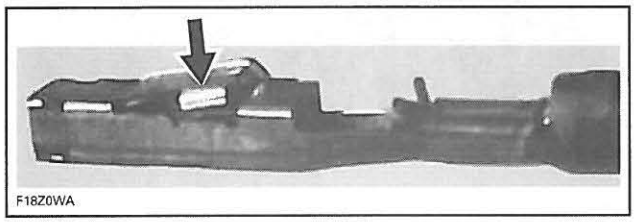
CAUTION: Using a probe larger than 0.76 mm (.030 in) may damage the terminal.

Insert the probe into the housing as shown, and locate the appropriate wire in the back of the housing. You may have to slightly cam the probe against the locking tab to release it, then remove the terminal from the housing.




F18Z0VA

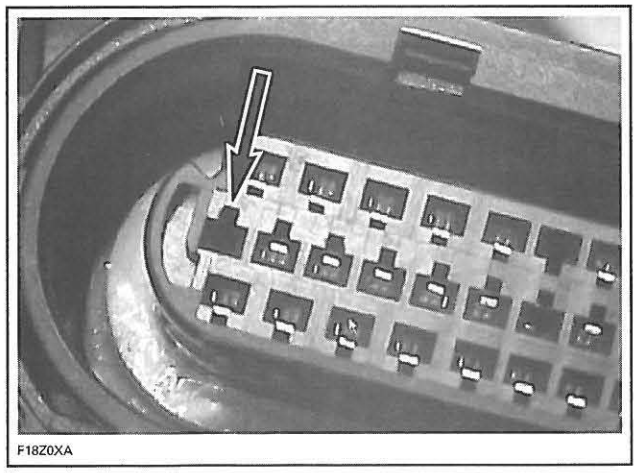
The locking tab on the connector may have to be bent out a little so it will lock in the housing when it's re-inserted.


F18Z0WA

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, acquire 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 connector, the locking tab must be installed facing the smaller cutout of the connector cavity.

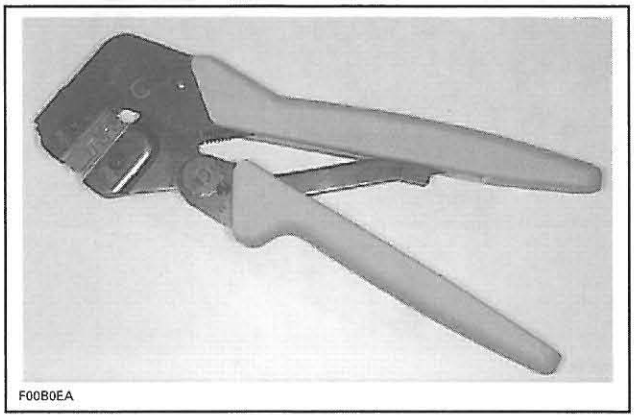

F18Z0XA

Insert the connector, ensuring the locking tab snaps into the housing.

Re-install the lock, attach the 2 tie raps, and close the housing cover.

Terminal Crimping (Kostal and AMP multilock)

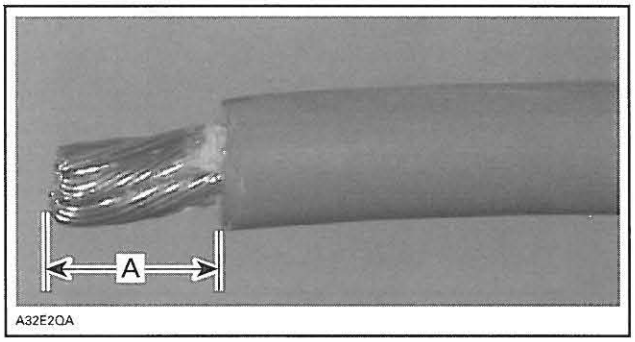
To crimp a new connector terminal, use the connector crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).


F00B0EA

CRIMPING TOOL

To properly crimp the wires, strictly follow this procedure.

Strip the wire to a maximum of 3 mm (1/8 in).

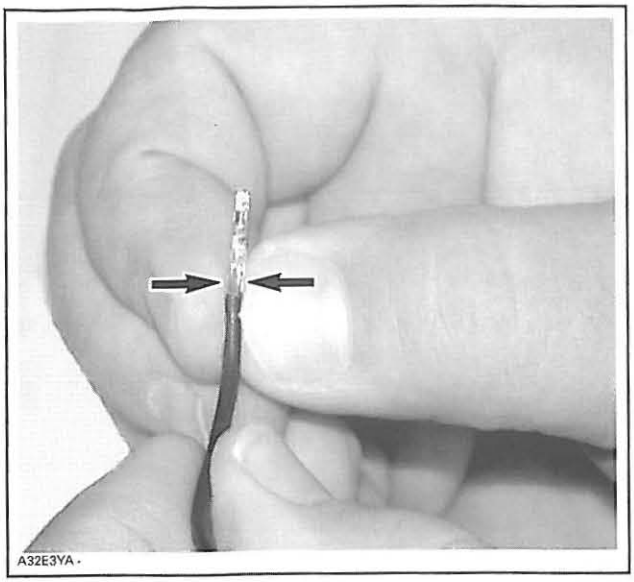


A32E2QA

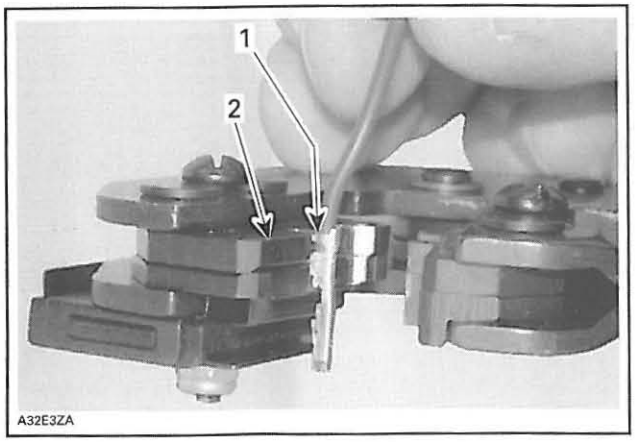
TYPICAL
A. 3 mm (1/8 in) max.

