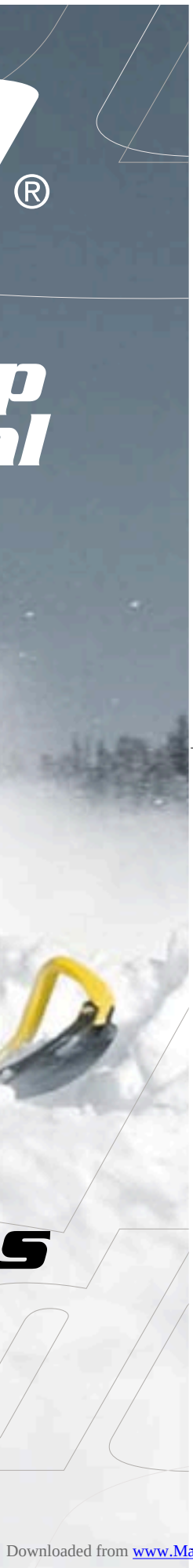
Ski Doo Service Repair Manual

Thank You for your purchase
eBay seller foxmoto951 is the only authorized seller for this software

If you have received this manual from any other eBay seller
send it back for a refund & contact foxmoto951

Inc.



2005
Shop Manual

RT SERIES

BOMBARDIER RECREATIONAL PRODUCTS INC.

Legal deposit:

National Library of Quebec
National Library of Canada 2004

Technical Publications

Bombardier Recreational Products Inc. (BRP)

Valcourt (Quebec) Canada

Printed in Canada

TABLE OF CONTENTS

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 2005 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.

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.

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.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

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

INTRODUCTION

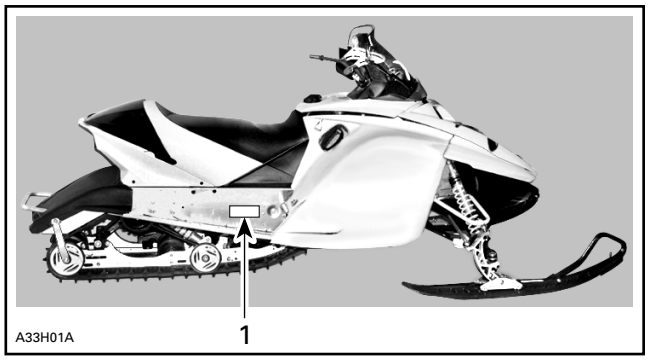
This shop manual covers the following BRP made 2005 RT Series models:

TYPICAL — RT SERIES

MODEL	ENGINE TYPE	MODEL NUMBER
MACH Z	995 SDI	AB5A, AB5B, AB5C
SUMMIT HIGHMARK	995 SDI	CD5A, CD5B, CD5C
SUMMIT HIGHMARK X	995 SDI	CA5A, CA5B, CA5C, CA5D

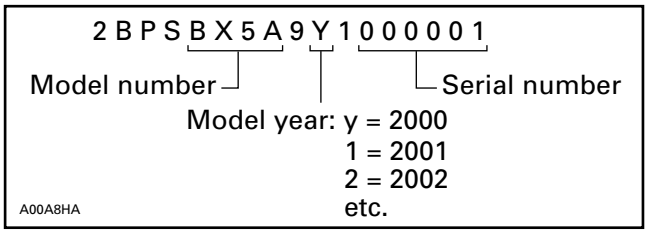
VEHICLE IDENTIFICATION NUMBER

Vehicle Identification Number Location



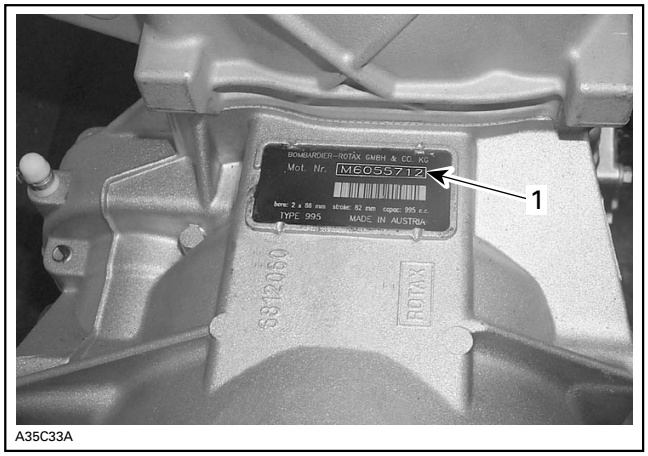
TYPICAL
1. Vehicle identification number

Identification Number Meaning



ENGINE SERIAL NUMBER

Engine Serial Number Location



1. Engine serial number

LIST OF ABBREVIATIONS USED IN THIS MANUAL

ABBREVIATION	MEANING
A	ampere
amp	ampere
A•h	ampere-hour
AC	alternate current
ACM	acceleration and control modulator
AMG	absorbed glass mat
BDC	bottom dead center
BTDC	before top dead center
°C	degree Celsius
cc	cubic centimeter

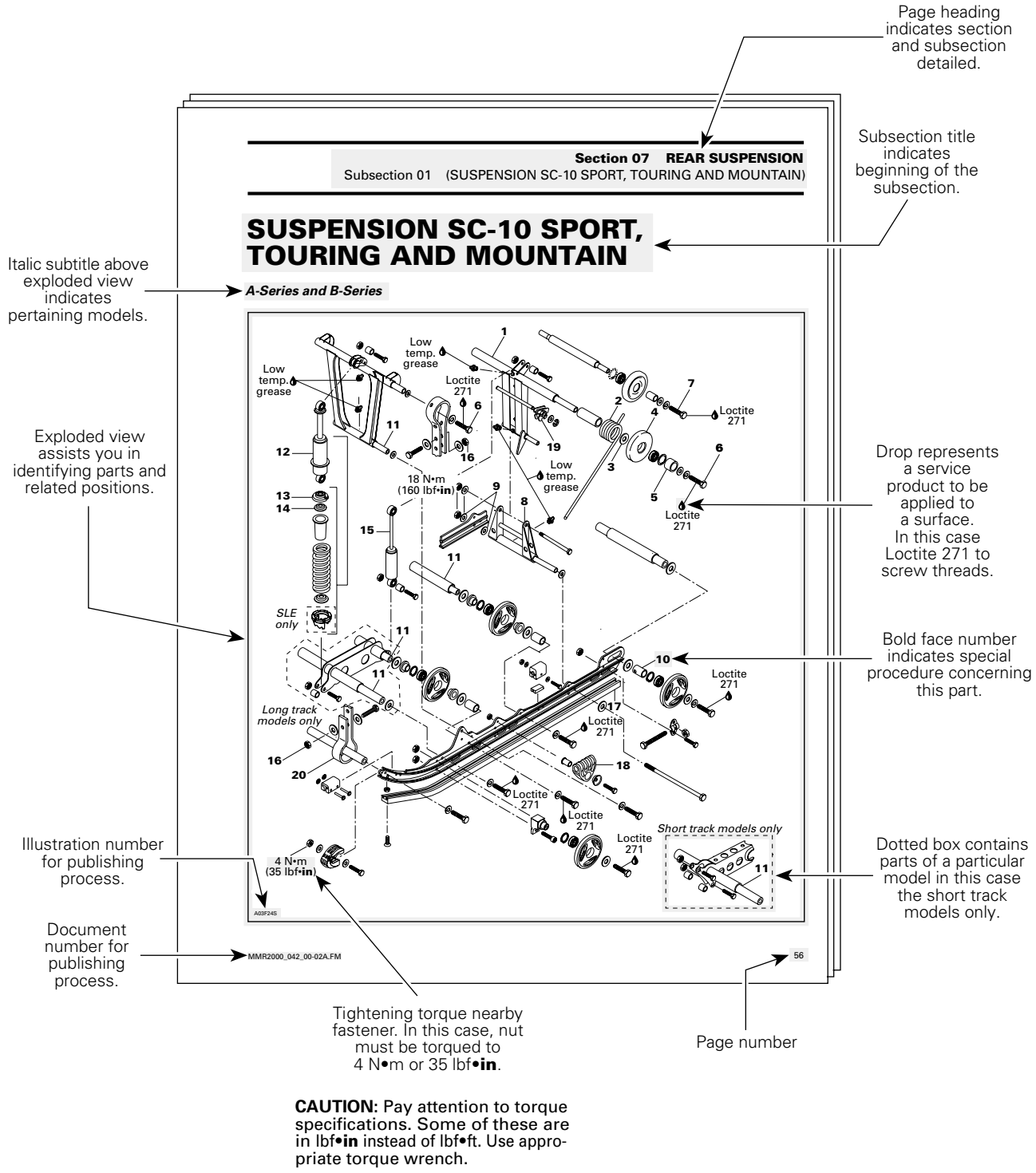
ABBREVIATION	MEANING
CDI	capacitor discharge ignition
CTR	center
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
DC	direct current
DESS	digitally encoded security system
DPM	digital performance management
°F	degree Fahrenheit
FC	fan cooled
fl. oz	fluid ounce
ft	foot
GRD	ground
H.A.C.	high altitude compensator
hal.	halogen
HI	high
IFP	internal floating piston
imp. oz	imperial ounce
in	inch
in^2	square inch
in^3	cubic inch
k	kilo (thousand)
kg	kilogram
km/h	kilometer per hour
kPa	Kilopascal
L	liter
lb	pound
lbf	pound (force)
lbf/in^2	pound per square inch
LH	left hand
LO	low
LT	long track
m	meter
MAG	magneto
Max.	maximum
Min.	minimum
mL	milliliter

ABBREVIATION	MEANING
mm	millimeter
M.E.	millennium edition
MPEM	multi-purpose electronic module
MPH	mile per hour
N	newton
N.A.	not applicable
no.	number
0	continuity
0.L	open line (open circuit)
O.D.	outside diameter
OPT	optional
oz	ounce
P/N	part number
PSI	pound per square inch
PTO	power take off
R	rectangular
RH	right hand
R.A.S.	response angle suspension
RAVE	Rotax adjustable variable exhaust
RER	Rotax electronic reverse
RPM	revolution per minute
RMS	root mean square
RRIM	reinforced reaction injection molding
SDI	semi-direct injection
Sp. Gr.	specific gravity
ST	semi-trapez
TDC	top dead center
TRA	total range adjustable
U.S. oz	ounce (United States)
V	volt
Vac	volt (alternative current)
VSA	variable sheave angle

ARRANGEMENT OF THIS MANUAL

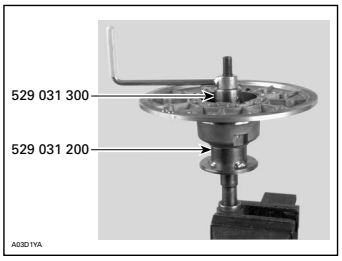
This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE



TYPICAL PAGE

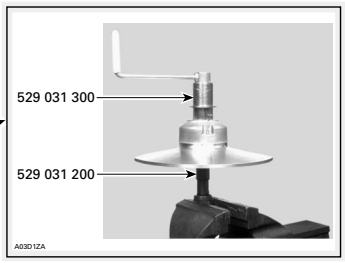
Turn puller handle and sliding half at once to extract the bushing.



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.

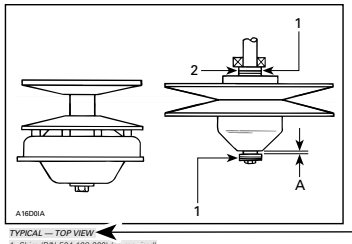
A-Series and B-Series Only

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

1. Shim (P/N 504 108 200) (as required)
2. Contact
A. 0 to 1 mm (0 to 3/64 in)

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.

Call-outs for above illustration.

Illustration always follows text to which it pertains.

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

GENERAL INFORMATION

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.

ILLUSTRATIONS AND PROCEDURES

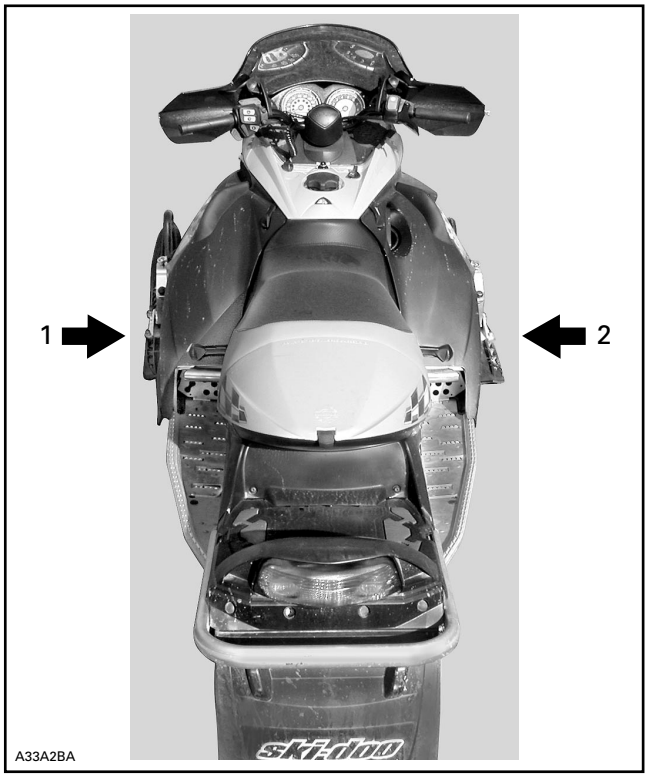
Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

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

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

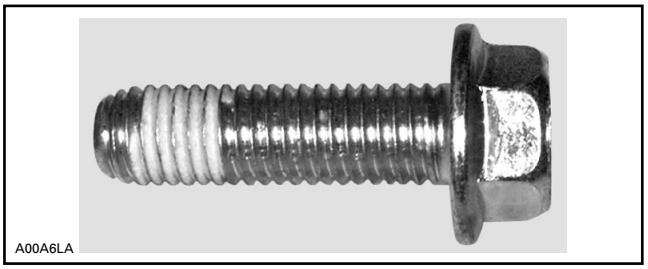
A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

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



TYPICAL
1. Left
2. Right

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 (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

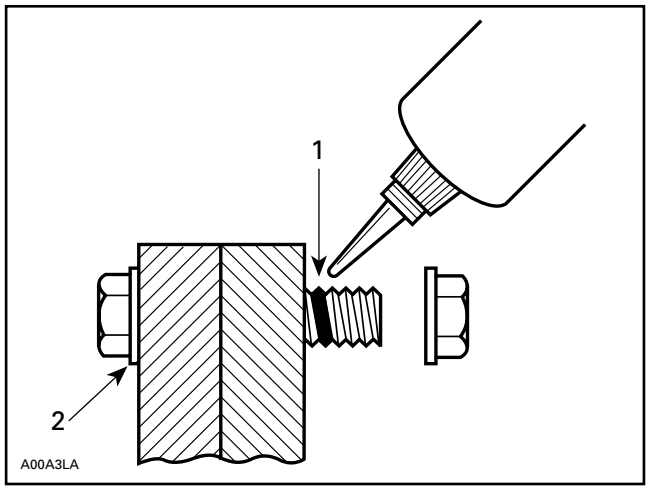
LOCTITE APPLICATION PROCEDURE

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

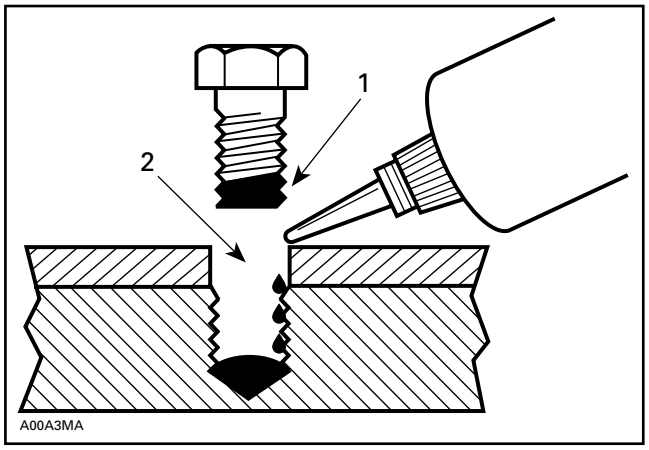
Uncovered Holes (bolts and nuts)



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.

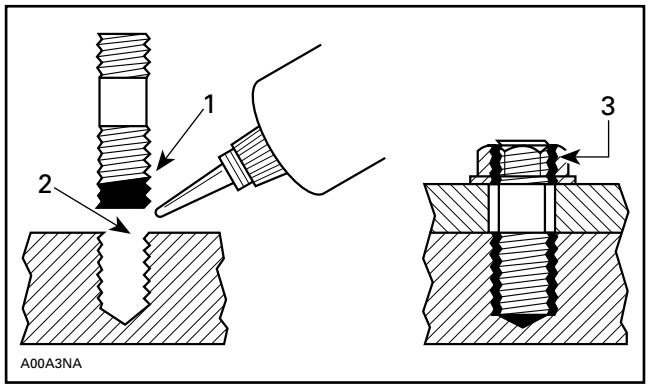
Blind Holes



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

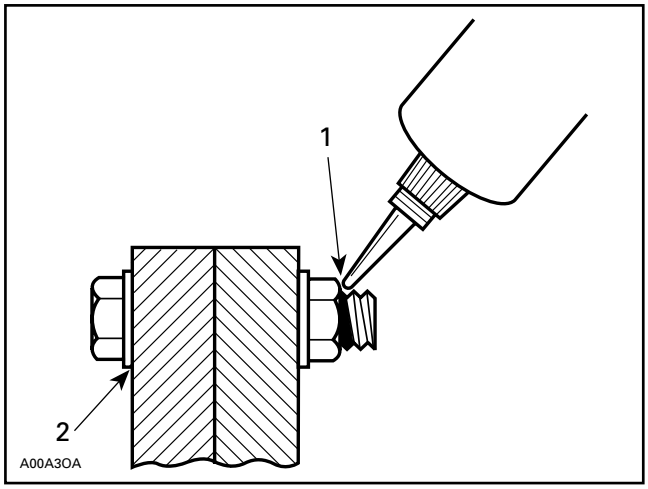


1. On threads
2. On threads and in the hole
3. Onto nut threads

– 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

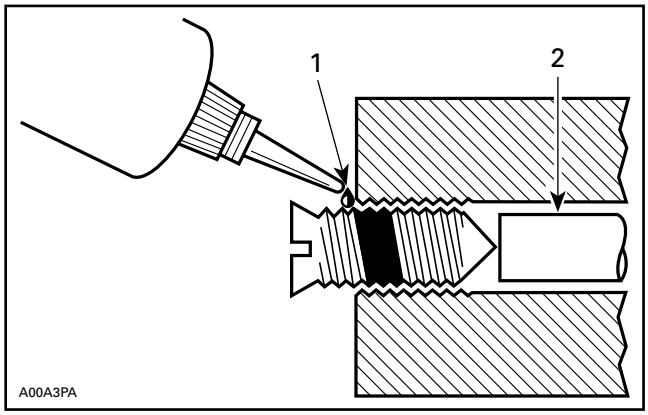


1. Apply here
2. Do not apply

– 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



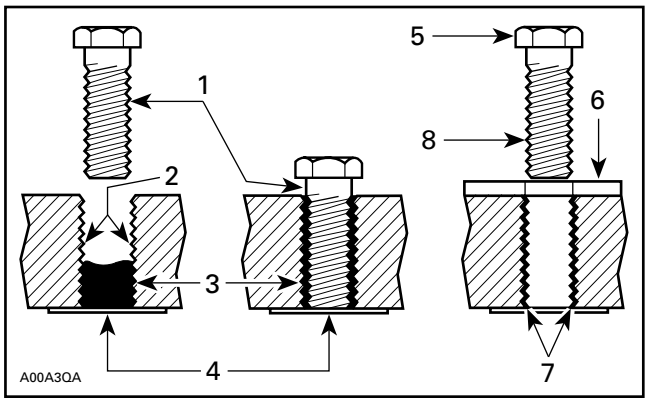
1. Apply here
2. Plunger

– 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

Stripped Threads



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
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:
  • Apply release agent on mating surfaces.
  • 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.

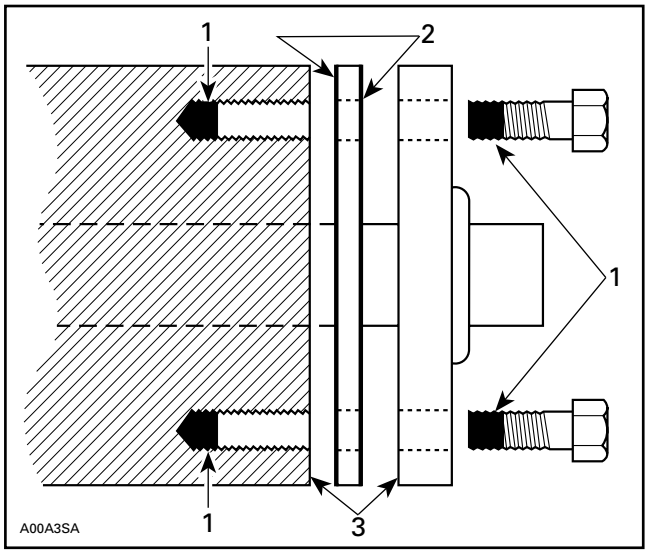
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

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

All Parts



1. Proper strength Loctite
2. Loctite Primer N (P/N 413 708 100) and Gasket Eliminator 515 (P/N 413 702 700) 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 515 (P/N 413 702 700) on both sides of gasket, using a clean applicator.
– Place gasket on mating surfaces and assemble immediately.

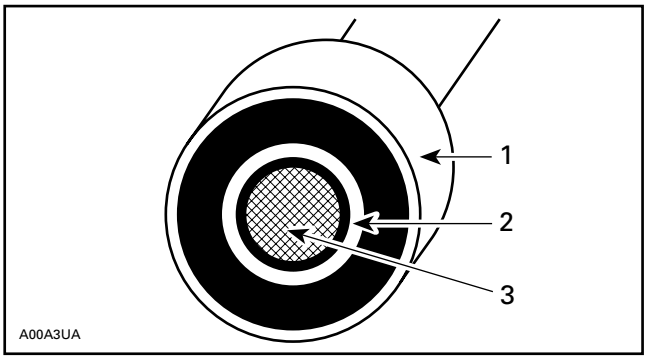
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

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

Standard

– 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.

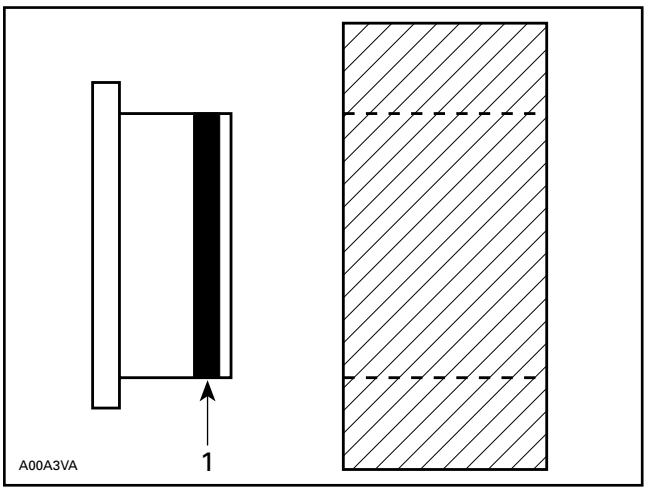
– DO NOT use anti-seize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

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

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

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

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

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

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

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

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 (ex.: 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:

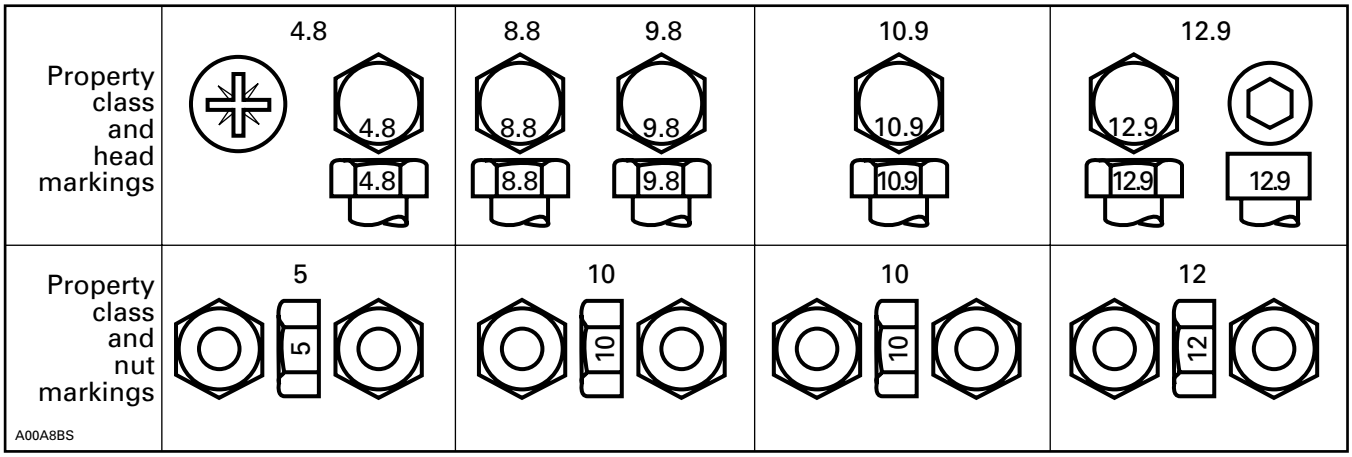
– Manually screw all screws, bolts and/or nuts.
– Apply the half of the recommended torque value.

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.



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)

We would be pleased if you could communicate to BRP any suggestions you may have concerning our publications.

BRP SERVICE PUBLICATIONS REPORT

Publication title and year _____ Page _____

Machine _____ Report of error ❑ Suggestion ❑

_____

_____

_____

_____

_____

Name _____

Address _____

City and State/Prov. _____ Date _____

Zip code/Postal code _____

BRP SERVICE PUBLICATIONS REPORT

Publication title and year _____ Page _____

Machine _____ Report of error ❑ Suggestion ❑

_____

_____

_____

_____

_____

Name _____

Address _____

City and State/Prov. _____ Date _____

Zip code/Postal code _____

BRP SERVICE PUBLICATIONS REPORT

Publication title and year _____ Page _____

Machine _____ Report of error ❑ Suggestion ❑

_____

_____

_____

_____

_____

Name _____

Address _____

City and State/Prov. _____ Date _____

Zip code/Postal code _____

A00A89

AFFIX
PROPER
POSTAGE

Bombardier
Recreational Products Inc.

Technical Publications
After Sales Service
565 de la Montagne Street
Valcourt, Quebec, Canada J0E 2L0

AFFIX
PROPER
POSTAGE

Bombardier
Recreational Products Inc.

Technical Publications
After Sales Service
565 de la Montagne Street
Valcourt, Quebec, Canada J0E 2L0

AFFIX
PROPER
POSTAGE

Bombardier
Recreational Products Inc.

Technical Publications
After Sales Service
565 de la Montagne Street
Valcourt, Quebec, Canada J0E 2L0

A00A8A

MAINTENANCE CHART

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

SYSTEM	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
ENGINE								
Rewind starter and rope						I,L	I	02-11
Engine motor mounts	I			I		I		Section 02, see the appropriate subsection
Exhaust system (4)	I		I			I		02-03
Engine lubrication						L		01-02
Cooling system	I			I			I	02-10
Coolant	I					R		02-10
Crankshaft PTO Seal (4)						I		Section 02, see the appropriate subsection
E-RAVE actuator (4)	A			A				02-06
Injection oil filter			I			R		02-12
Oil injection pump	A			A			A	02-12
Rags in air intake and exhaust system						T	T	01-02 and 01-03
FUEL SYSTEM								
Fuel stabilizer						T		01-02
Fuel filter							R	01-03
Fuel lines, fuel rail and connections	I						I	Section 02 or 04-03
Throttle cable	I			I			I	04-03
Air filter(4)			C				C	01-03
Throttle body (4)							C	04-03
Air intake system (4)							I	02-02
DRIVE SYSTEM								
Drive belt	I	I					I	06-01
Drive and driven pulley	I		I	C		I	C	06-02 and 06-03
Tightening torque of drive pulley screw	I			I			I	06-02
Tightening torque of ring gear screws							I	06-02
Brake fluid	I	I				R	I	06-05
Drive pulley ramp and roller							I	06-02
Brake hose, pads and disk	I	I					I	06-05
Drive chain tension	A(5)		A(5)			I		06-06
Chaincase oil	I		I			R	I	06-06

A: ADJUST I: INSPECT L: LUBRICATE R: REPLACE C: CLEAN T: PROCEED WITH TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
SYSTEM								
Drive axle end bearing [2]	L		L			L		06-07
Countershaft [2]	L		L			L		06-07
Track	I		I			I		06-08
Track tension and alignment	A	AS REQUIRED						06-08
STEERING/FRONT SUSPENSION								
Steering and front suspension mechanism [2]	I,L		I	L		I,L		08-01 and 08-02
Wear and condition of skis and runners	I	I				I		08-02
SUSPENSION								
Suspension adjustments	A	AS REQUIRED						Section 07 or 08, see the appropriate subsection
Suspension [2]	I		I,L			I,L		
Suspension stopper strap				I		I		
ELECTRICAL								
EMS fault codes [4]	I				I			04-03
Spark plugs [1] [4]	I		I				R	05-01
Battery (if so equipped)	I		I			I	I	05-02
Wiring harnesses, cables and lines [4]	I		I			I		09-01
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/or 05–05
VEHICLE								
Headlamp beam aiming				A			A	05-04
Engine compartment	C		C			C		01-02
Vehicle cleaning and protection	C		C			C		01-02

(1) To be performed by an authorized ski-doo dealer.

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

(3) 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.

(4) Emission-related.

(5) Summit models only.

STORAGE

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
anti-seize lubricant	293 800 070	5
BOMBARDIER LUBE	293 600 016	4, 6
BOMBARDIER scratch remover kit	861 774 800	6
fuel stabilizer	413 408 600	4
heavy duty cleaner (4 L)	293 110 002	6
heavy duty cleaner (spray can 400 g)	293 110 001	6
storage oil (Canada)	413 711 600	4
storage oil (USA)	413 711 900	4
suspension synthetic grease	293 550 033	5
vinyl & plastic cleaner (6 x 1 L)	413 711 200	6

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 ENGINE section.

Engine Motor Mounts

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

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

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

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

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 (Canada) (P/N 413 711 600) or storage oil (USA) (P/N 413 711 900) 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.

Cooling System

For coolant replacement, refer to ENGINE section.

Crankshaft PTO Seal

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

Injection Oil Filter

Replace injection oil filter, refer to ENGINE section.

Rags in Air Intake and Exhaust System

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

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 DRIVE SYSTEM section.

Drive Chain Tension

Summit Models

Check drive chain tension and adjust if necessary, refer to DRIVE SYSTEM section.

Mach Z

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

Chaincase Oil

Replace chaincase oil, refer to DRIVE SYSTEM section.

Drive Axle End Bearing

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.

Countershaft

Driven pulley and brake disc must be floating on the countershaft for efficient operation. Lubricate with anti-seize 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 DRIVE SYSTEM section.

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

STEERING/FRONT SUSPENSION

Steering and Front Suspension Mechanism Lubrication

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

Wear and Condition of Skis and Runners

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

SUSPENSION

Rear Suspension Lubrication

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

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

Suspension Stopper Strap

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

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 ELECTRICAL section.

Wiring Harnesses, Cables and Lines

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

VEHICLE

Engine Compartment

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

Vehicle 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 further damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (spray can 400 g) (P/N 293 110 001) or heavy duty cleaner (4 L) (P/N 293 110 002).

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

For vinyl and plastic parts use vinyl & plastic cleaner (6 x 1 L) (P/N 413 711 200).

To remove scratches on windshield or hood use BOMBARDIER 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 chromed 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.

Vehicle Protection

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.

NOTE: Do not release track tension.

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

Rags in Air Intake and Exhaust System

Remove rags that were installed during STORAGE preparation.

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.

Cooling System

Inspect cooling system for leaks, to perform a cooling system leak test, refer to ENGINE 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.

Oil Injection Pump

Make sure oil injection pump is properly adjusted, refer to ENGINE section.

FUEL SYSTEM

Fuel Filter

Replace fuel filter, refer to FUEL SYSTEM section.

Fuel Lines, Fuel Rails and Connections

Inspect fuel system for leaks, to perform a fuel system pressurization, refer to FUEL SYSTEM.

Throttle Cable

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

Air Filter/Air Intake System

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

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

Throttle Body

Remove the throttle body from vehicle.

Using the pulley flange cleaner (P/N 413 711 809), remove the dirt ejected by the drive belt from the throttle plate and from both throttle body bores. After throttle body installation, adjust throttle and injection oil cables.

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).

Tightening Torque of Drive Pulley Screw

Retorque if necessary drive pulley screw to 88 N•m (65 lbf•ft).

Tightening Torque of Ring Gear Screws

Retorque if necessary ring gear screws to 53 N•m (39 lbf•ft).

NOTE: If a screw is loose, remove screw, clean screw and pulley flange hole. Retorque screw to 53 N•m (39 lbf•ft).

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.

Drive Pulley Ramp and Roller

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

Brake Hose, Pads and Disk

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

Inspect brake pads for proper thickness. Refer to DRIVE TRAIN section and the appropriate subsection.

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

Chaincase Oil

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

Track Tension and Alignment

Verify track tension and alignment, refer to DRIVE SYSTEM section and the appropriate subsection.

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 (if so equipped)

Verify that battery is fully charged, if not, refer to the appropriate charging procedure in ELECTRICAL 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.

Spark Plugs

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

VEHICLE

Headlamp Beam Aiming

Verify beam aiming and adjust if necessary, refer to ELECTRICAL SYSTEM section.

LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
exhaust plates	529 035 999	9
intake plugs	529 036 000	10
RAVE plates	529 036 003	11
small hose pincher	295 000 076	10
vacuum/pressure pump kit	529 021 800	9

LEAK TEST

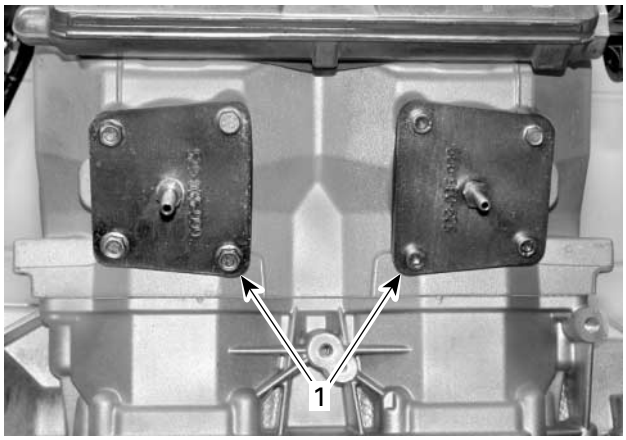
Use vacuum/pressure pump kit (P/N 529 021 800) to pressure test engine. The following gives verification procedures for liquid cooled engines.

529 021 800

PREPARATION

Remove tuned pipe and install two exhaust plates (P/N 529 035 999).

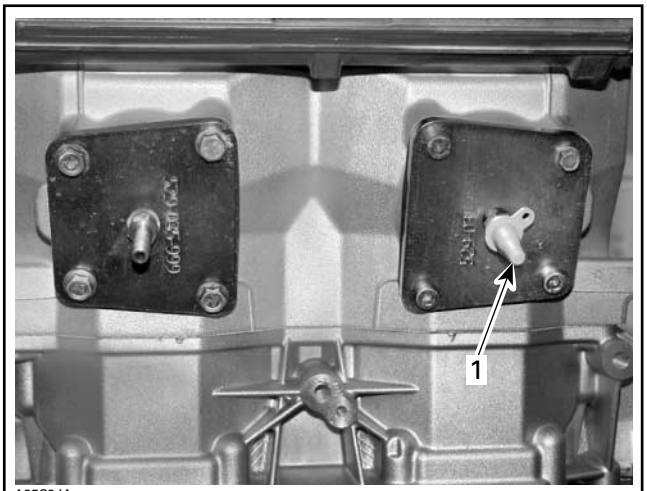
529 035 999



A35C3IA

1. Exhaust plates

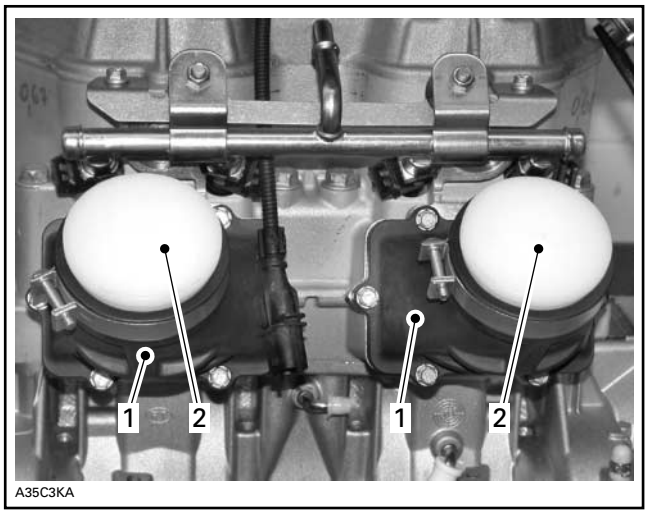
Block one fitting with a cap.



A35C3JA

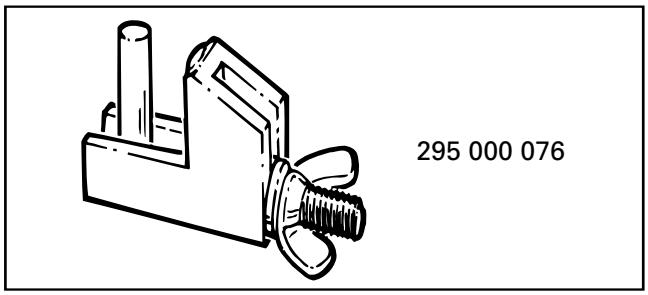
1. Rubber cap

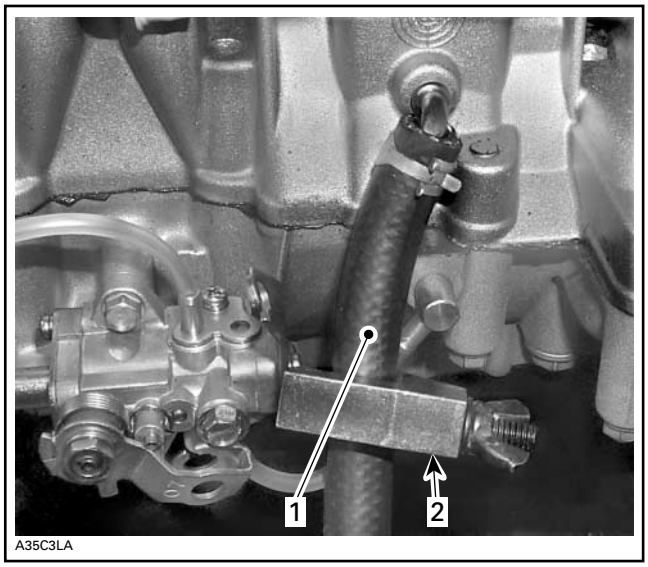
Install intake plugs (P/N 529 036 000) in the intake rubber boots.



1. *Intake rubber boots*
2. *Intake plugs*

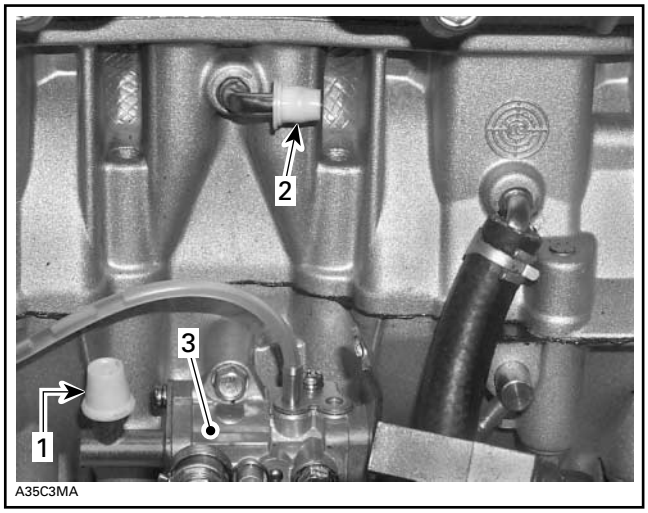
Using a small hose pincher (P/N 295 000 076), block impulse hose.





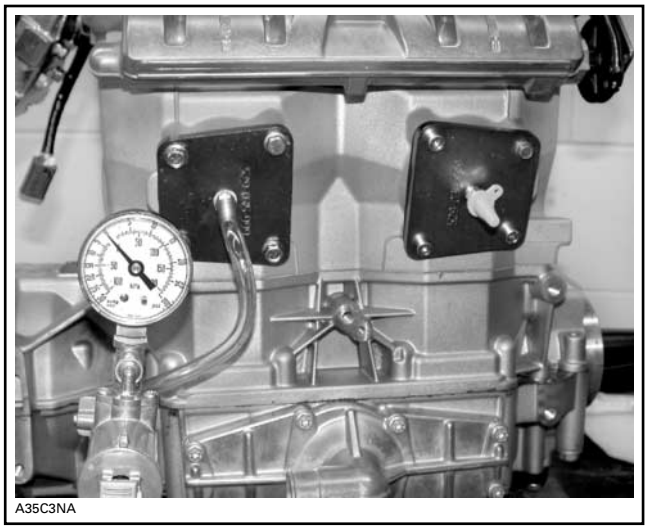
1. *Impulse line*
2. *Hose pincher*

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



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

Install the vacuum/pressure pump on exhaust plate fitting.

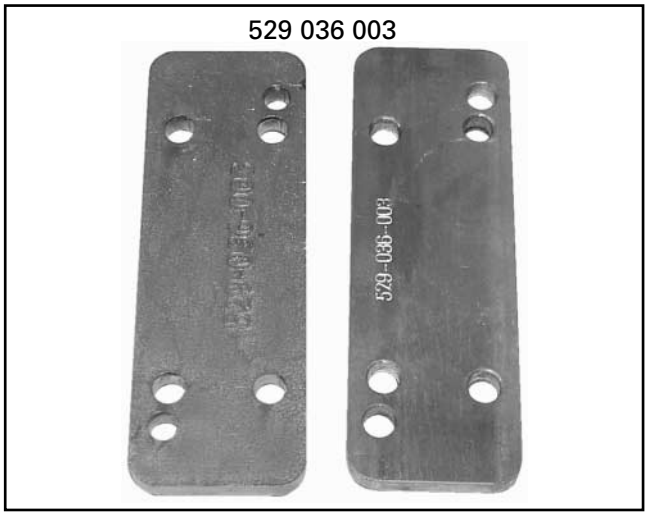

A35C3NA

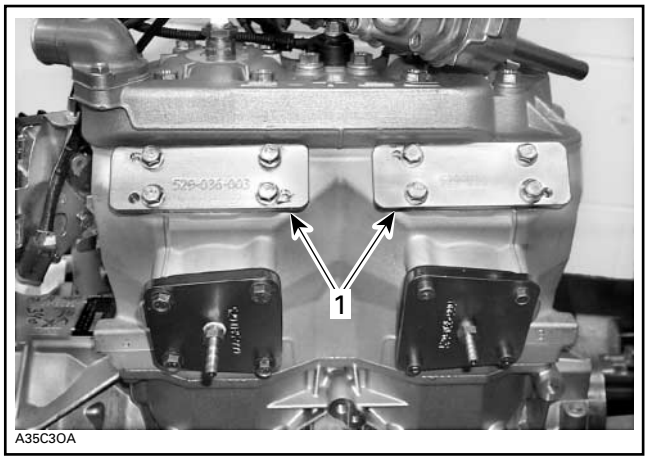
NOTE: If necessary, lubricate air pump piston with mild soap.

CAUTION: Using hydrocarbon lubricant (such as engine oil) will damage rubber seal of pump piston.

Two leak tests must be performed, without RAVE valves and with RAVE valves.

To perform the first test, remove the RAVE valve cover and its gasket then replace the cover by two RAVE plates (P/N 529 036 003).



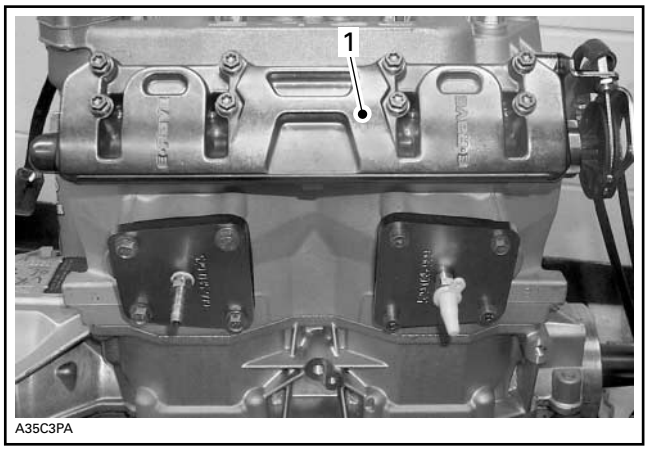


A35C3OA

1. RAVE plates

Execute the test. Refer to PROCEDURE further in this section.