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.



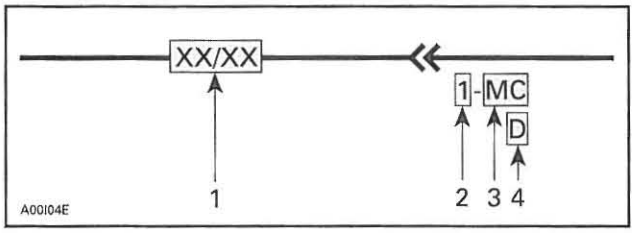
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

WIRING DIAGRAMS

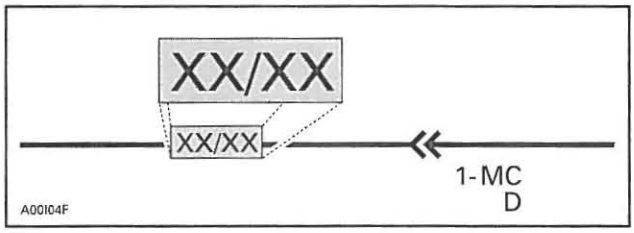
NOTE: For the wiring diagrams, refer to the end of the manual.

WIRING DIAGRAM LEGEND



1. *Wire colors*
2. *Connector location*
3. *Connector code*
4. *Terminal position in connector*

Wire Colors



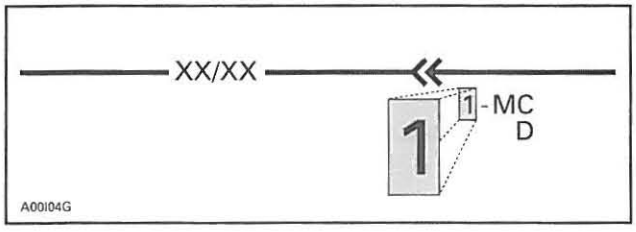
The first color of a wire is the main color, second color is the stripe.

Example: YL/BK is a YELLOW wire with a BLACK stripe.

COLOR CODE					
BE	—	BEIGE	OR	—	ORANGE
BK	—	BLACK	RD	—	RED
BU	—	BLUE	VI	—	VIOLET
BR	—	BROWN	WH	—	WHITE
GN	—	GREEN	YL	—	YELLOW
GY	—	GREY			

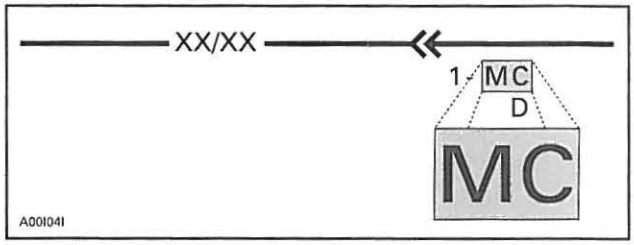
Connector Location

The first digit of the connector identification number presents the location of the connector on the vehicle.