To perform the second test, the RAVE cover must be in place.



A35C3PA

1. RAVE cover

PROCEDURE

Using flow chart at the end of this section and following text, pressurize area to be tested and spray soapy solution at the indicated location.

TEST PRESSURE: 34 KPA (5 PSI) FOR 3 MINUTES

- 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.

Tools

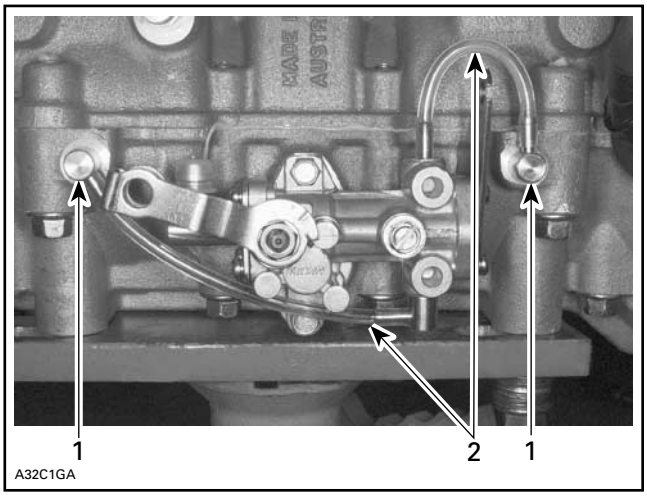
Check all tools used for the test:

– exhaust plates and the cap on the fitting
– plugs in intake rubber boots
– hose pincher on impulse hose
– rubber caps on inlet and outlet fittings of oil injection system
– RAVE plates (if so installed)
– pump and hose.

Engine

Check the following:

– Spark plugs base and insulators.
– All jointed surfaces:
  - cylinder head
  - cylinder
  - RAVE valve cover (if so installed)
  - injectors area
  - decompressor areas
  - 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.



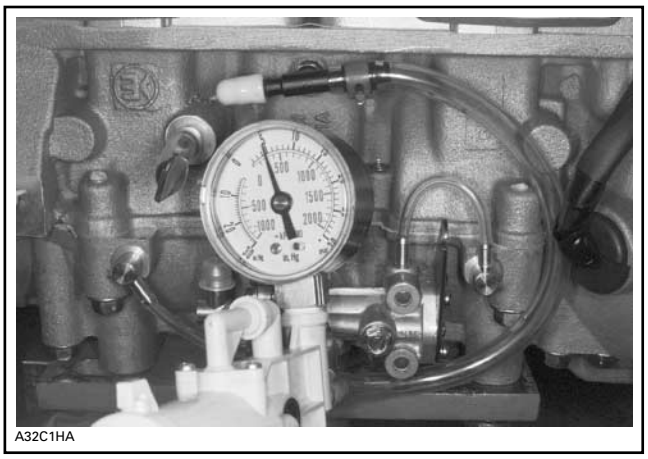
TYPICAL
1. Injection nipples
2. Small injection oil lines

Check for air bubbles or oil column going toward pump. It indicates defective check valve in injection nipples.

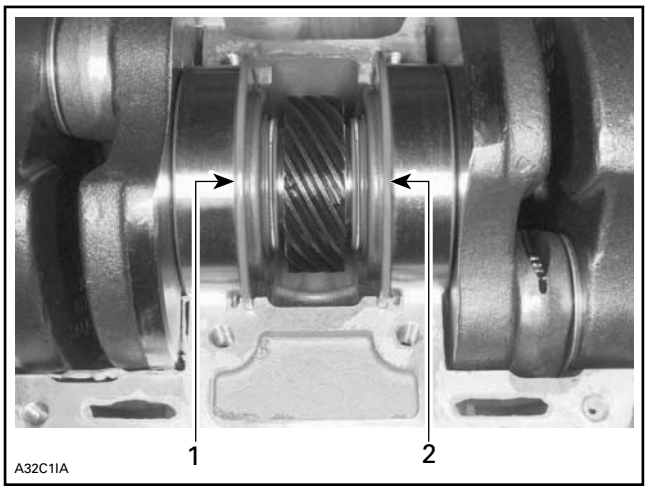
Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install air pump on adapter and pressurize as above.

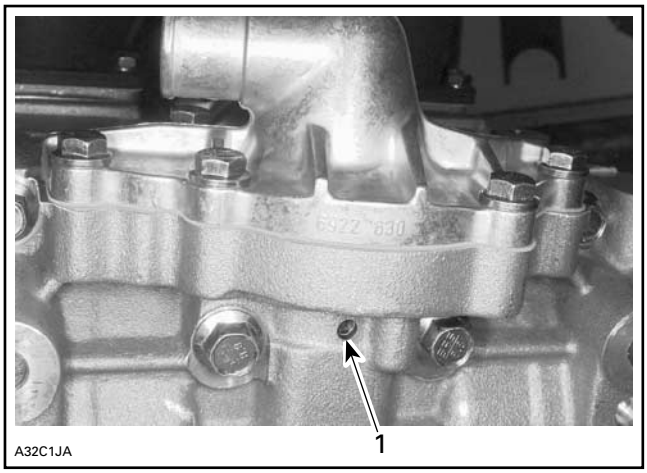


If pressure drops, it indicates a defective crankshaft inner seal.



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

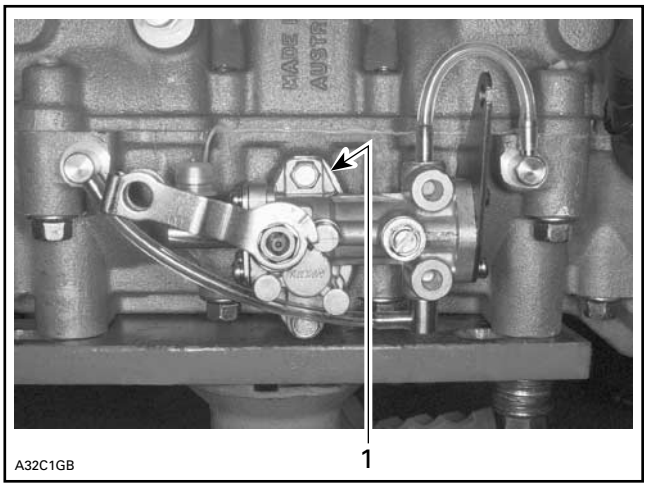
– Check leak indicator hole below coolant pump housing with soapy water.



1. Leak indicator hole

If there is a leak, it indicates that a pump shaft is defective (oil seal beside coolant ceramic seal).

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



TYPICAL
1. Check mounting area

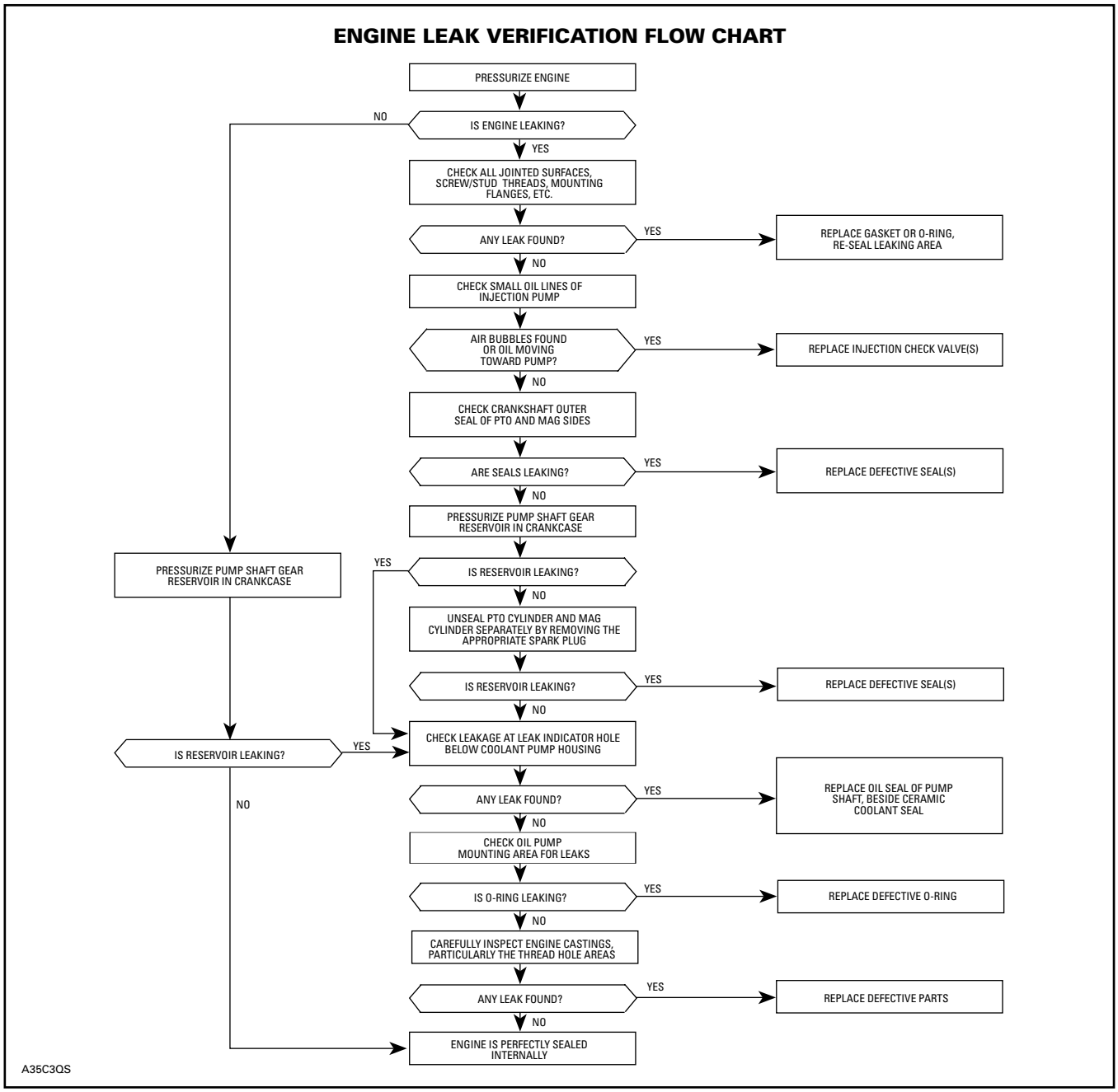
– If leak still persists, it indicates a defective casting somewhere in engine.

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.

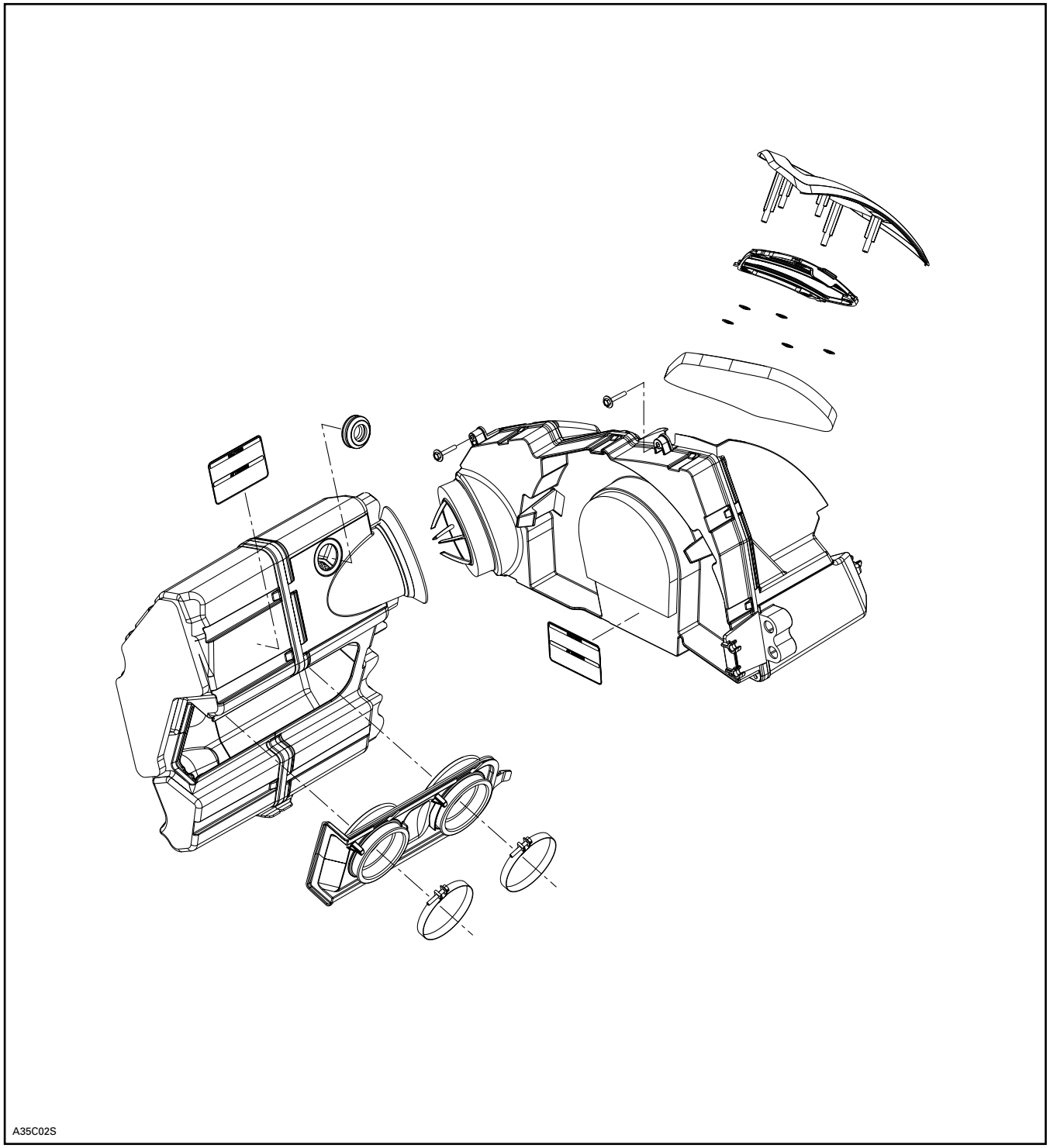
FINALIZING REASSEMBLY

After reassembling engine, always recheck for leakage.

ENGINE LEAK VERIFICATION FLOW CHART



AIR INTAKE SYSTEM



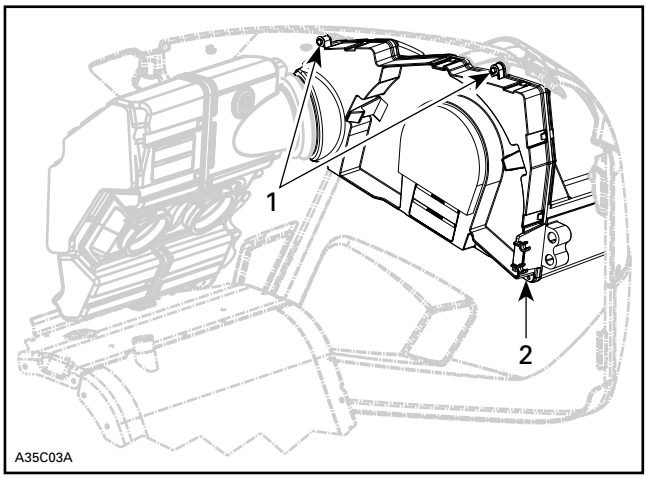
AIR FILTER/AIR INTAKE SILENCER REMOVAL (BODY SIDE)

Open LH side panel.

Unplug air pressure sensor connector.

Remove screws retaining air intake silencer to LH side panel.

Remove air intake silencer (body side).

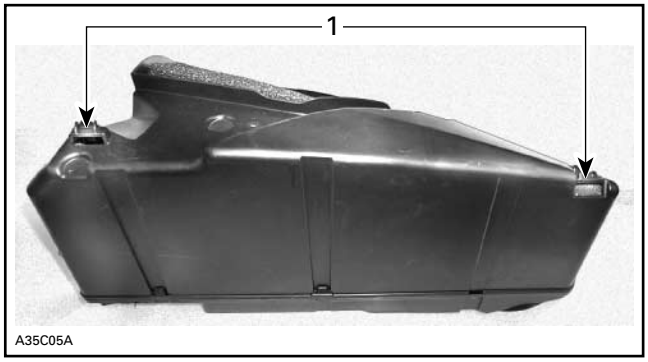


1. Remove screws
2. Air intake silencer (body side)

1. Remove air filter

AIR FILTER/AIR INTAKE SILENCER INSTALLATION (BODY SIDE)

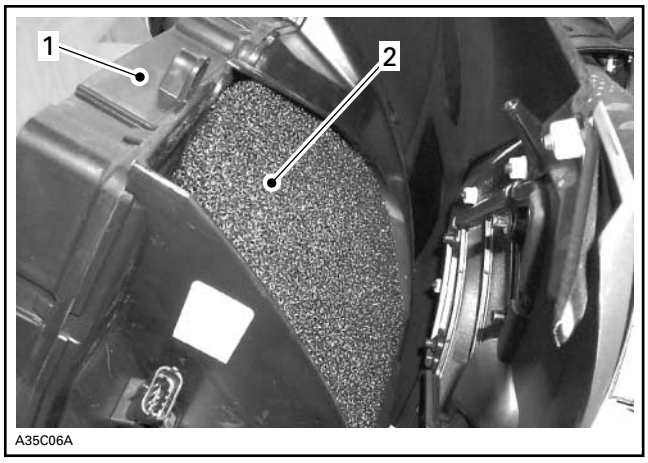
Position lower section of air intake silencer on LH side panel using locating holes.



1. Locating holes

Install air filter on air intake silencer.

NOTE: Make sure air filter stays in place at installation.



1. Air intake silencer (body side)
2. Air filter

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

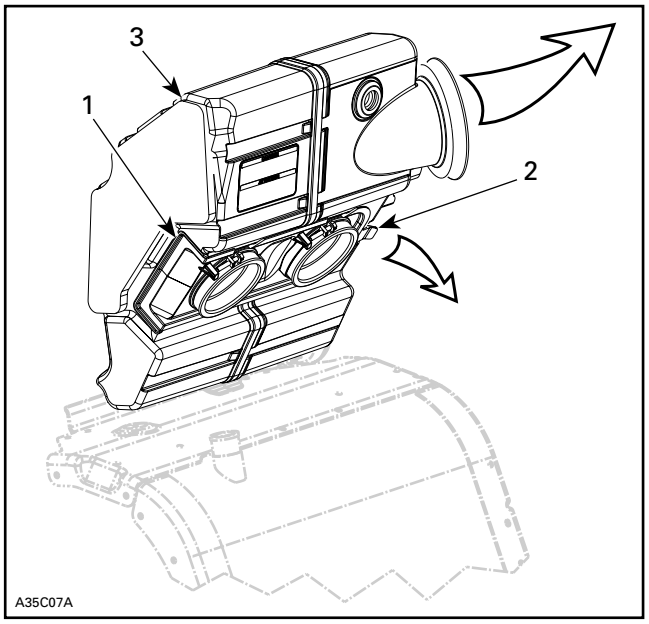
AIR INTAKE SILENCER REMOVAL (ENGINE SIDE)

Open LH side panel.

Unplug air temperature sensor connector.

Release locking tab of adapter plate.

Pull on air intake silencer to remove.



1. *Adaptor plate*
2. *Locking tab*
3. *Air intake silencer*

AIR INTAKE SILENCER INSTALLATION (ENGINE SIDE)

The installation is the reverse of the removal procedure.

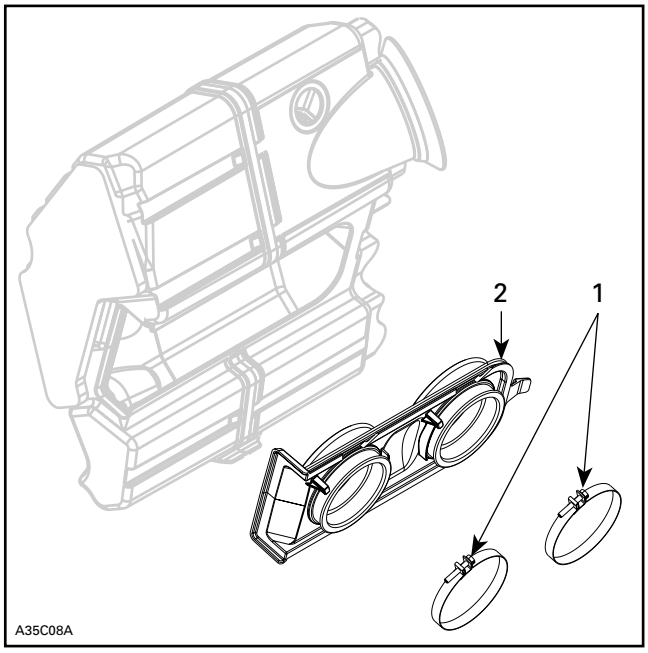
ADAPTOR PLATE REMOVAL

Open LH side panel.

Remove air intake silencer (engine side), refer to procedure above.

Unscrew clamps from throttle body.

Remove adaptor plate.



1. *Clamps*
2. *Adaptor plate*

ADAPTOR PLATE INSTALLATION

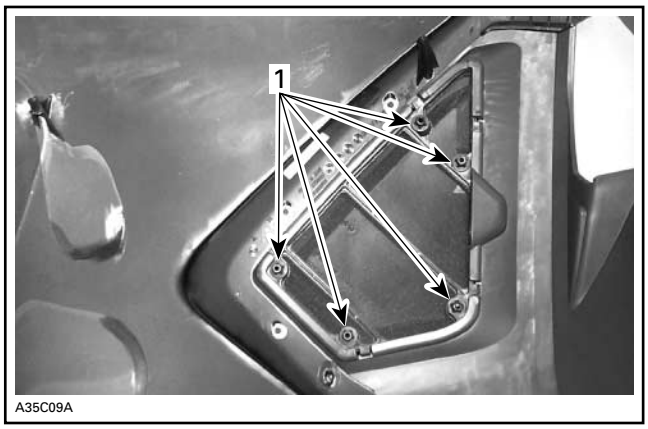
The installation is the reverse of the removal procedure.

INTAKE DEFLECTOR/FILTER REMOVAL

Open LH side panel.