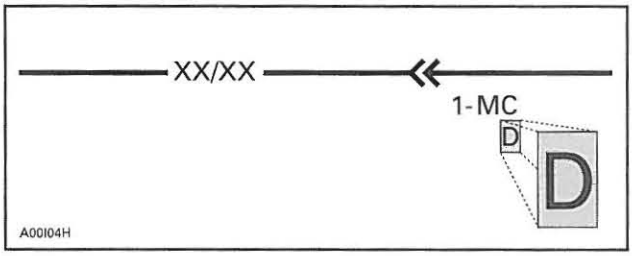
Connector Code

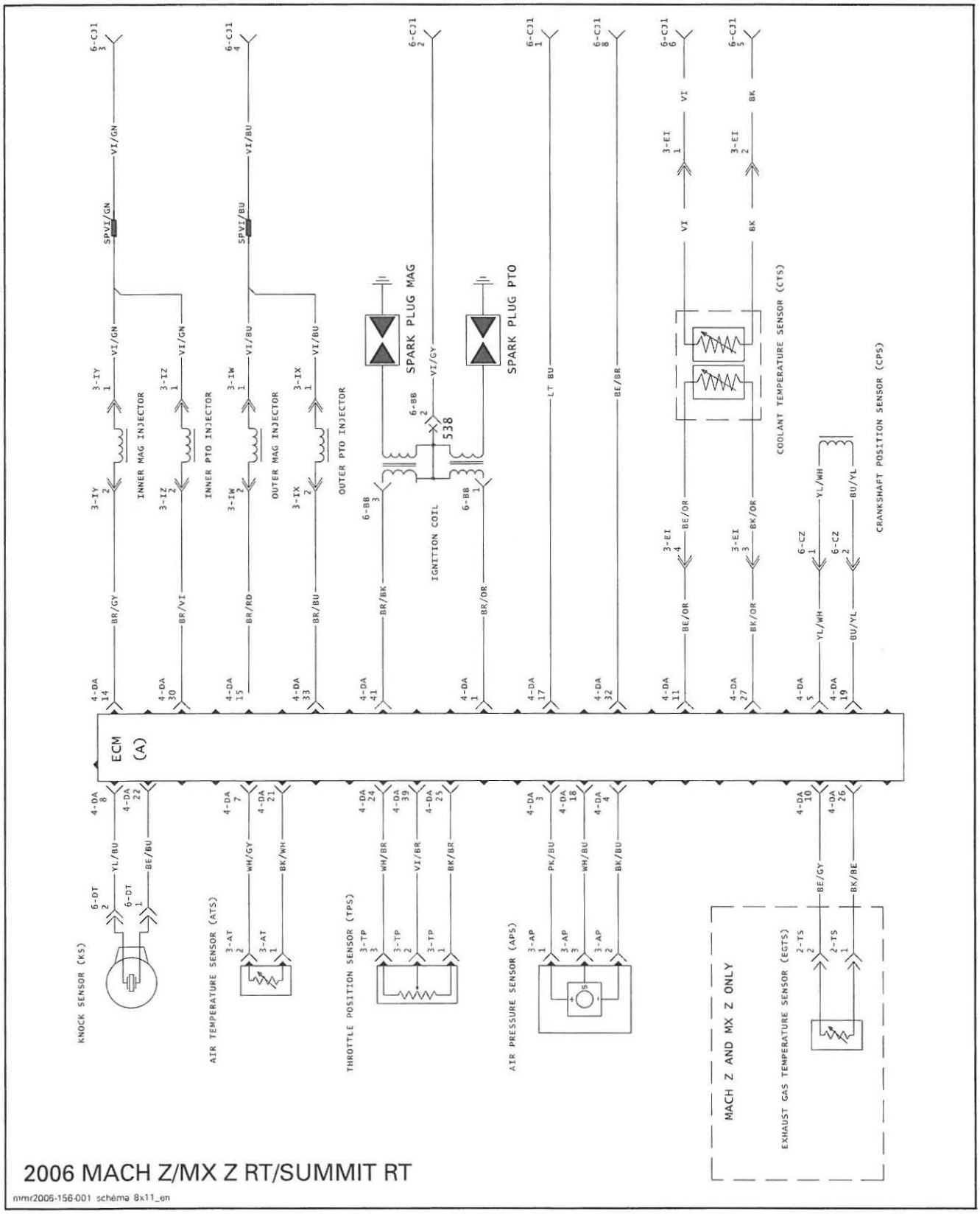
The next two letters of the connector identification number represents a connector reference. If there are many connectors in the same area this helps identify which wire is in which connector.