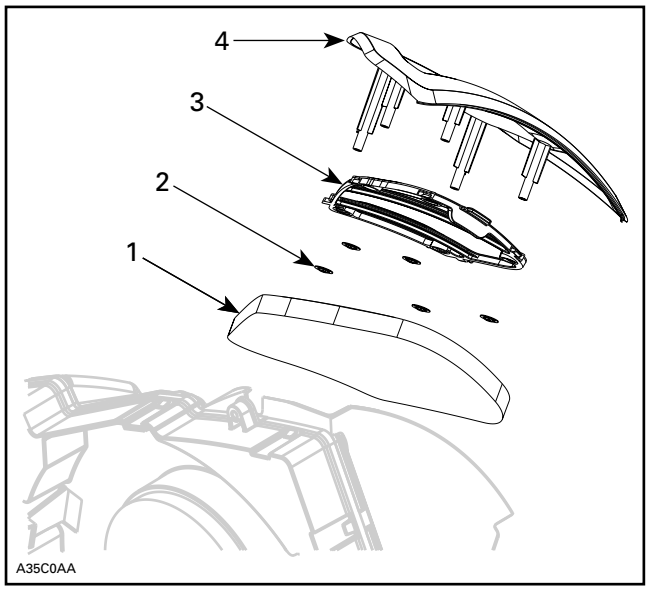
Remove air intake silencer (body side), refer to procedure above.

Remove push nuts retaining intake deflector to LH side panel.



1. *Push nuts*

Remove intake deflector and filter.



1. *Air filter*
2. *Push nut*
3. *Intake filter*
4. *Intake deflector*

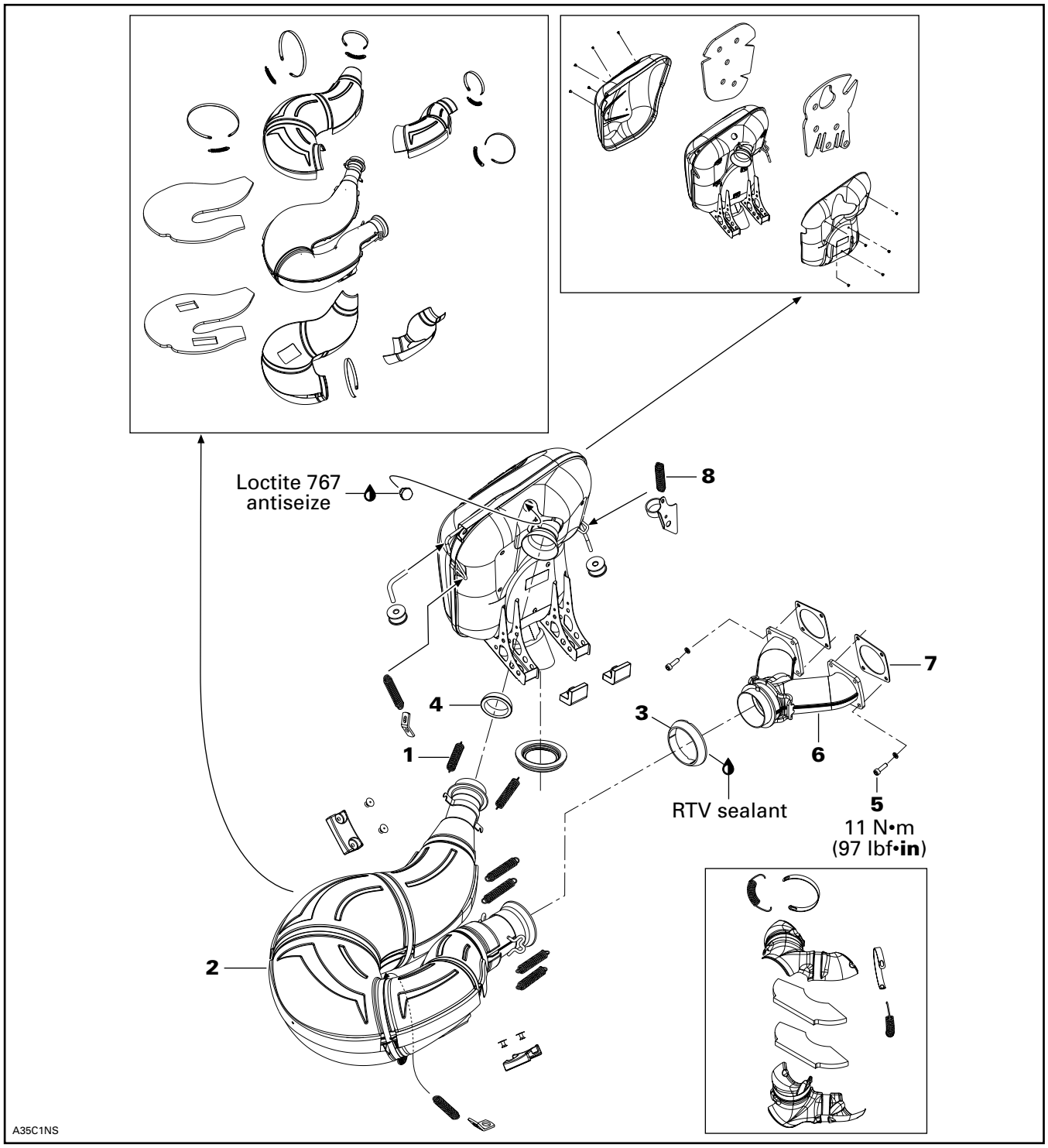
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
exhaust spring installer/remover	529 035 401	23
exhaust spring installer/remover	529 035 989	21–22

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 antiseize	293 800 070	23
RTV sealant	293 800 090	22



GENERAL

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.

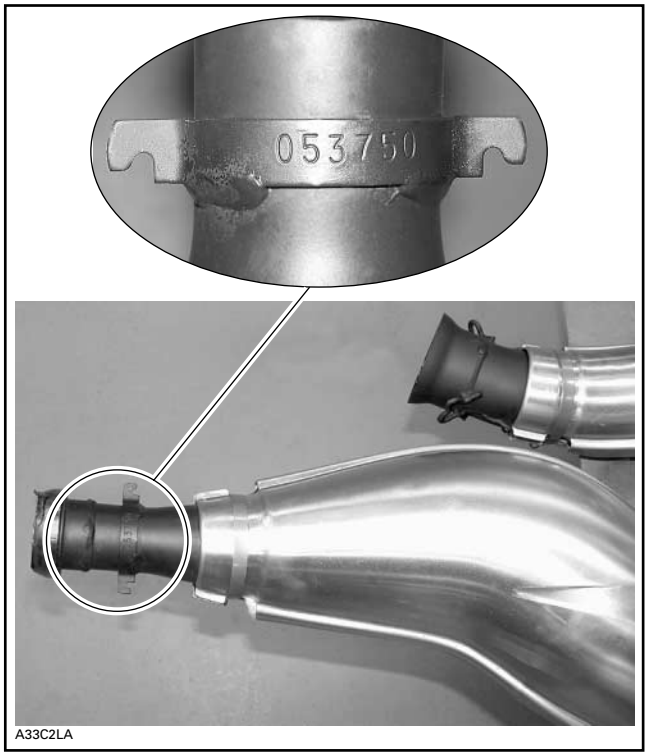
⚠ WARNING

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.

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 numbers of BRP part number.



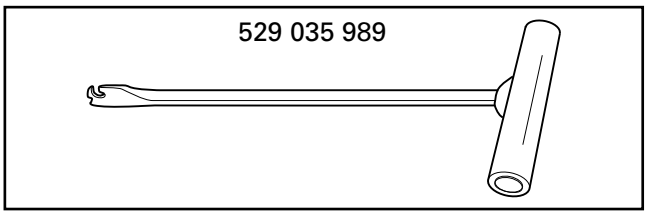
TYPICAL

Removal

Open hood and right side panel.

Remove:

– all exhaust springs **no. 1** using exhaust spring installer/remover (P/N 529 035 989)



– tuned pipe **no. 2**
– exhaust gasket **no. 3** and **no. 4**.

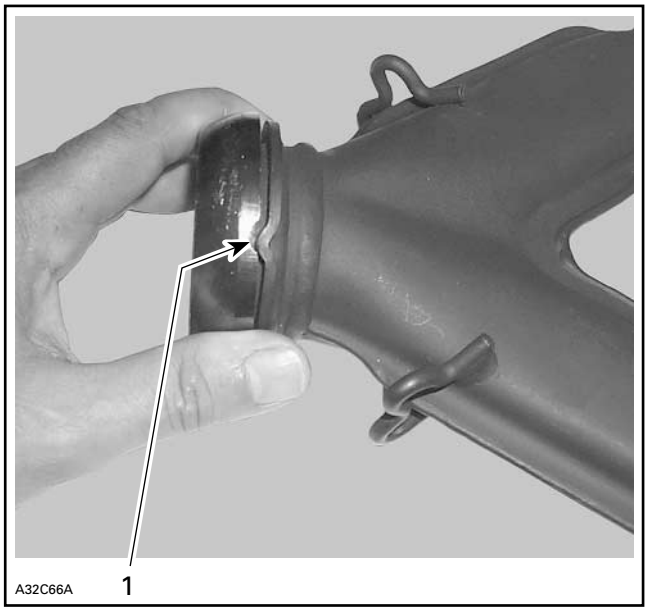
Inspection

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: On engines with 6 mm (1/4 in) screws, heat screws for 30 seconds before loosening to prevent screw breakage.

– manifold **no. 6**
– gaskets **no. 7**.

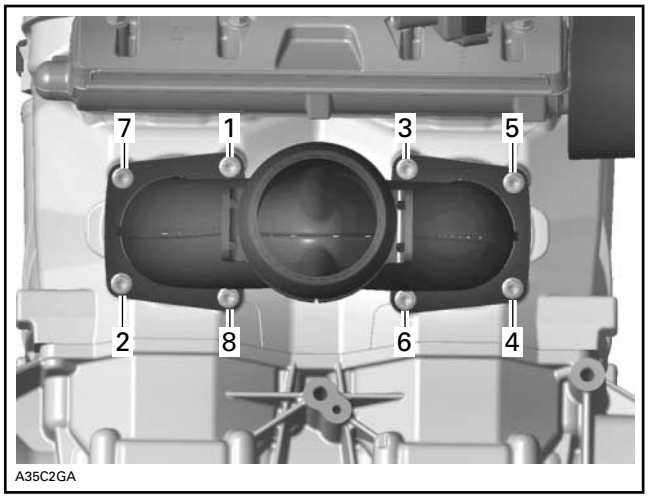
Inspection

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 numbers of BRP part number.

TYPICAL

Removal

Remove tuned pipe **no. 2**.

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).

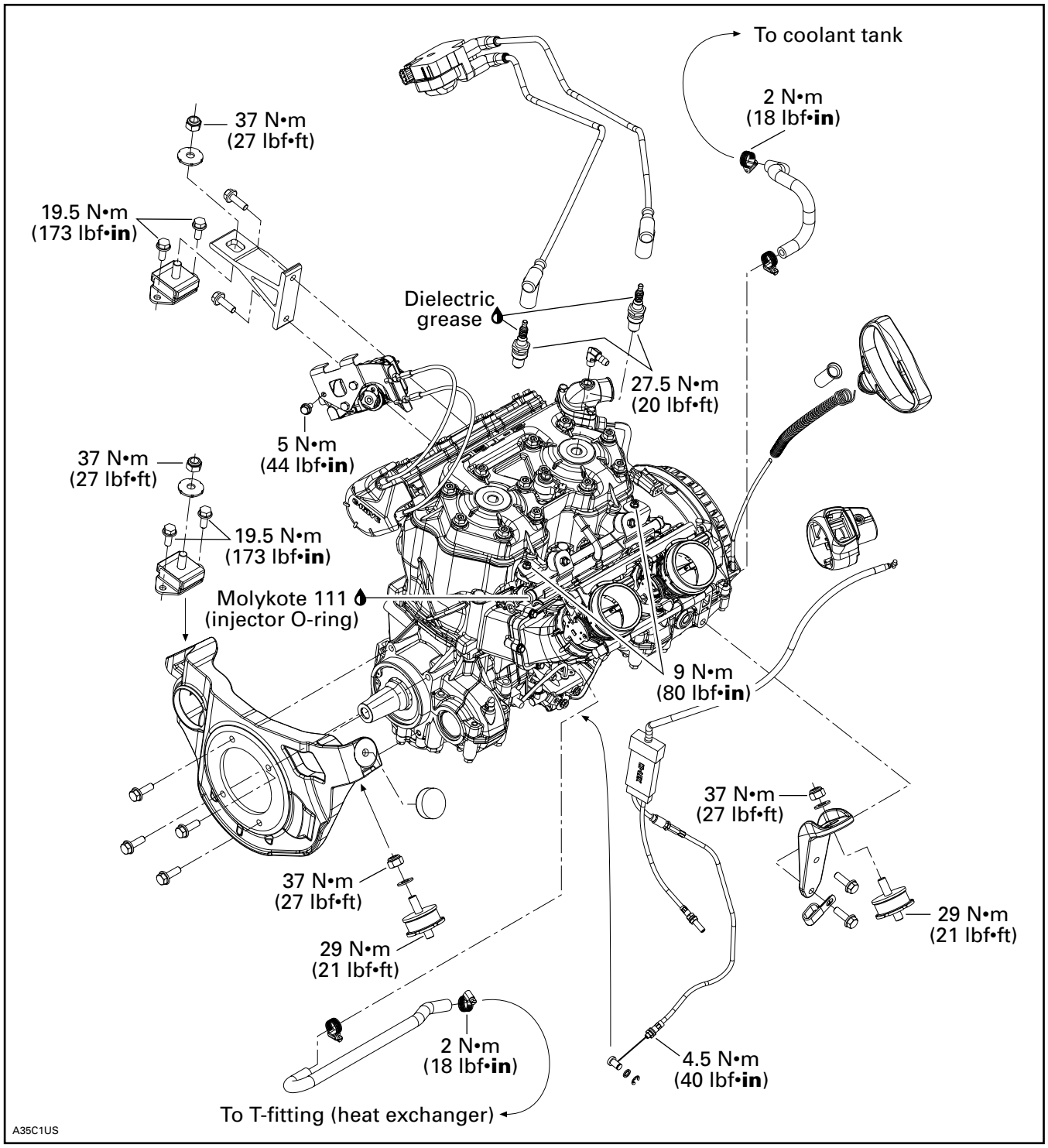
ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
engine removal hook	529 035 829	30
hose pincher	295 000 076	31
spark plug lift ring	529 035 830	30

SERVICE PRODUCTS

Description	Part Number	Page
Dielectric grease	293 550 004	33
Molykote 111	413 707 000	33



REMOVAL FROM VEHICLE

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

Remove the following:

– windshield
– RH and LH side panels.

NOTE: On LH side panel, unplug APS (Air Pressure Sensor) connector.

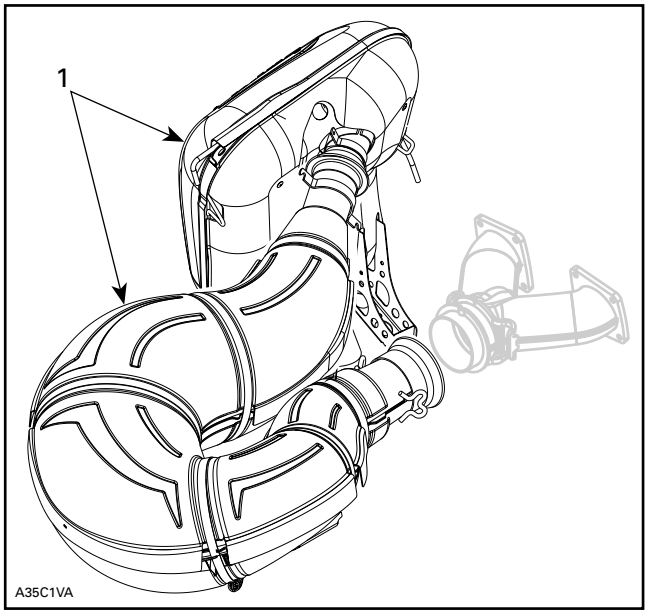
Using B.U.D.S., release fuel pressure from fuel system. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

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 tuned pipe and muffler. Refer to EXHAUST SYSTEM sub-section.

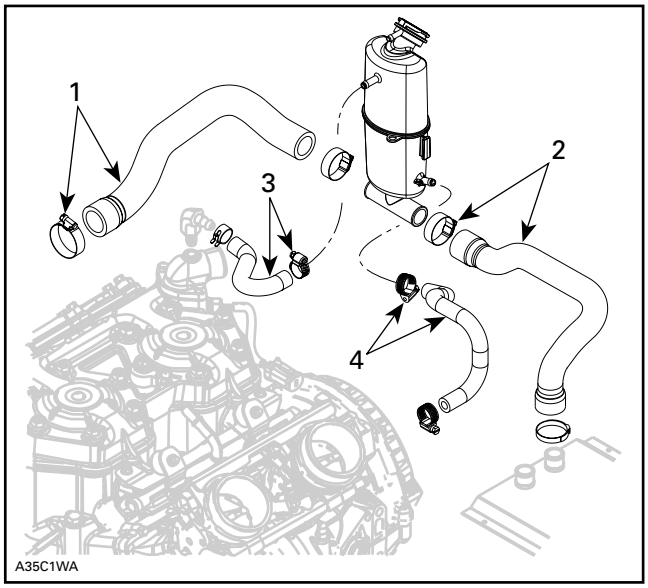


REMOVE
1. Tuned pipe and muffler

On Right Side of Vehicle, do the Following:

Drain cooling system. Refer to COOLING SYSTEM sub-section.

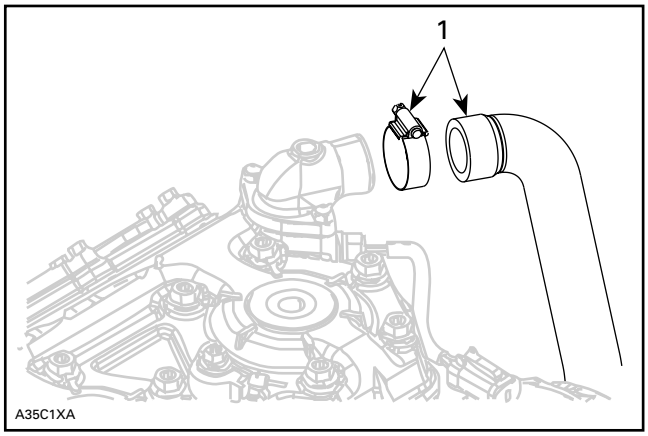
Unplug from the coolant reservoir the following:



UNPLUG
1. Engine inlet hose
2. Heat exchanger outlet hose
3. Bleed hose
4. Throttle body inlet hose

Remove coolant reservoir.

Unplug engine outlet hose.

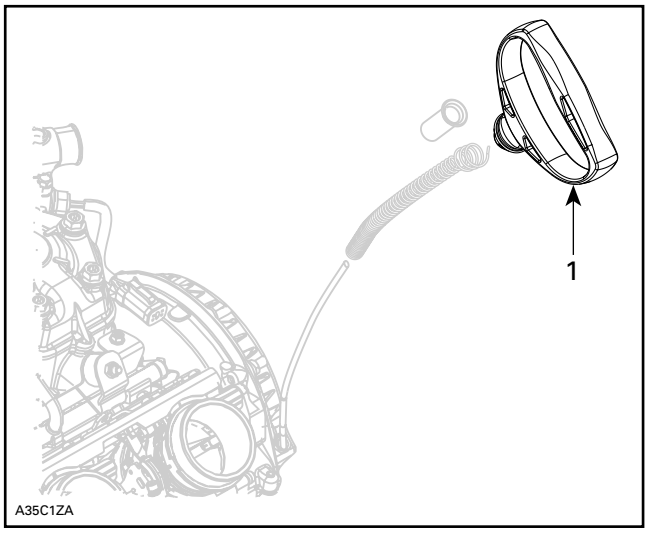


UNPLUG
1. Engine outlet hose

Unplug the following connectors:

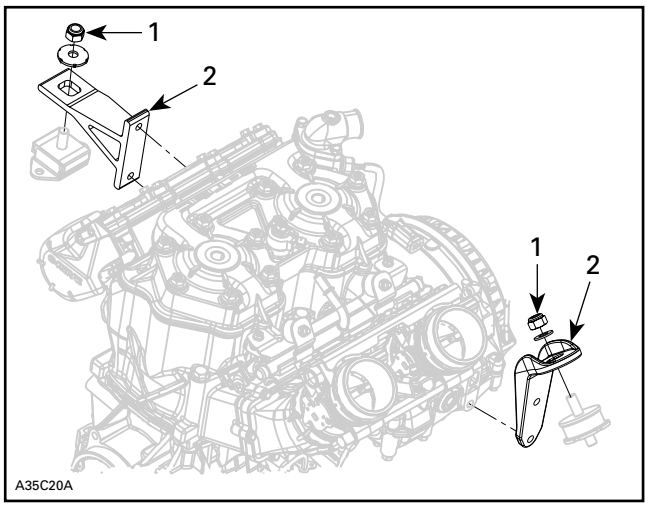
– magneto
– crankshaft position sensor (CPS)
– coolant temperature sensor (CTS)
– spark plug cables
– knock sensor
– ground cable from engine to frame.

Remove the following:



REWIND STARTER HANDLE REMOVAL
1. Rewind starter handle

NOTE: As an alternative method, the rewind starter can be removed from the engine and put aside.



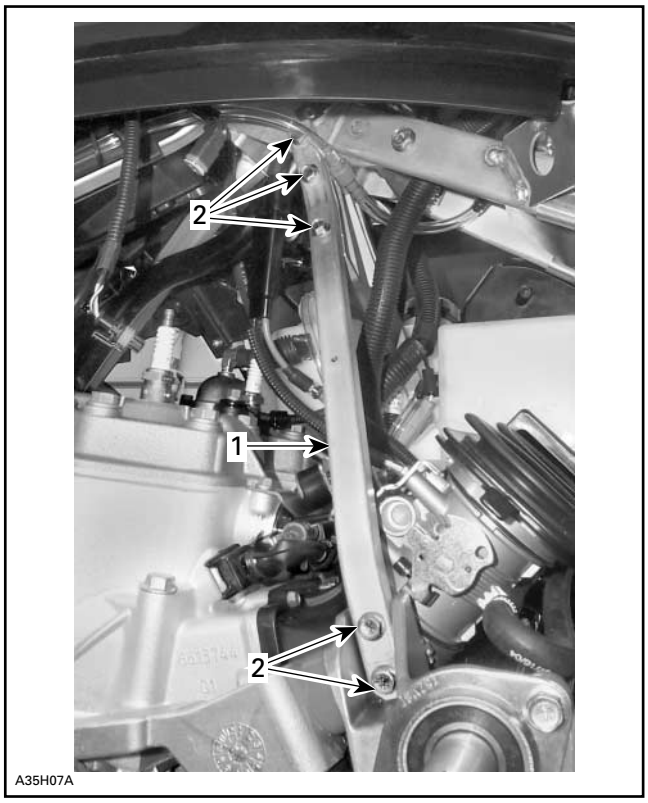
ENGINE SUPPORT NUTS REMOVAL
1. Nuts
2. Engine support

On Left Side of Vehicle, do the Following:

Remove:

- belt guard
- drive belt
- drive pulley (refer to DRIVE PULLEY subsection)
- driven pulley (refer to DRIVEN PULLEY subsection)
- air intake silencer (engine side), refer to AIR INTAKE SYSTEM section.

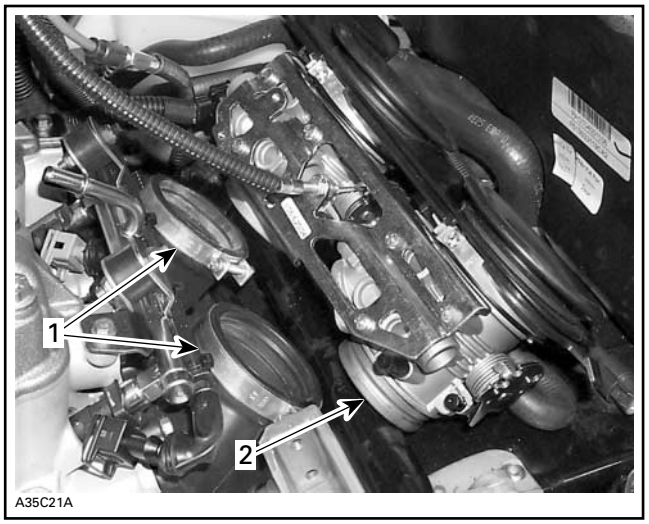
Remove LH handlebar support.



HANDLEBAR SUPPORT REMOVAL
1. Handle support
2. Bolts

Unscrew throttle body clamps.

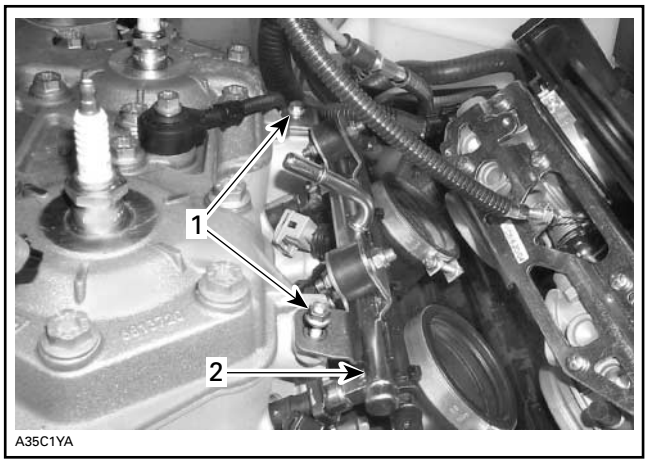
Remove throttle body from intake adapters with throttle cable and TPS connector in place.



THROTTLE BODY REMOVAL
1. *Clamps*
2. *Throttle body*

Unplug fuel filter line from fuel rail.

Unscrew and remove fuel rail from engine.

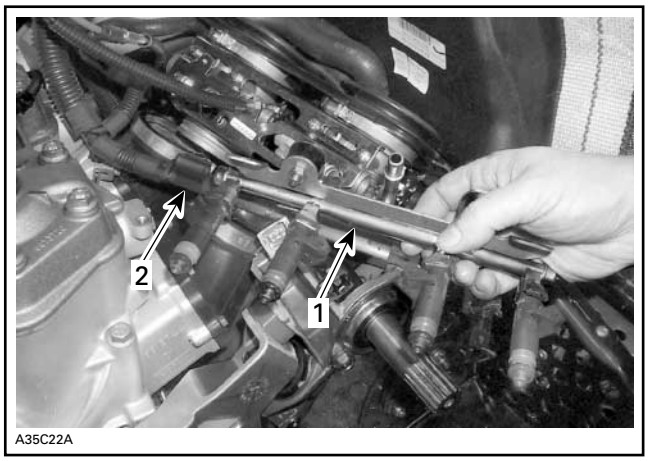


FUEL RAIL REMOVAL
1. *Screws*
2. *Fuel rail*

Unplug injectors and remove fuel rail from plastic retaining plate.

Put fuel rail aside.

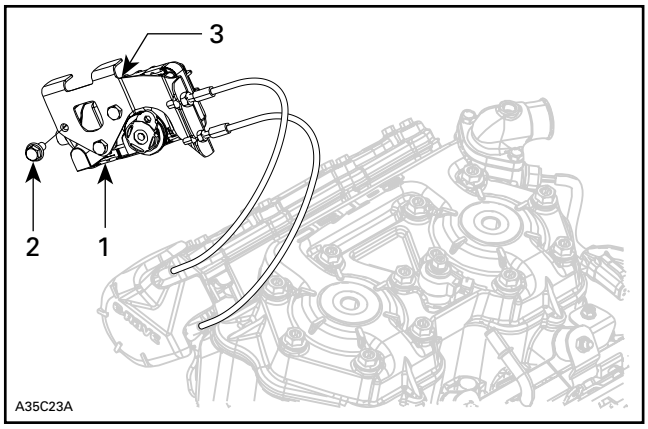
CAUTION: Take care not to damage fuel injectors.



FUEL RAIL DISASSEMBLY
1. *Fuel rail*
2. *Plastic retainer plate*

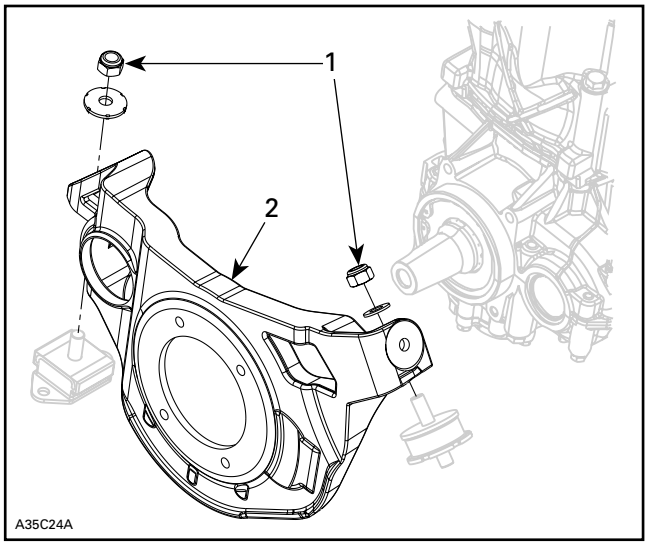
Unscrew E-RAVE actuator from frame.

Unplug connector and put E-RAVE actuator on top of engine.



E-RAVE ACTUATOR REMOVAL
1. *E-RAVE actuator*
2. *Unscrew*
3. *Connector*

Remove LH engine support nuts.

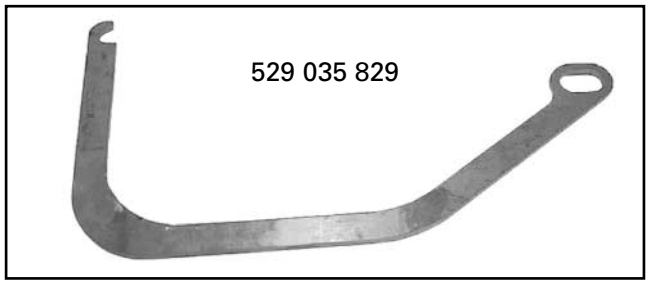


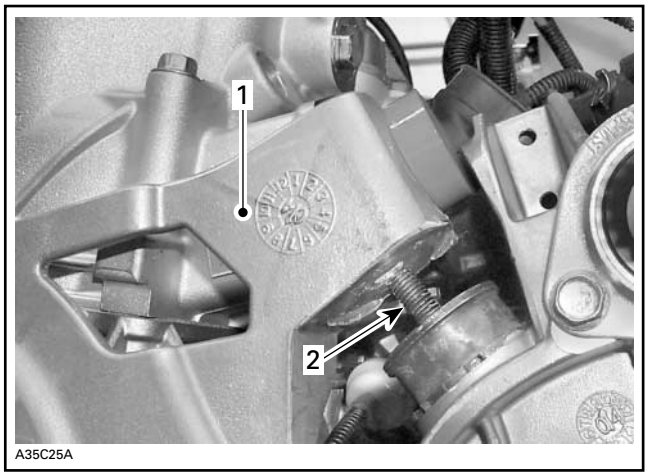
ENGINE SUPPORT NUTS REMOVAL
1. Nuts
2. Engine support

Remove both spark plugs.

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

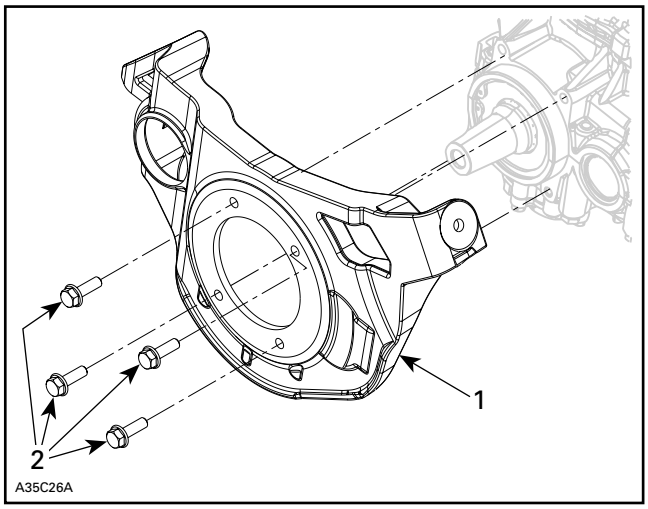
Using the engine removal hook (P/N 529 035 829), lift engine until engine supports are free from rubber mount studs.





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

Remove PTO engine support.



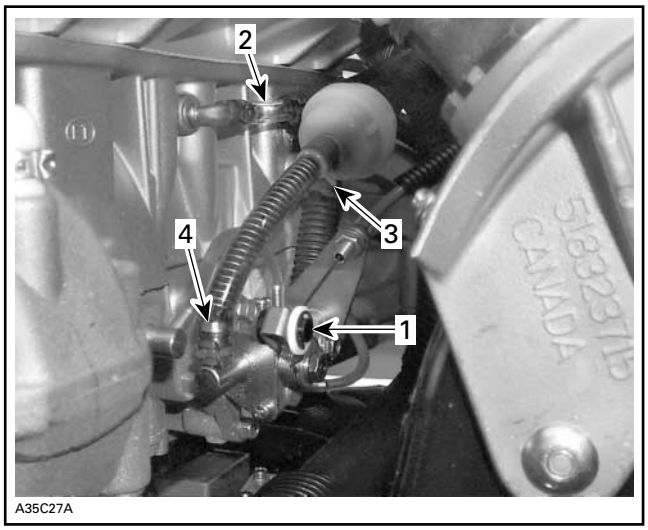
PTO ENGINE SUPPORT REMOVAL
1. Remove
2. PTO engine support

Detach oil pump cable from oil pump.

Unplug oil outlet hose.

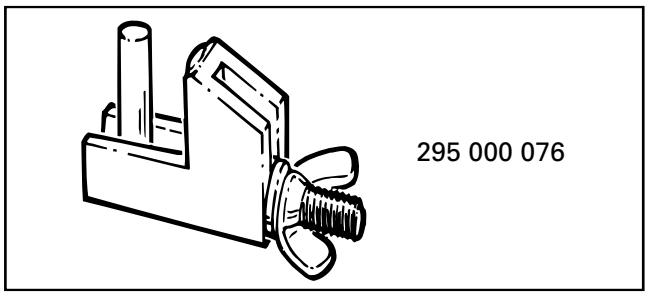
Unplug diaphragm fuel pump pulse hose.

Unplug oil inlet hose.

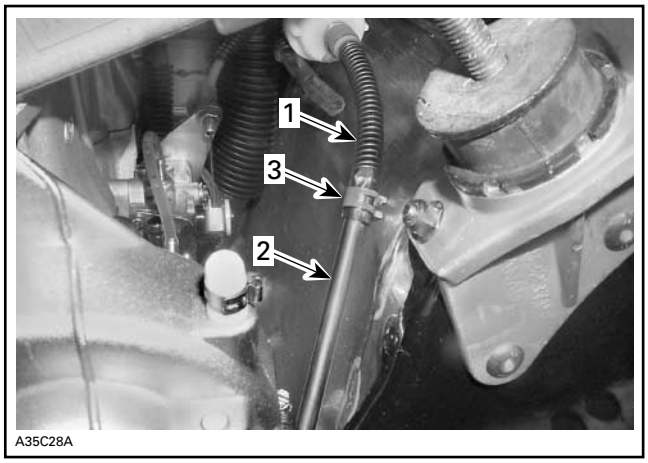


DETACH AND UNPLUG
1. *Detach oil pump cable*
2. *Unplug oil return hose*
3. *Unplug engine vacuum hose*
4. *Unplug oil inlet hose*

NOTE: For oil outlet hose, install a 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*

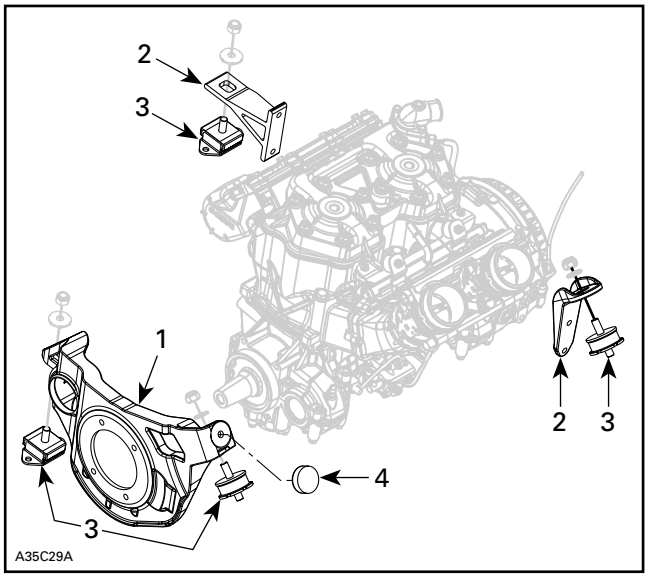
Remove engine from vehicle.

REMOVE ENGINE

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.



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

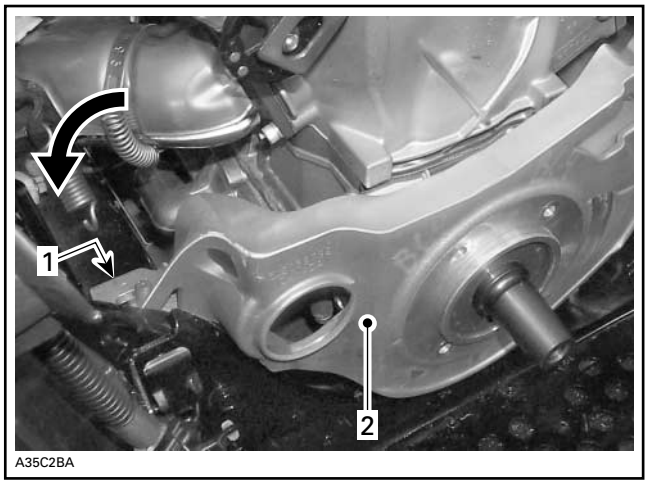
INSTALLATION

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

PTO Engine Support

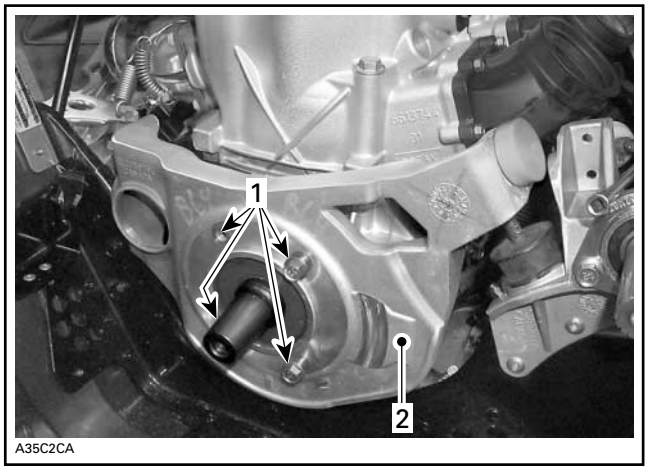
Lower engine as close as possible to its original position.

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



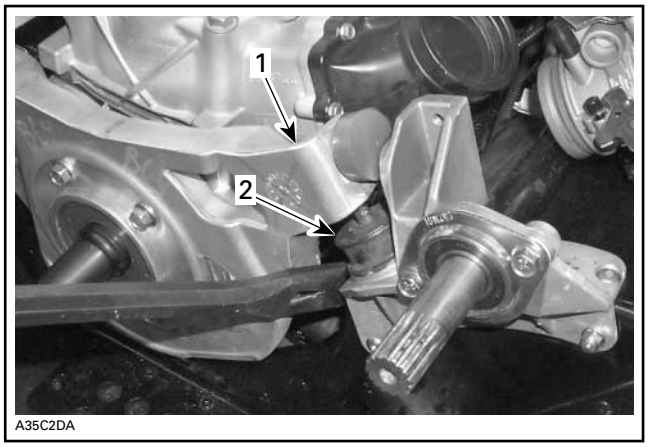
INSERT FRONT TAB FIRST
1. *Front tab*
2. *PTO engine support*

Secure PTO engine support.



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

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

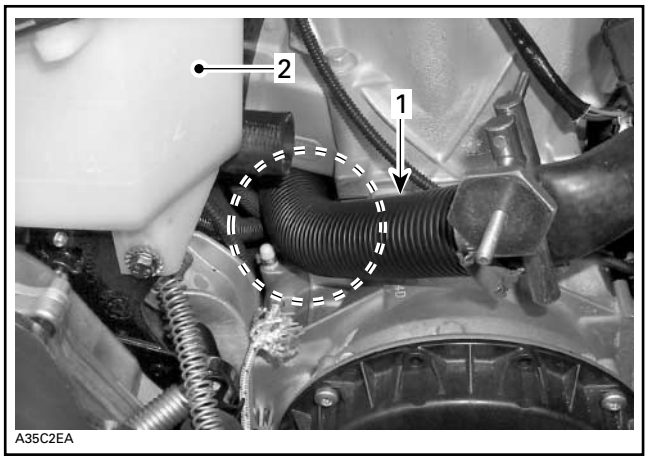


INSERT REAR TAB
1. *Rear tab*
2. *Rubber mount*

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

Heat Exchanger Outlet Hose

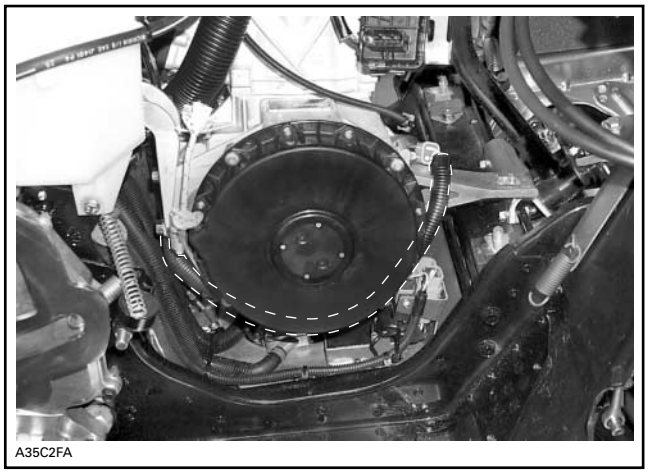
Make sure that heat exchanger outlet hose is routed as per photo.



RH SIDE — HEAT EXCHANGER 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 SYSTEM sub-section.

Fuel Injectors

Lubricate fuel injectors O-ring with Molykote 111 (P/N 413 707 000) before fuel rail installation.

Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Rear rubber mount	29 N•m (21 lbf•ft)
Front rubber mount bolts	19.5 N•m (173 lbf•**in**)
Engine support nuts	37 N•m (27 lbf•ft)
E-RAVE actuator bolts	5 N•m (44 lbf•**in**)
Throttle body hose clamps	2 N•m (18 lbf•**in**)
Fuel rail	9 N•m (80 lbf•**in**)
Spark plugs	27.5 N•m (20 lbf•ft)
Oil pump cable adjustment nut	4.5 N•m (40 lbf•**in**)

Make sure to apply the following product on the appropriate parts:

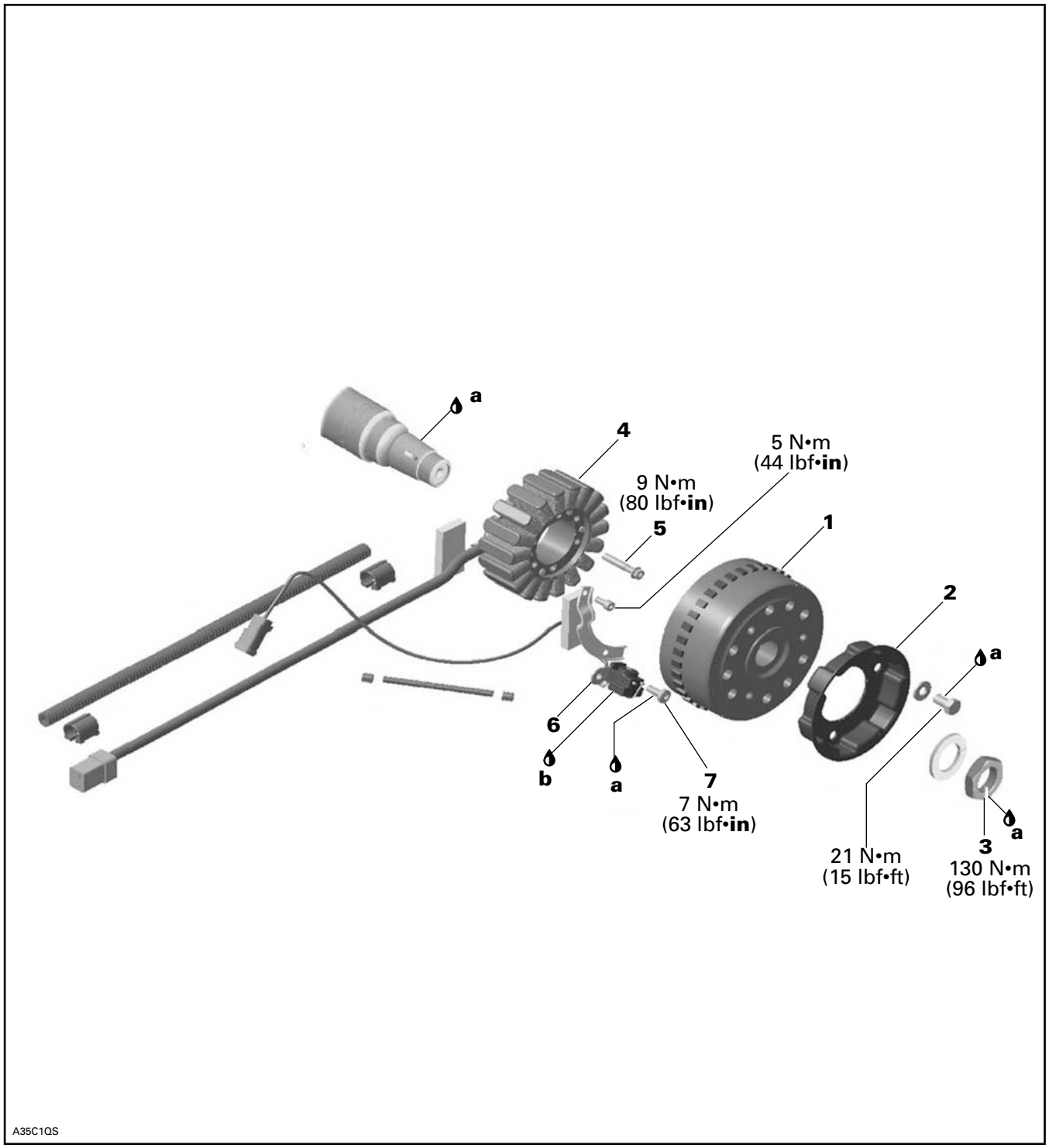
DESCRIPTION	PRODUCT
Fuel injectors O-ring	Molykote 111 (P/N 413 707 000)
Spark plug caps	Dielectric grease (P/N 293 550 004)

Reinstall all removed parts by using the appropriate component/system reinstallation procedures described in this shop.