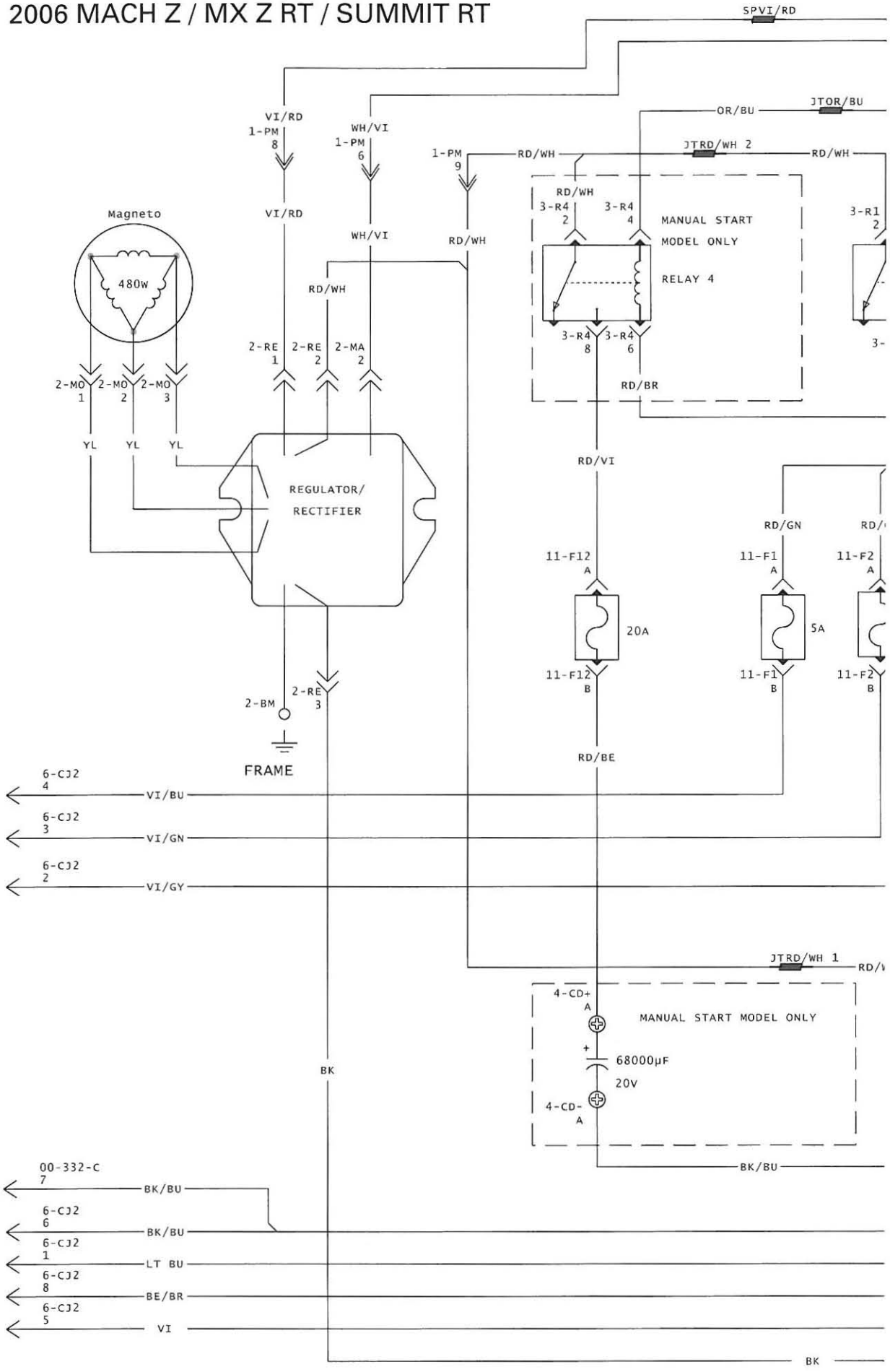
Terminal Position in Connector

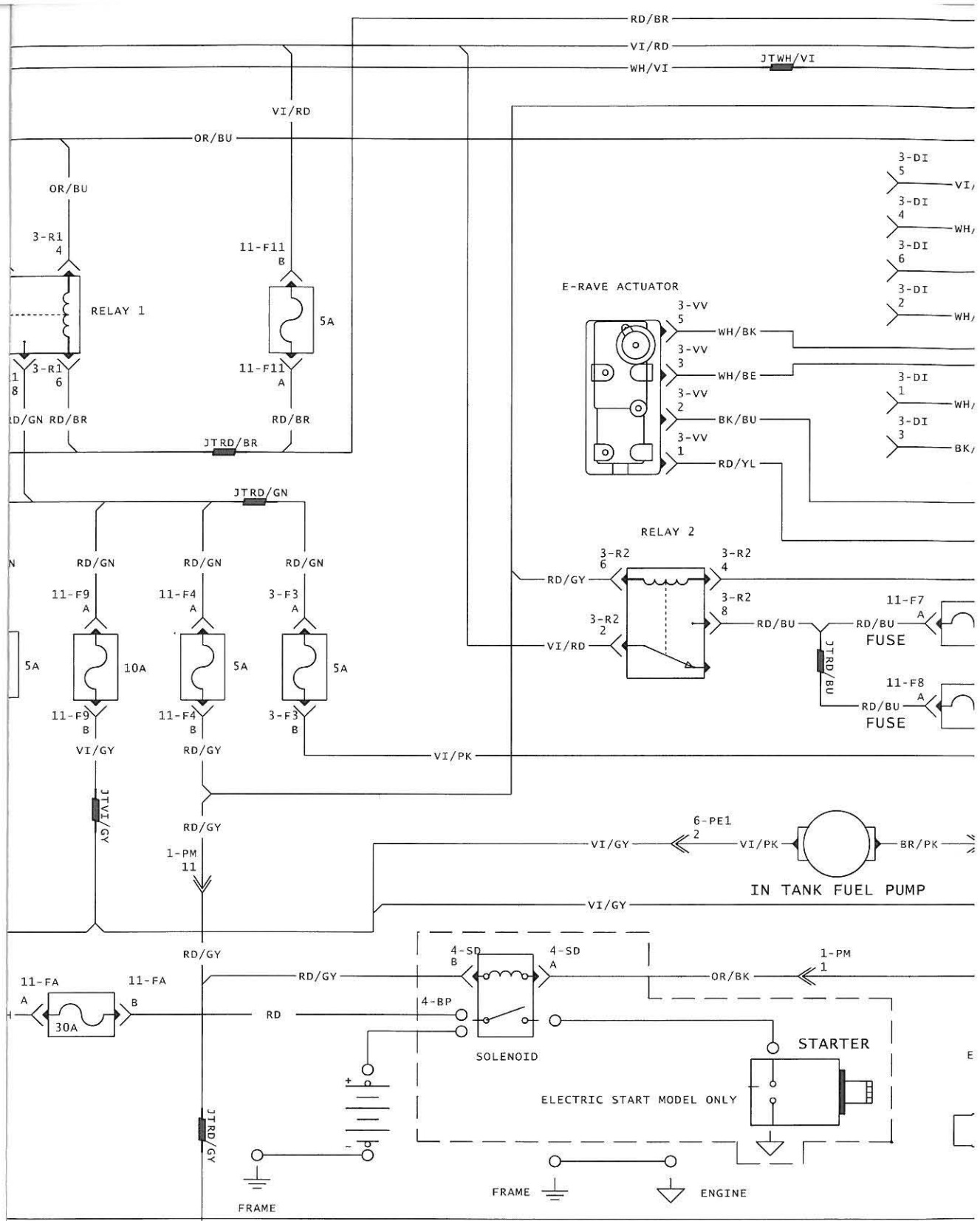
The third portion of the connector identification number represents the location of the terminal in the connector. This could be identified by either a number such as 1, 2, 3 or by a letter such as A, B, C depending on the type of connector used.