MAGNETO SYSTEM

SERVICE TOOLS

SERVICE PRODUCTS



a) Loctite 243 (blue) (P/N 293 800 060)
b) Loctite 5910 (P/N 293 800 081)

GENERAL

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

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.

MAGNETO FLYWHEEL

Cleaning

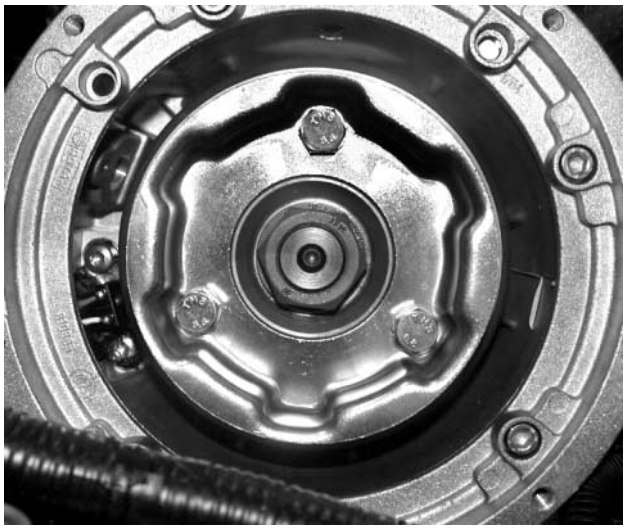
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Removal

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

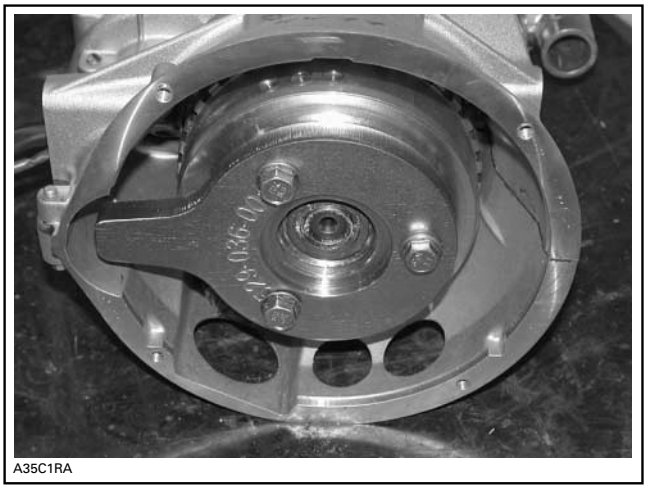
– tuned pipe and muffler
– rewind starter
– starting pulley no. 2.


A32C8KA

TYPICAL

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

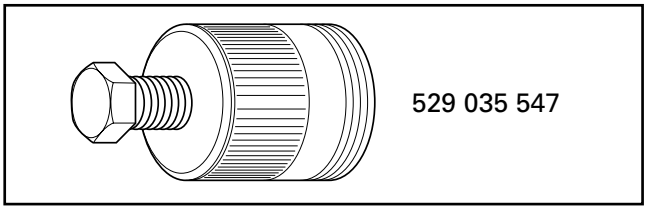
CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto flywheel.

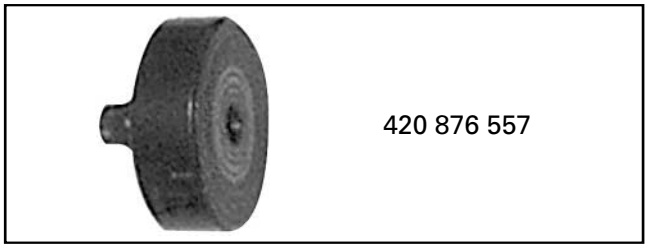

A35C1RA

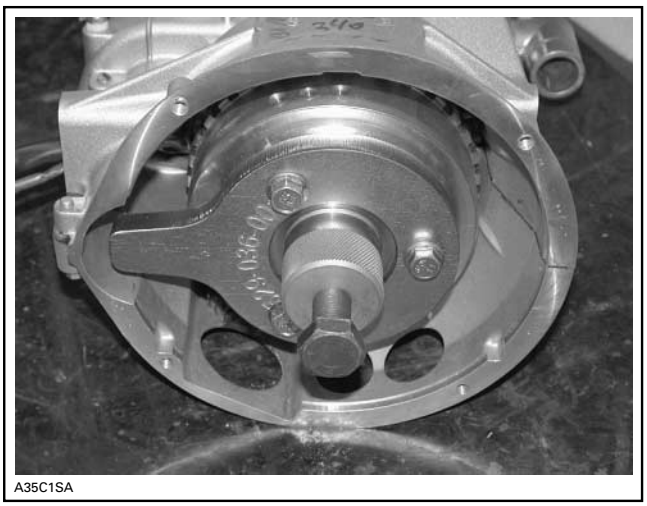
– Remove magneto flywheel nut.

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.


529 035 547


420 876 557


A35C1SA

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. Install magneto flywheel **no. 1** on crankshaft. Torque nut **no. 3**.

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.

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.


A35C1TA

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

Install the grommet on crankcase.

Reinstall all other removed parts.

CPS

Inspection

Always check CPS before changing it. Refer to ENGINE MANAGEMENT.

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

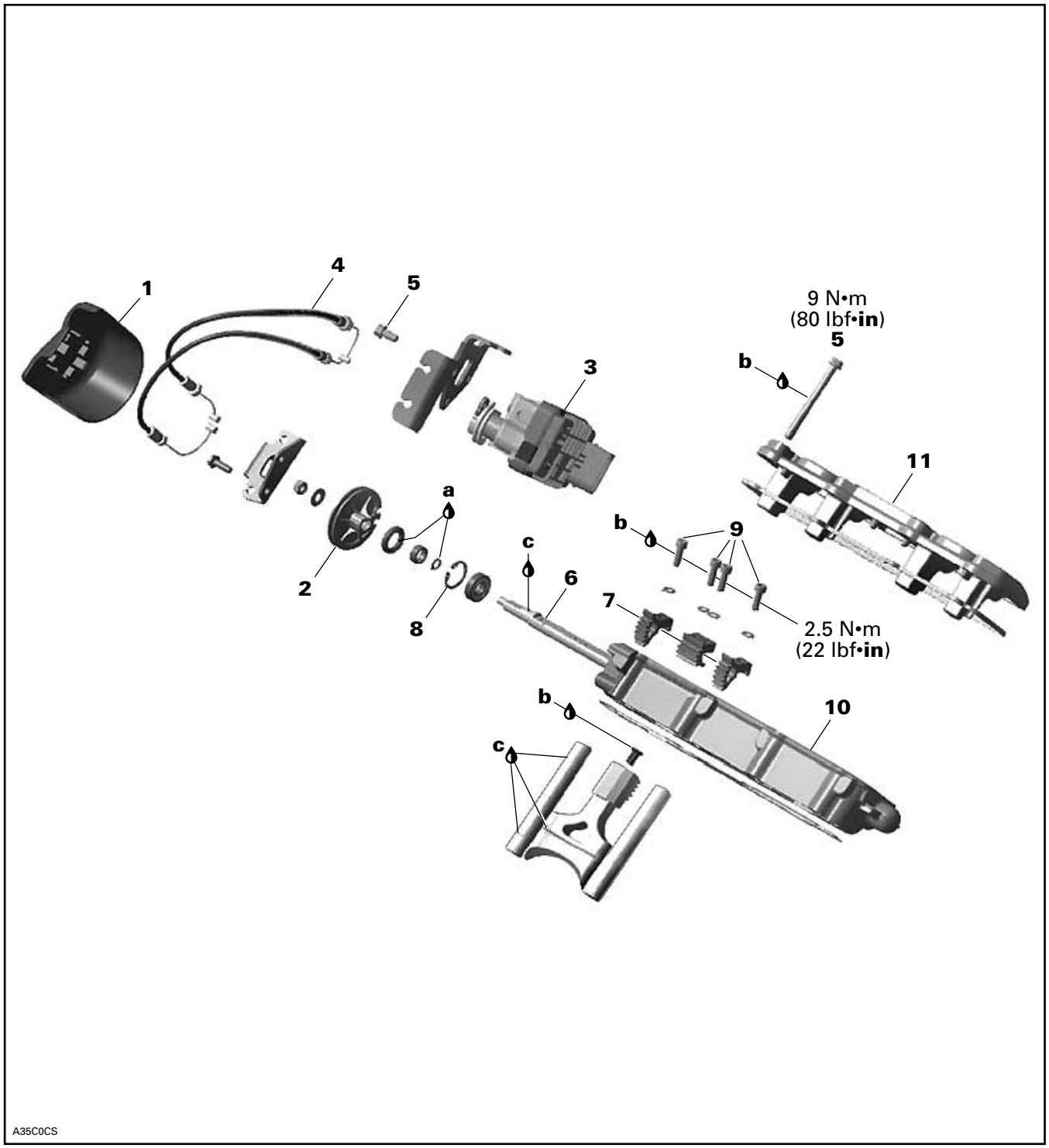
For installation, reverse the removal procedure.

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	42
Molykote 111	413 707 000	42
XPS-synthetic blend Injection oil	293 600 071	42



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

GENERAL

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 SYSTEM DYNAMIC TEST

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

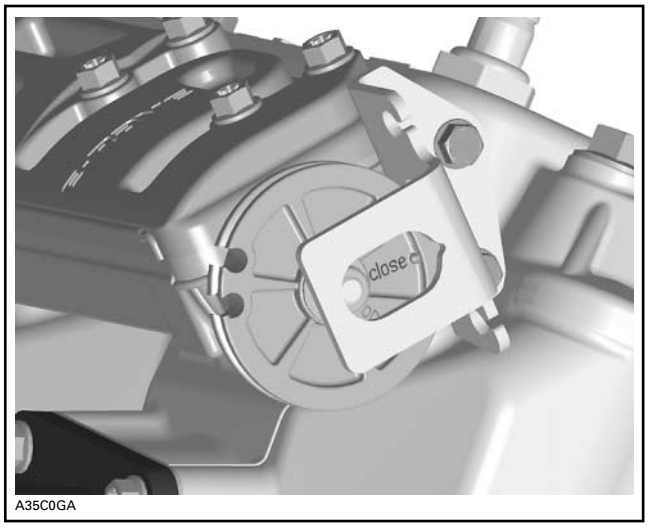
⚠ WARNING

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.**

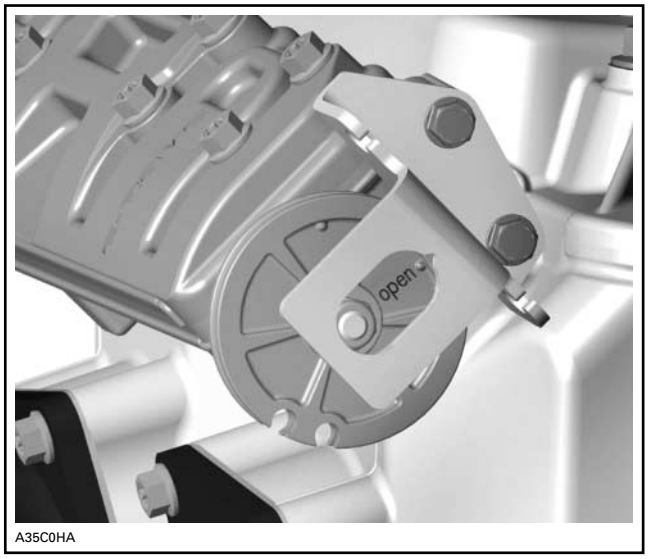
Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

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



A35C0GA

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.



A35C0HA

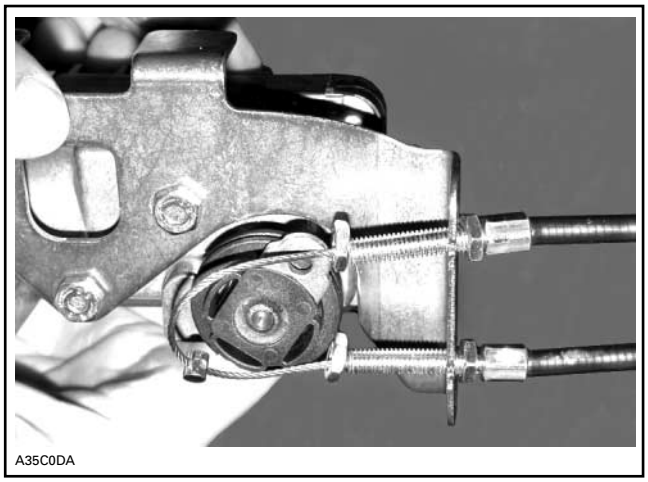
If test fails, check cables and pulleys condition and adjustment. If correct, disconnect cable from E-RAVE actuator **no. 3** and check for smooth mechanical movement of the E-RAVE system by turning the pulley. If it works, check the E-RAVE actuator. Refer to ENGINE MANAGEMENT.

E-RAVE CABLES

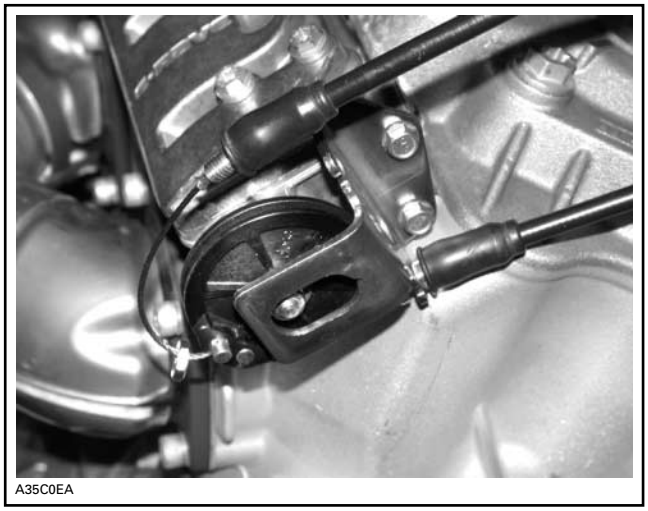
Removal

Completely unscrew adjuster nuts from E-RAVE actuator bracket.

Detach cables from E-RAVE actuator pulley.


A35C0DA

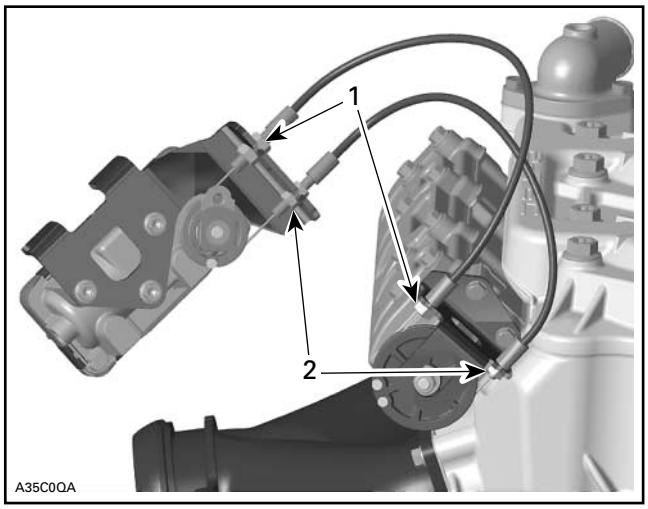
Detach cables from E-RAVE shaft pulley **no. 2**.


A35C0EA

Installation

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

Connect E-RAVE cables as per following photo:



A35C0QA

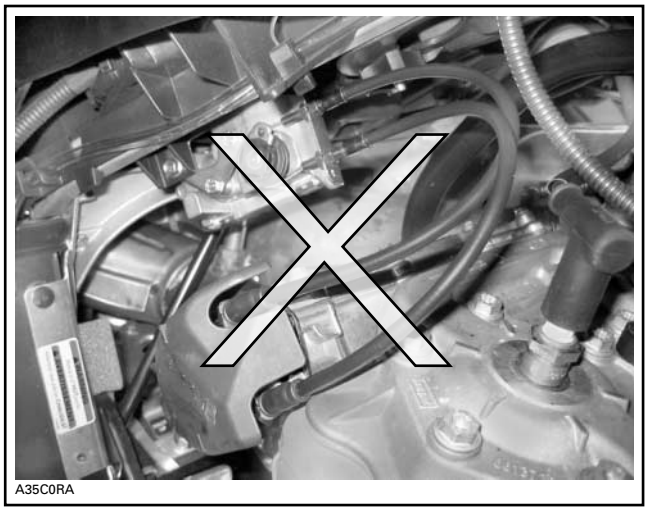
CABLE POSITIONS
1. Cable ends in top holes
2. Cable ends in bottom holes

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

Ensure cables are parallel to each other.

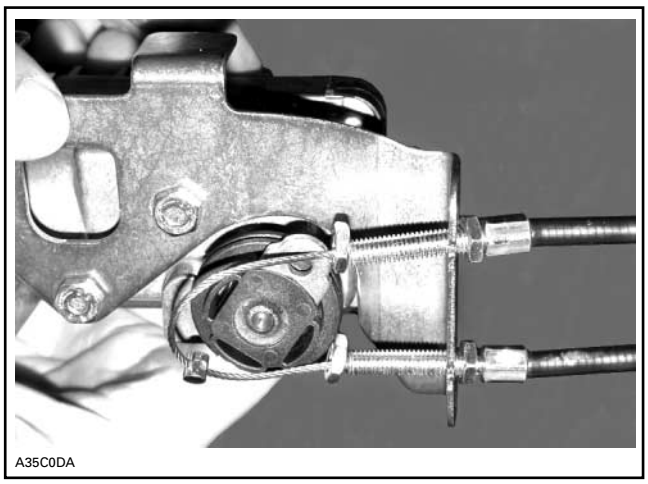

A35C0SB

RIGHT


A35C0RA

WRONG

Insert cables in E-RAVE actuator pulley.


A35C0DA

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

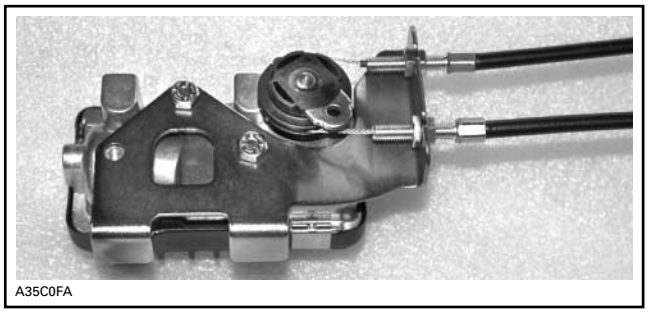
Adjustment

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

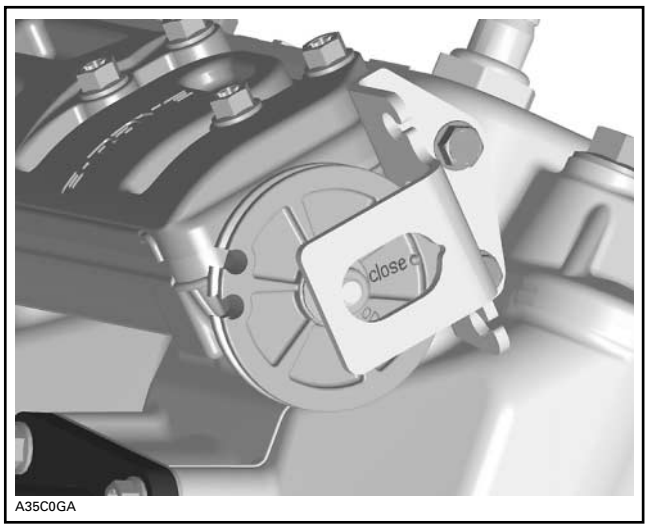
Remove DESS key and wait until lights of speedometer turn off. ECM must be off.

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

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


A35C0FA

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



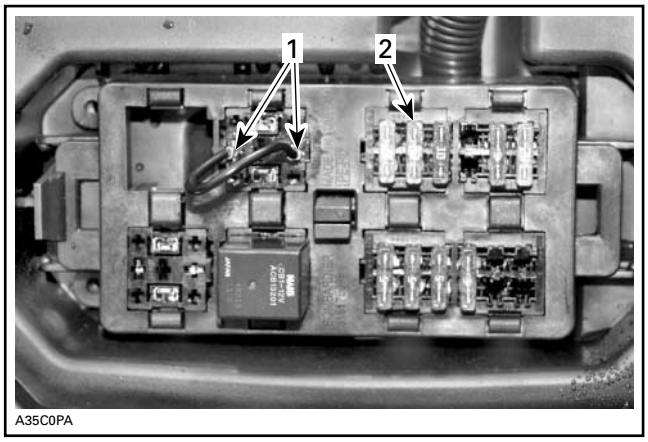
A35C0GA

Remove the headlight relay (R2).

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

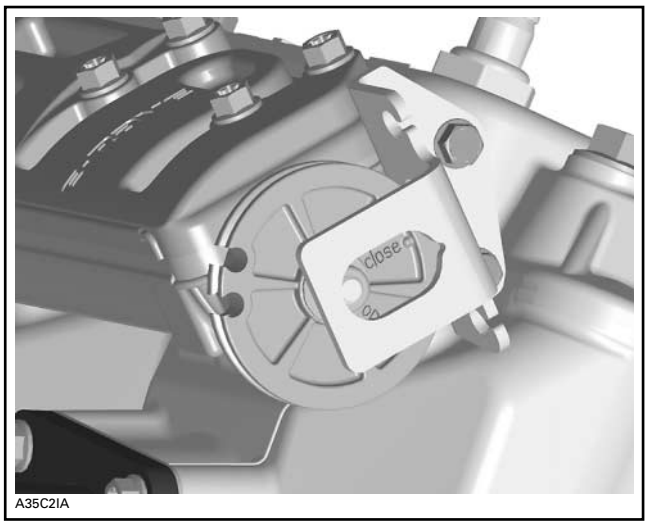
Bypass relay with a jumper. This will turn the E-RAVE shaft pulley to the adjustment position.

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



A35C0PA

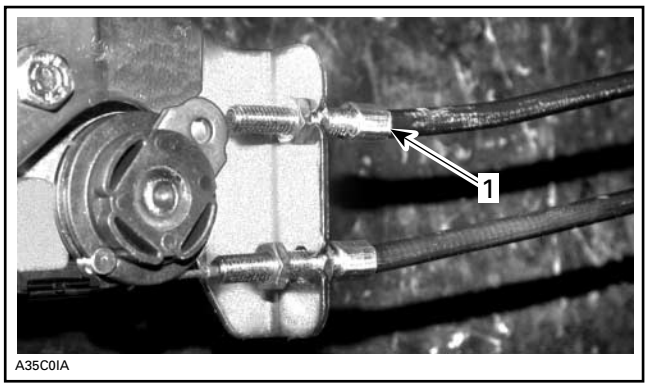
1. Jumper
2. Headlight fuse



A35C2IA

ADJUSTMENT POSITION

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

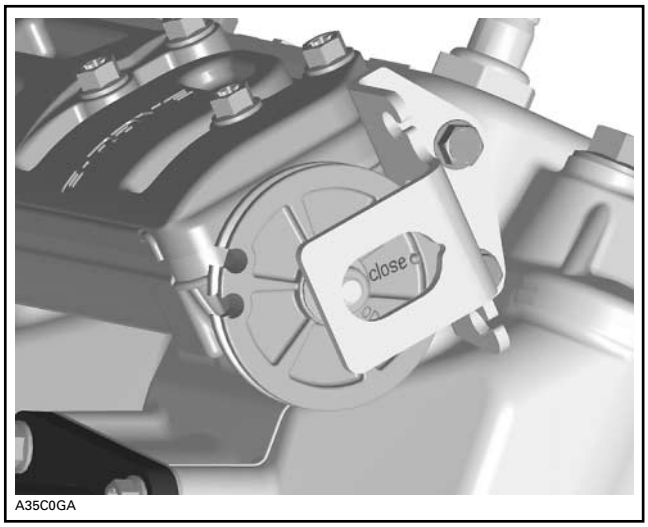


A35C0IA

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.

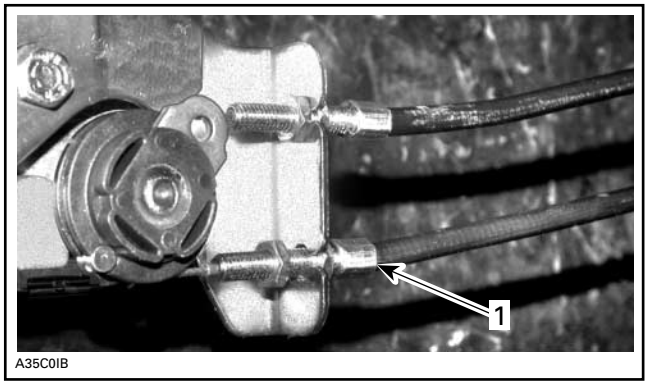


A35C0GA

Readjust top (closing) cable as necessary.

Remove relay jumper.

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



A35C0IB

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. Check with VCK and B.U.D.S. for fault codes.

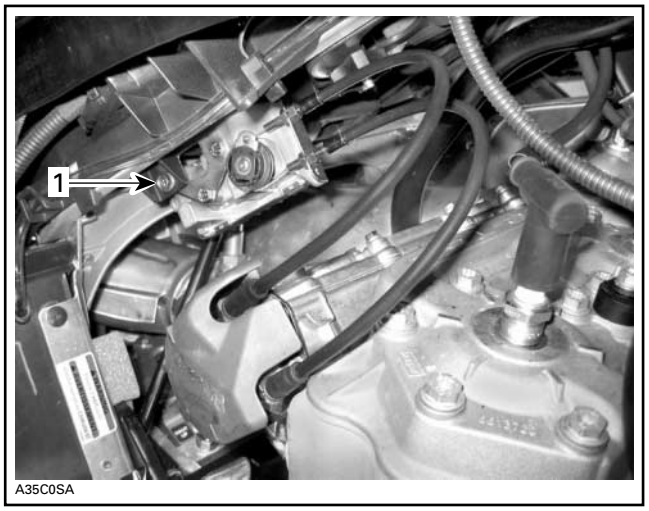
E-RAVE ACTUATOR

Inspection

Refer to E-RAVE DYNAMIC TEST above.

Removal

Remove retaining screw **no. 5**.



1. Remove screw

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

Disconnect electrical connector.

Detach cable **no. 4**.

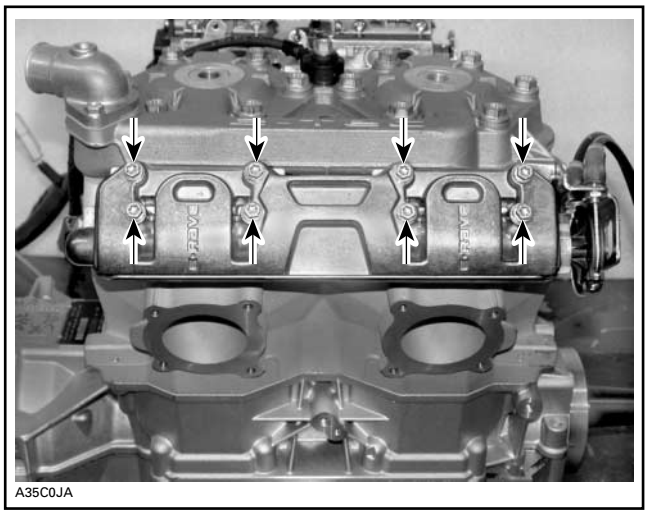
Installation

Reverse removal steps.

E-RAVE COVER

Removal

Remove retaining screws **no. 5**.



Remove cover **no. 11**.

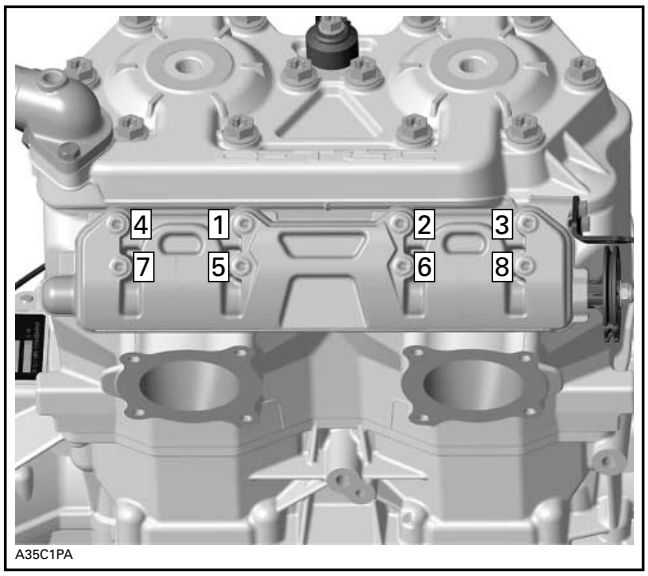
Inspection

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**.

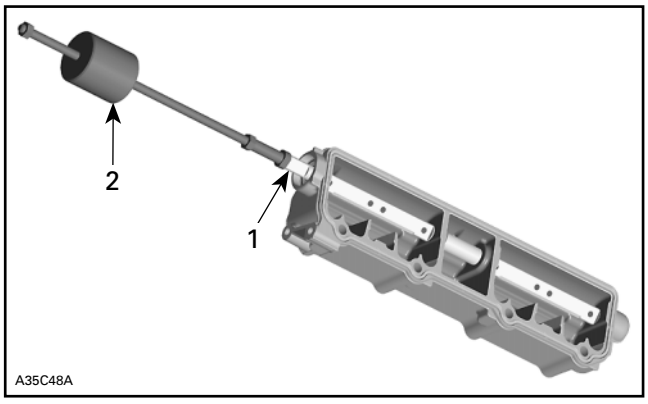
Pulley **no. 2**.

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

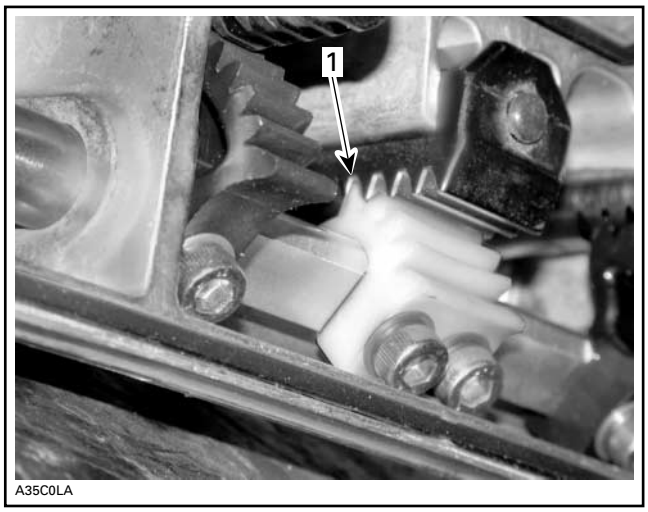
Push bearing out of shaft.

Installation

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

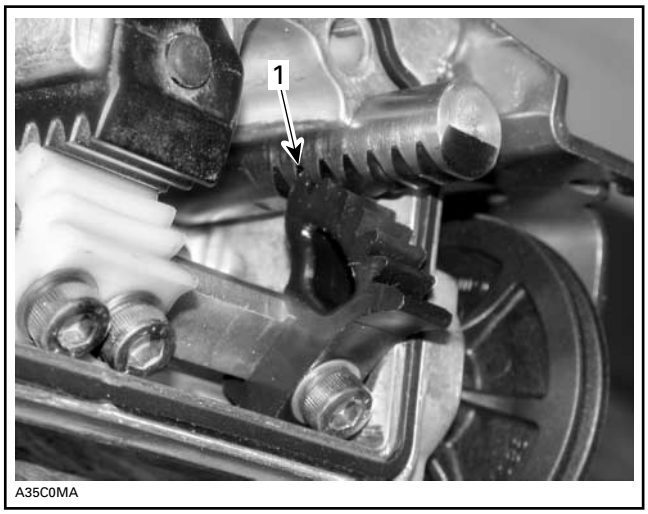
When installing new bearing on shaft, use an appropriate pusher that seats against the inner race of bearing. Drive shaft in housing until it bottoms.

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



A35C0LA

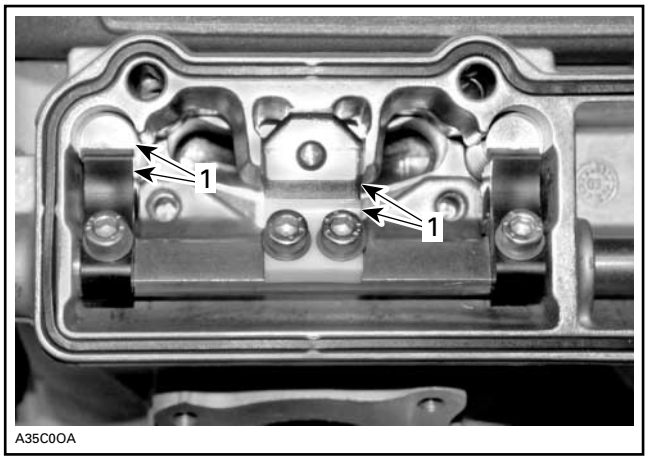
CENTER VALVE
1. Mesh in 1st tooth of center valve gear



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.



1. Gears aligned

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

E-RAVE HOUSING

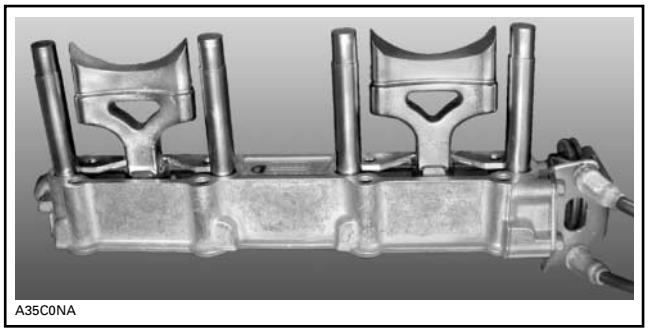
Removal

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.



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.

Installation

Reverse removal steps.

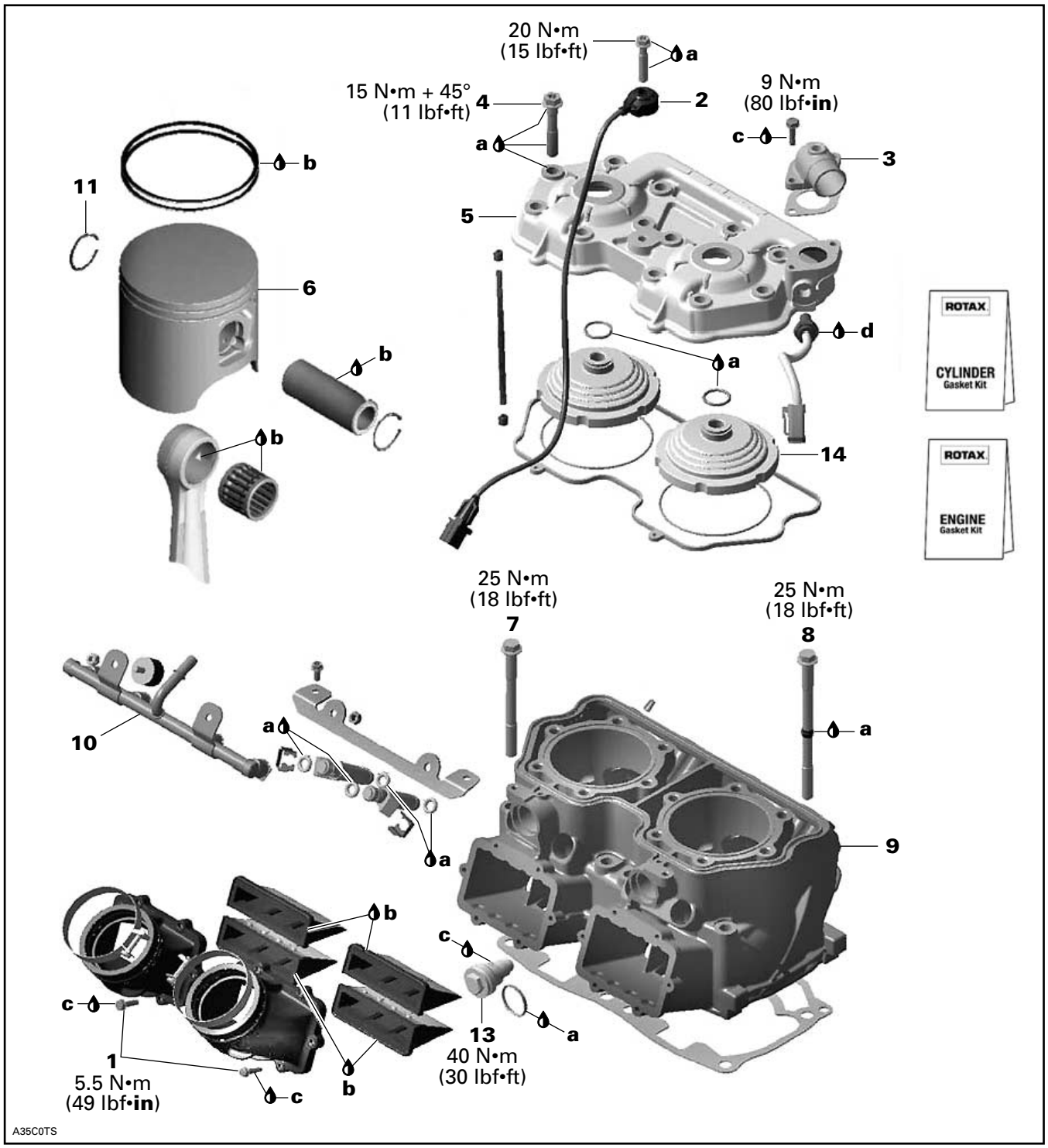
TOP END

SERVICE TOOLS

Description	Part Number	Page
Piston circlip installer	529 035 998	57
piston pin puller/installer	529 036 002	54

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	52
Loctite 5910	293 800 081	52
Loctite Chisel	413 708 500	54
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. 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)

TROUBLESHOOTING

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

GENERAL

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.

It is not mandatory to remove engine from chassis for top end repair. To proceed with engine removal, refer to REMOVAL AND INSTALLATION.

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.

DISASSEMBLY

RAVE System

Remove RAVE system. Refer to RAVE SYSTEM.

Fuel Rail

Remove fuel rail **no. 10**. Refer to ENGINE MANAGEMENT.

REED Valve

Unscrew reed valve screws **no. 1** then remove reed valves.

A35C0UA

Cylinder Head

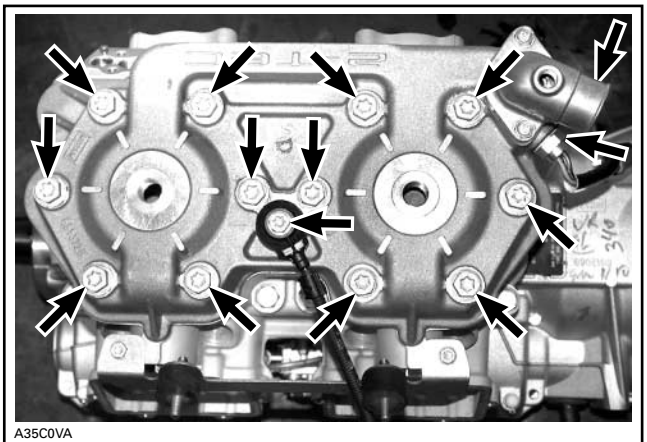
Remove the knock sensor **no. 2**.

Disconnect the temperature sensor connector.

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

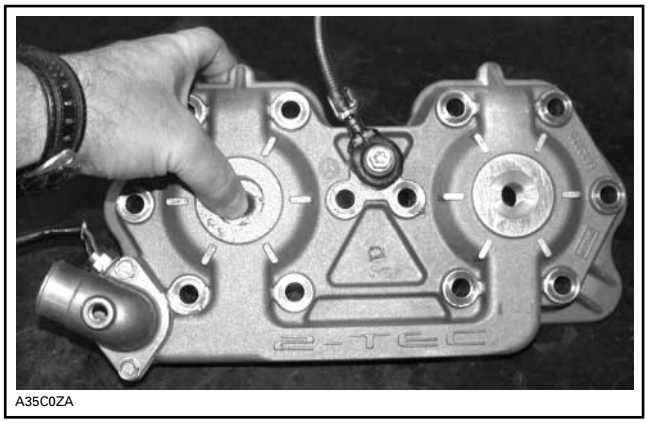
Unscrew cylinder block head screws **no. 4**.

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

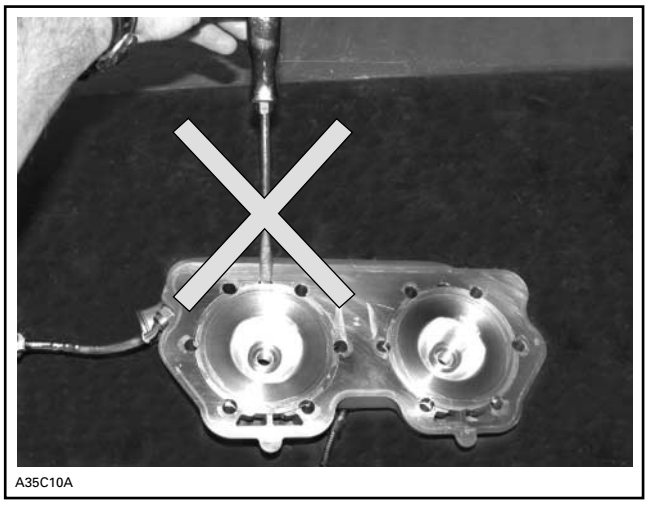


A35C0VA

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

Cylinder Block

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.

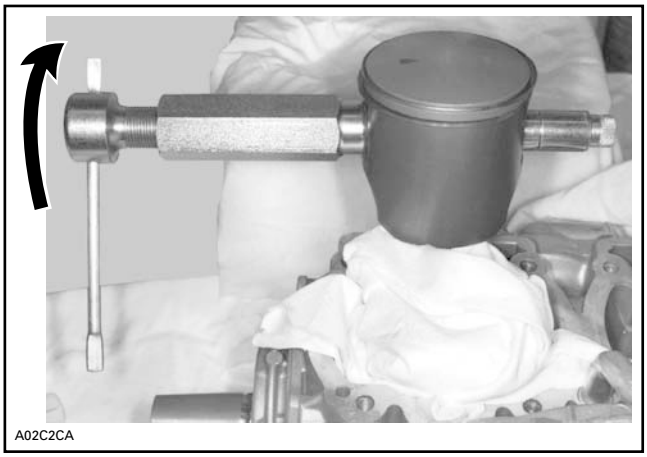
Piston

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


A02C29A

TYPICAL

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


A02C2CA

TYPICAL — PISTON PIN EXTRACTION

Decompressor

Mach Z

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

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

NOTE: For dimension measurement procedures, refer to ENGINE MEASUREMENT.