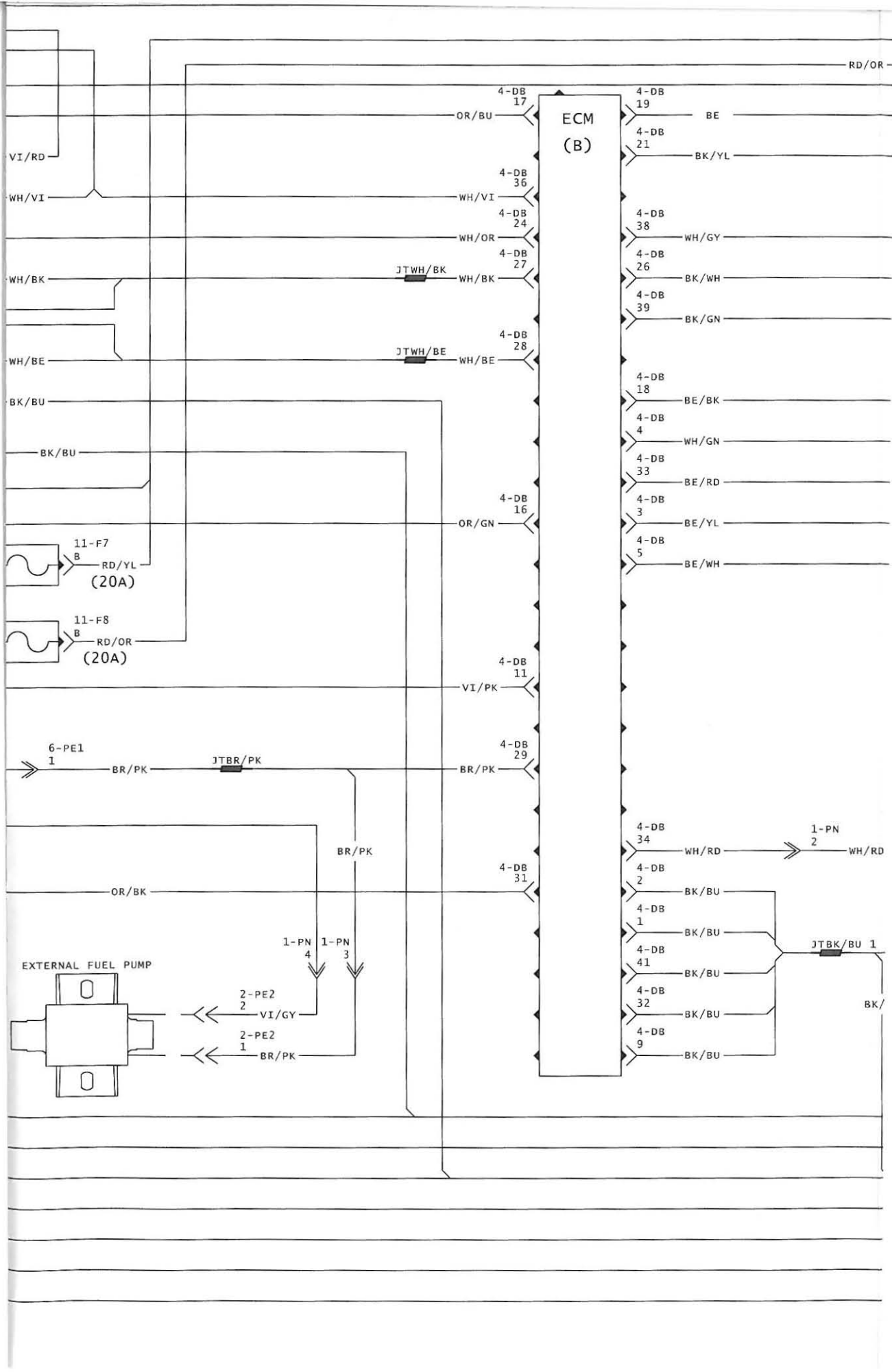


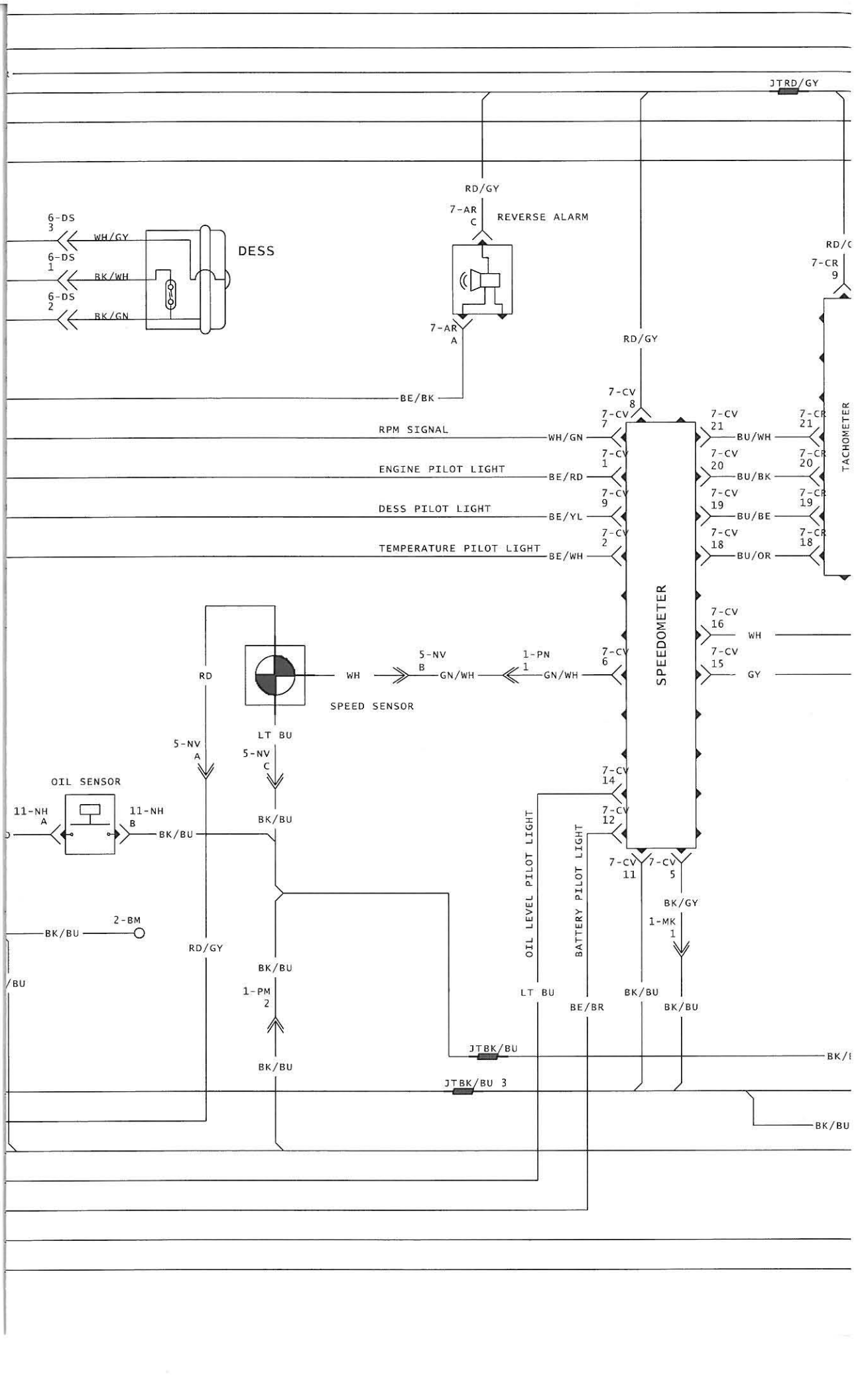

ECM (A)
KNOCK SENSOR (KS)
AIR TEMPERATURE SENSOR (ATS)
THROTTLE POSITION SENSOR (TPS)
AIR PRESSURE SENSOR (APS)
EXHAUST GAS TEMPERATURE SENSOR (EGTS)
MACH Z AND MX Z ONLY
INNER MAG INJECTOR
INNER PTO INJECTOR
OUTER MAG INJECTOR
OUTER PTO INJECTOR
SPARK PLUG MAG
SPARK PLUG PTO
IGNITION COIL
538
COOLANT TEMPERATURE SENSOR (CTS)
CRANKSHAFT POSITION SENSOR (CPS)
2006 MACH Z/MX Z RT/SUMMIT RT
mmr2006-156-001 schéma 8x11_en

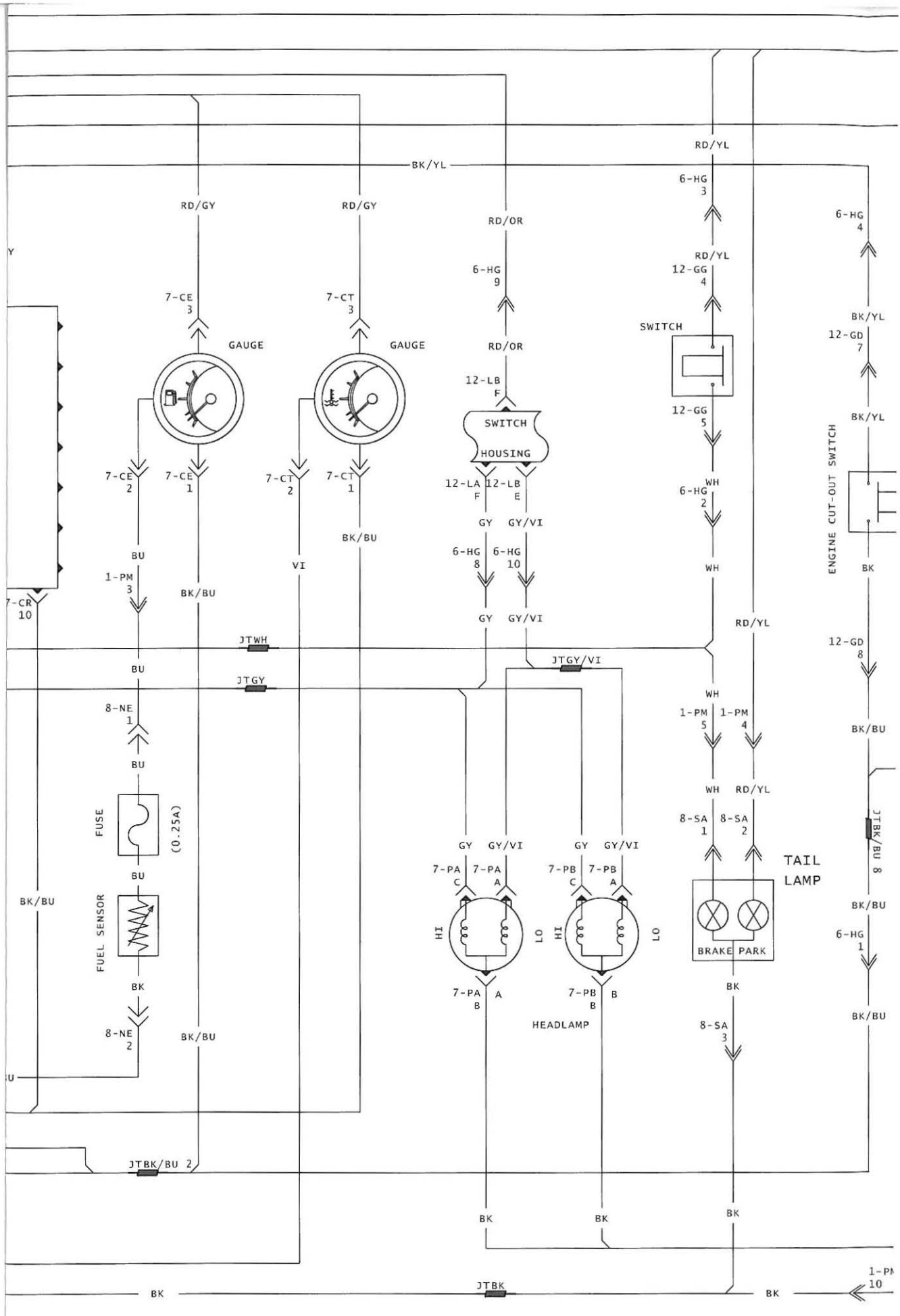
2006 MACH Z / MX Z RT / SUMMIT RT

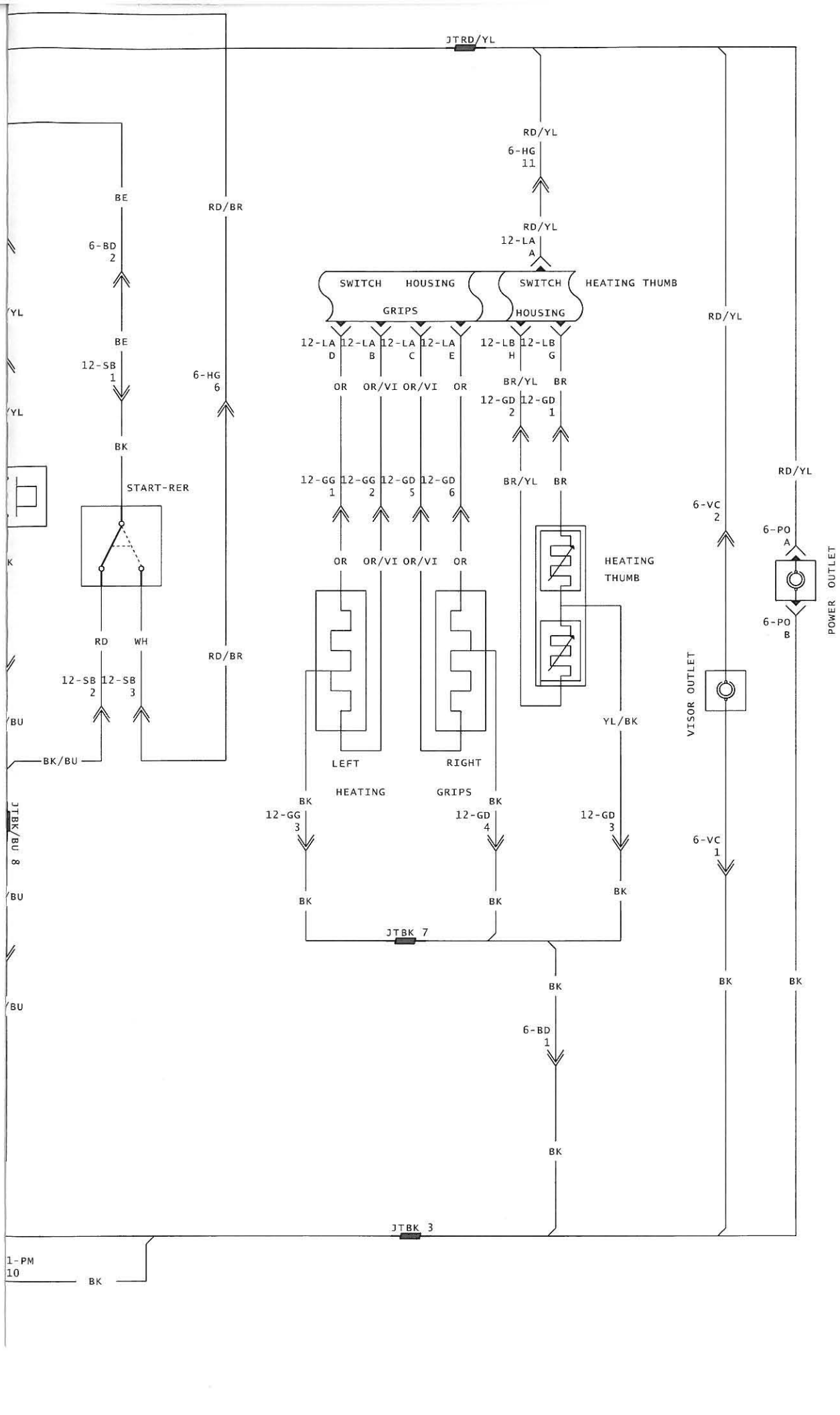



RD/BR
VI/RD
WH/VI
JTWH/VI
VI/RD
OR/BU
OR/BU
3-R1
4
RELAY 1
3-R1
6
11-F11
B
5A
11-F11
A
RD/GN RD/BR
RD/BR
JTRD/BR
E-RAVE ACTUATOR
3-VV
5
WH/BK
3-VV
3
WH/BE
3-VV
2
BK/BU
3-VV
1
RD/YL
3-DI
5
3-DI
4
3-DI
6
3-DI
2
3-DI
1
3-DI
3
JTRD/GN
RELAY 2
3-R2
6
3-R2
4
RD/GY
3-R2
8
RD/BU
3-R2
2
VI/RD
11-F7
A
RD/BU
FUSE
JTRD/BU
11-F8
A
RD/BU
FUSE
RD/GN
RD/GN
RD/GN
11-F9
A
11-F4
A
3-F3
A
5A
10A
5A
5A
11-F9
B
11-F4
B
3-F3
B
VI/GY
RD/GY
VI/PK
JTVI/GY
RD/GY
1-PM
11
6-PE1
2
VI/GY
VI/PK
BR/PK
IN TANK FUEL PUMP
VI/GY
RD/GY
11-FA
A
11-FA
B
30A
RD/GY
RD
4-SD
B
4-SD
A
4-BP
SOLENOID
OR/BK
1-PM
1
STARTER
ELECTRIC START MODEL ONLY
JTRD/GY
FRAME
FRAME
ENGINE


ECM
(B)
RD/OR
VI/RD
WH/VI
WH/BK
WH/BE
BK/BU
BK/BU
OR/BU
WH/VI
WH/OR
WH/BK
WH/BE
OR/GN
VI/PK
BR/PK
OR/BK
4-DB 17
4-DB 36
4-DB 24
4-DB 27
4-DB 28
4-DB 16
4-DB 11
4-DB 29
4-DB 31
JTWH/BK
JTWH/BE
JTBR/PK
11-F7 8 RD/YL (20A)
11-F8 8 RD/OR (20A)
6-PE1 1 BR/PK
4-DB 19 BE
4-DB 21 BK/YL
4-DB 38 WH/GY
4-DB 26 BK/WH
4-DB 39 BK/GN
4-DB 18 BE/BK
4-DB 4 WH/GN
4-DB 33 BE/RD
4-DB 3 BE/YL
4-DB 5 BE/WH
4-DB 34 WH/RD
1-PN 2 WH/RD
4-DB 2 BK/BU
4-DB 1 BK/BU
4-DB 41 BK/BU
4-DB 32 BK/BU
4-DB 9 BK/BU
JTBK/BU 1
BK/
EXTERNAL FUEL PUMP
1-PN 4
1-PN 3
2-PE2 2 VI/GY
2-PE2 1 BR/PK


JTRD/GY
RD/GY
7-AR C
REVERSE ALARM
7-AR A
6-DS 3
WH/GY
6-DS 1
BK/WH
6-DS 2
BK/GN
DESS
BE/BK
RD/GY
7-CV 8
RPM SIGNAL
WH/GN
7-CV 7
ENGINE PILOT LIGHT
BE/RD
7-CV 1
DESS PILOT LIGHT
BE/YL
7-CV 9
TEMPERATURE PILOT LIGHT
BE/WH
7-CV 2
7-CV 21
BU/WH
7-CV 20
BU/BK
7-CV 19
BU/BE
7-CV 18
BU/OR
7-CR 21
7-CR 20
7-CR 19
7-CR 18
7-CR 9
TACHOMETER
SPEEDOMETER
7-CV 16
WH
7-CV 15
GY
7-CV 6
GN/WH
1-PN 1
GN/WH
5-NV B
WH
RD
SPEED SENSOR
LT BU
5-NV A
5-NV C
OIL SENSOR
11-NH A
11-NH B
BK/BU
BK/BU
7-CV 14
7-CV 12
7-CV 11
7-CV 5
BK/GY
1-MK 1
OIL LEVEL PILOT LIGHT
BATTERY PILOT LIGHT
LT BU
BE/BR
BK/BU
BK/BU
2-BM
BK/BU
RD/GY
BK/BU
1-PM 2
BK/BU
JTBK/BU
JTBK/BU 3
BK/BU
BK/BU


BK/YL
RD/YL
6-HG 3
6-HG 4
RD/GY
RD/GY
RD/OR
6-HG 9
RD/YL
12-GG 4
BK/YL
12-GD 7
7-CE 3
7-CT 3
GAUGE
GAUGE
SWITCH
RD/OR
12-LB F
12-GG 5
BK/YL
SWITCH HOUSING
ENGINE CUT-OUT SWITCH
7-CE 2
7-CE 1
7-CT 2
7-CT 1
12-LA F
12-LB E
WH
6-HG 2
BU
VI
BK/BU
GY
GY/VI
6-HG 8
6-HG 10
BK
1-PM 3
7-CR 10
BK/BU
WH
RD/YL
JTWH
JTGY/VI
12-GD 8
BU
JTGY
WH
8-NE 1
1-PM 5
1-PM 4
BK/BU
BU
WH
RD/YL
FUSE
(0.25A)
8-SA 1
8-SA 2
JTBK/BU 8
TAIL LAMP
GY
GY/VI
GY
GY/VI
BU
7-PA C
7-PA A
7-PB C
7-PB A
BK/BU
FUEL SENSOR
HI
LO
HI
LO
BRAKE PARK
6-HG 1
BK
7-PA B
7-PB B
BK
8-NE 2
BK/BU
8-SA 3
BK/BU
HEADLAMP
JTBK/BU 2
BK
BK
BK
JTBK
BK
BK
1-PM 10


JTRD/YL
RD/YL
6-HG
11
RD/YL
12-LA
A
SWITCH HOUSING
GRIPS
SWITCH HOUSING
HEATING THUMB
12-LA D
12-LA B
12-LA C
12-LA E
12-LB H
12-LB G
OR
OR/VI
OR/VI
OR
BR/YL
BR
12-GD 2
12-GD 1
12-GG 1
12-GG 2
12-GD 5
12-GD 6
BR/YL
BR
OR
OR/VI
OR/VI
OR
HEATING THUMB
LEFT
RIGHT
HEATING GRIPS
BK
12-GG 3
BK
12-GD 4
12-GD 3
BK
BK
BK
JTBK 7
BK
6-BD 1
BK
JTBK 3
BE
6-BD 2
BE
12-SB 1
BK
START-RER
RD
WH
12-SB 2
12-SB 3
BK/BU
RD/BR
6-HG 6
RD/BR
YL
YL
K
BU
BU
BU
JTBK/BU 8
1-PM 10
BK
RD/YL
6-VC 2
6-VC 1
BK
VISOR OUTLET
RD/YL
6-PO A
6-PO B
POWER OUTLET
BK
YL/BK

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