Reed Valve

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

A35C12A

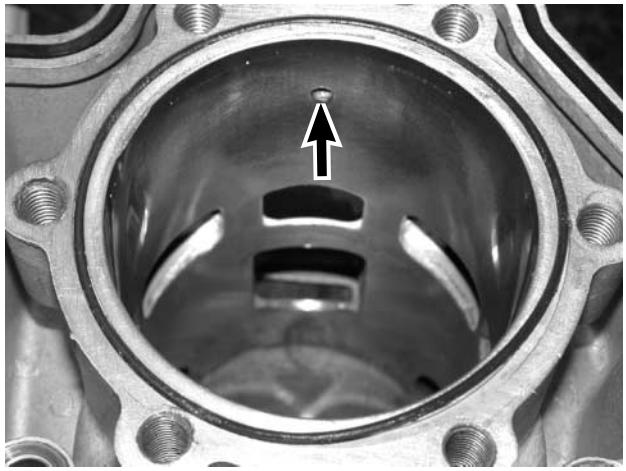
If a play is felt, replace reed valve.

Check the rubber flange for cracks and/or damage.

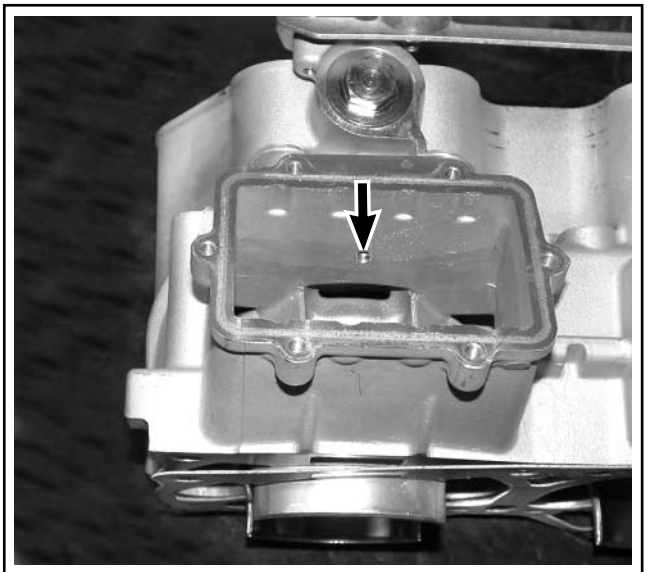
Decompressor

Mach Z

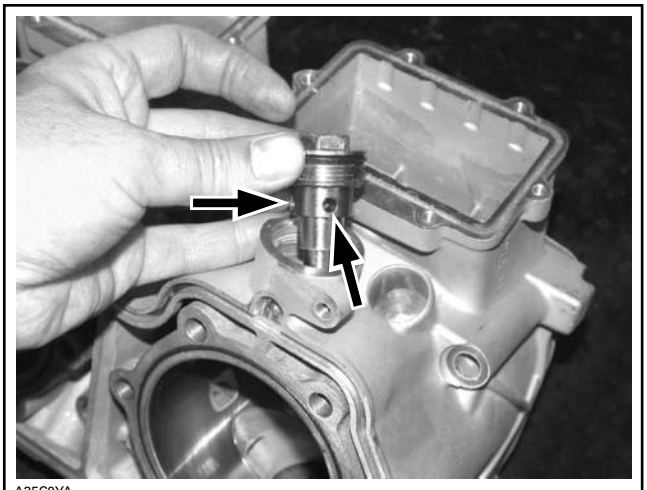
Inspect holes for carbon deposits and if clogged, remove decompressor plug to allow proper cleaning.



A35C0WA



A35C0XA



A35C0YA

Cylinder Head, Cylinder Block and Piston

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder head volume	44.84 cc	48.97 cc	N.A.
Cylinder taper	N.A.	0.04 mm (.0016 in)	0.10 mm (.004 in)
Cylinder out of round	0.008mm (.0003 in)	0.015 mm (.0006 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance	0.115 mm (.0045 in)	0.151 mm (.0059) 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)

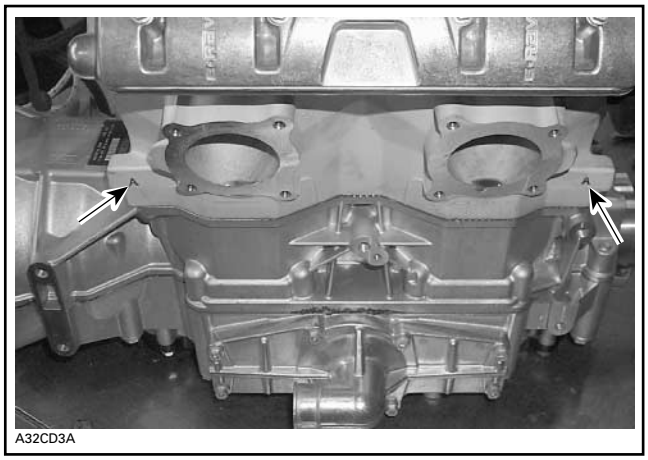
Piston and Cylinder Block Replacement

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.

ASSEMBLY

Piston

Lubricate needle bearings and insert into connecting rod.


A02C2HA

TYPICAL

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

1. Arrow pointing toward exhaust port

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

TYPICAL

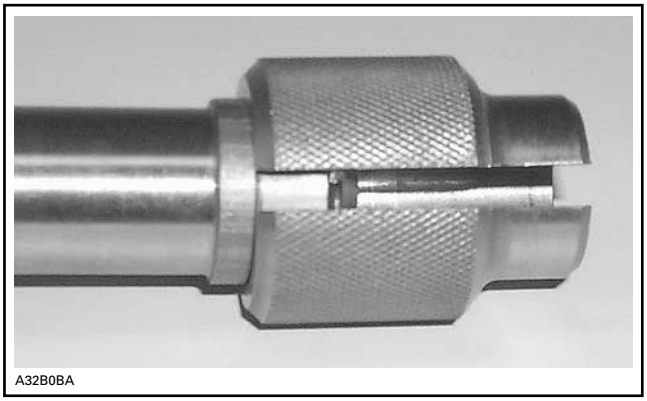
CAUTION: Always install new circlips.

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

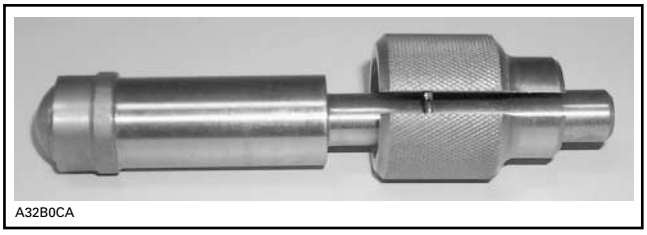
ENGINE	TOOL
995	Piston circlip installer (P/N 529 035 998)

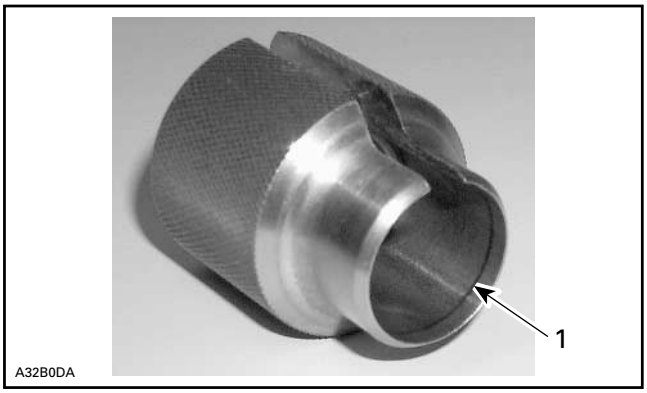
Insert circlip into support so that, when installed in piston groove, the tab faces upward.

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



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

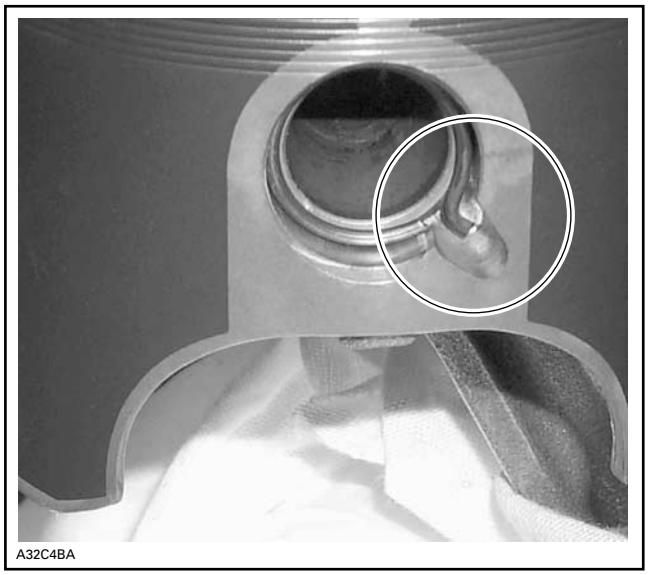




1. Groove

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.



TAB TOWARD TOP

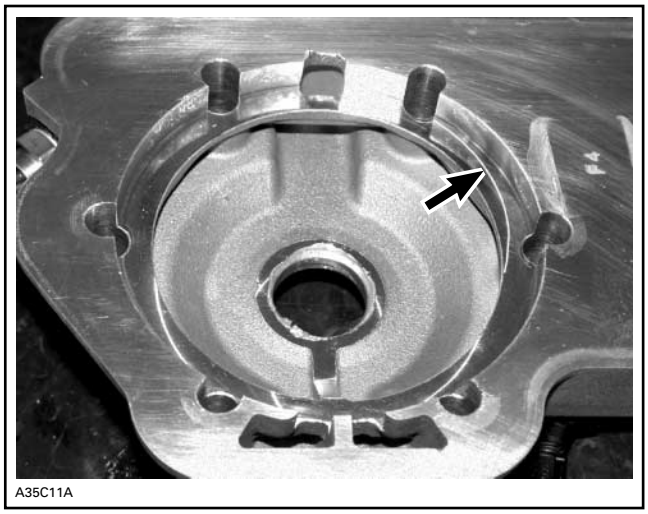
CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one because, on a second attempt, the circlip will lose its normal retaining capabilities.

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

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

Cylinder Head and Cylinder Block

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



Ensure to properly align mounting holes.

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

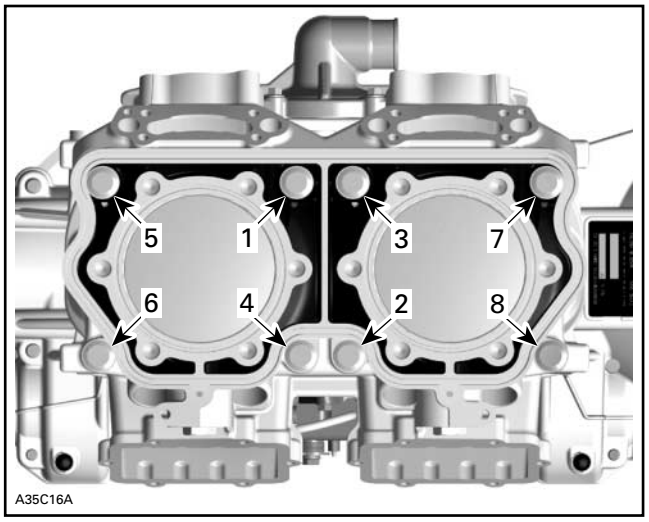
CAUTION: Always install a gasket of the proper thickness. Failure to do so may lead engine to poor performance.

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.

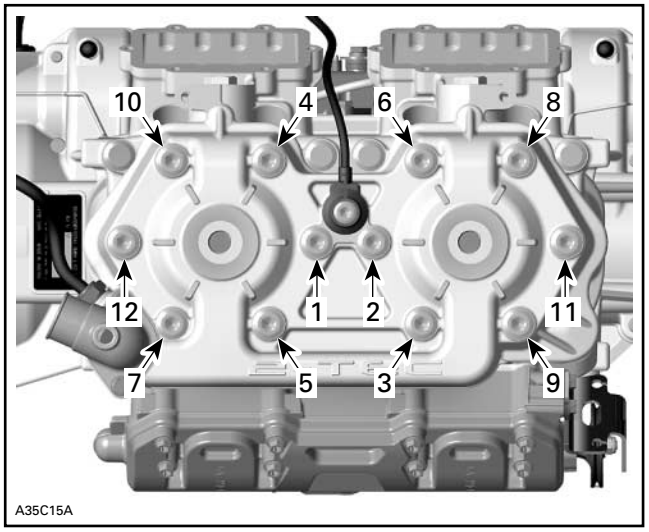
Bring one piston close to TDC then carefully slide piston into cylinder.

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



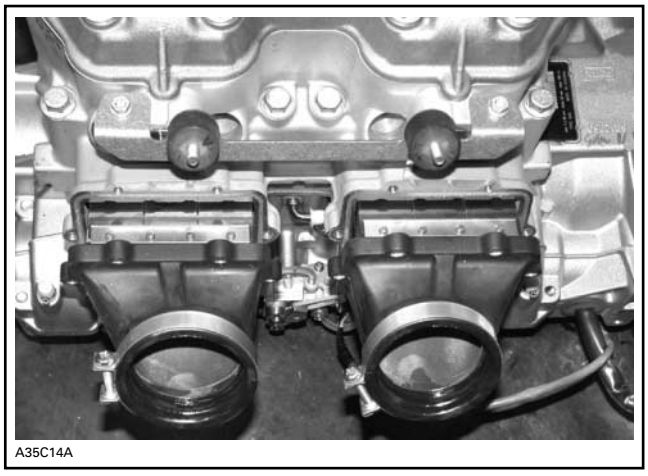
A35C16A

Install cylinder head and torque screws following this sequence.



A35C15A

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.

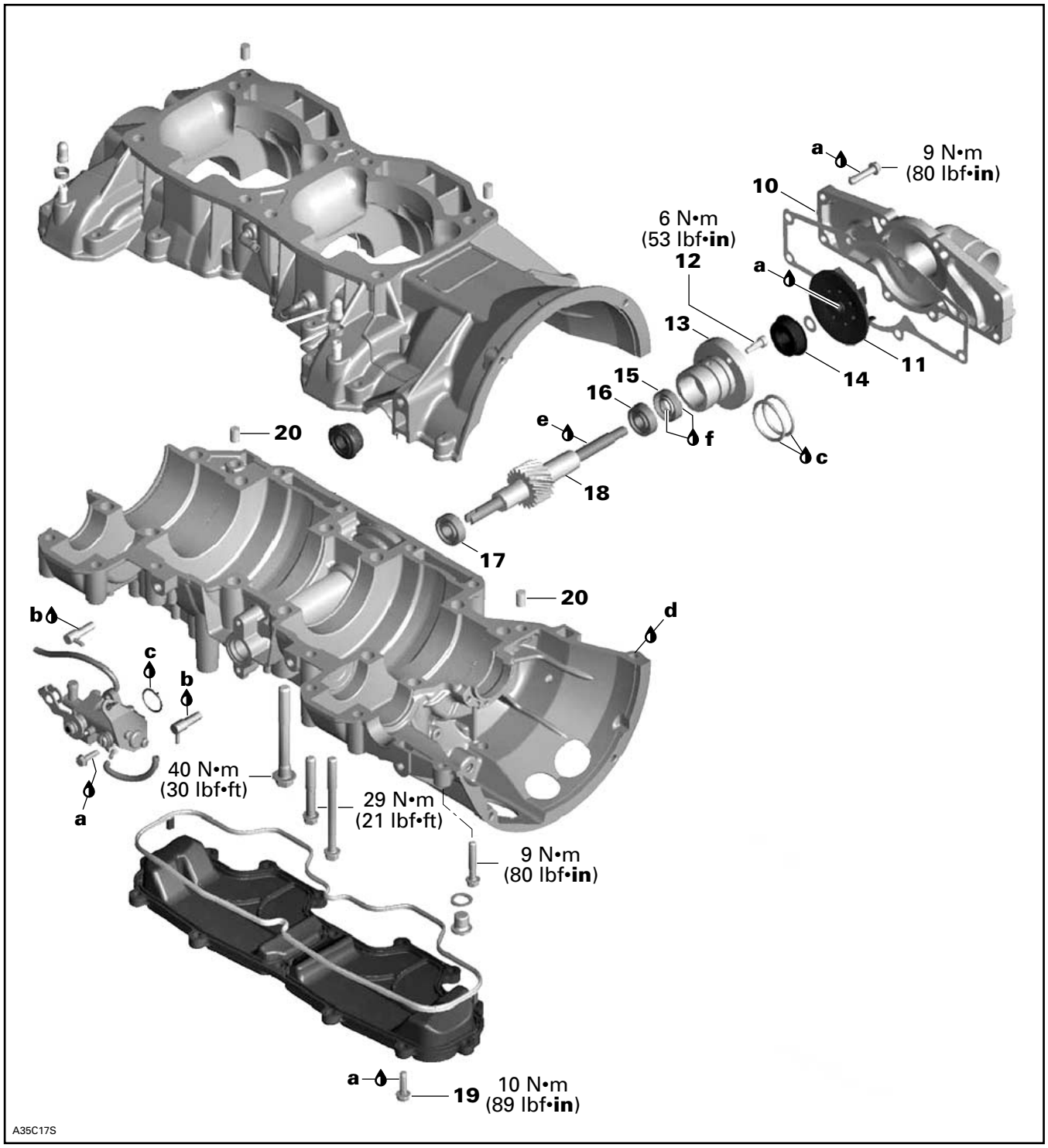
BOTTOM END

SERVICE TOOLS

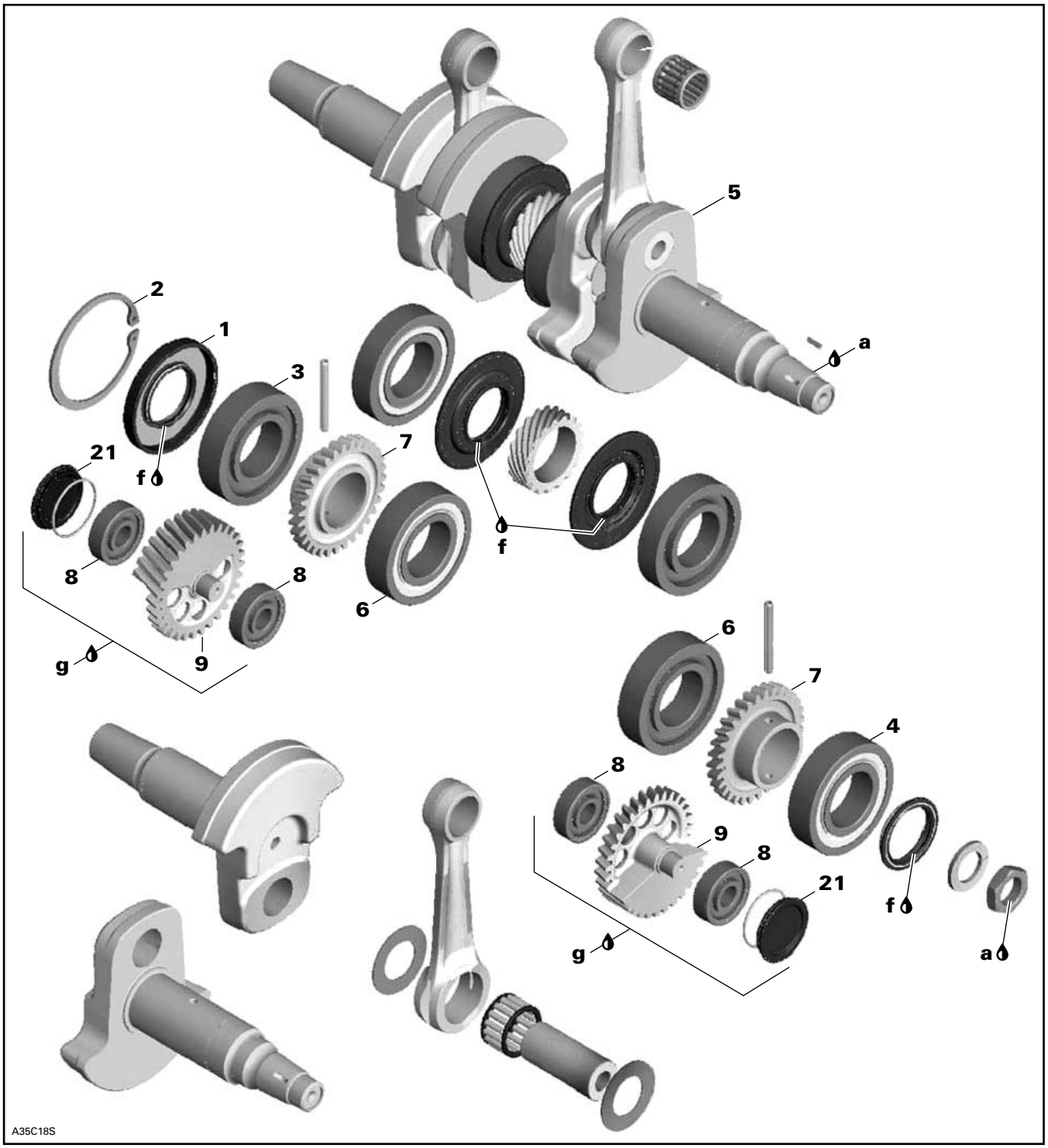
Description	Part Number	Page
bearing heater	529 035 969	70
bearing puller	529 036 004	65
ceramic seal installer	529 036 014	68–69
crankshaft protector	420 876 552	65
crankshaft protector	420 876 557	65
half rings	420 977 479	64
oil seal protector	529 035 822	68
oil seal pusher	529 035 757	67
puller ring	420 977 494	64
screws	420 840 681	65
temperature indicator stick	529 035 970	71

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	70
BOMBARDIER LUBE	293 600 016	65
Loctite chisel	413 708 500	64
pulley flange cleaner	413 711 809	70



a. Loctite 243 (P/N 293 800 060)
b. Loctite 648 (P/N 413 711 400)
c. Molykote 111 grease, 150 g (P/N 413 707 000)
d. Loctite 5910 (P/N 293 800 081)
e. Injection oil
f. Petamo grease GHY133N (P/N 420 899 271)
g. Isoflex grease 500 g (P/N 420 898 351)



a. Loctite 243 (P/N 293 800 060)
b. Loctite 648 (P/N 413 711 400)
c. Molykote 111 grease, 150 g (P/N 413 707 000)
d. Loctite 5910 (P/N 293 800 081)
e. Injection oil
f. Petamo grease GHY133N (P/N 420 899 271)
g. Isoflex grease 500 g (P/N 420 898 351)

TROUBLESHOOTING

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

GENERAL

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.

PREPARATION

Remove engine from chassis. Refer to REMOVAL AND INSTALLATION.

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

Remove rewind starter. Refer to REWIND STARTER.

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

CLEANING

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

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.

DISASSEMBLY

General

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

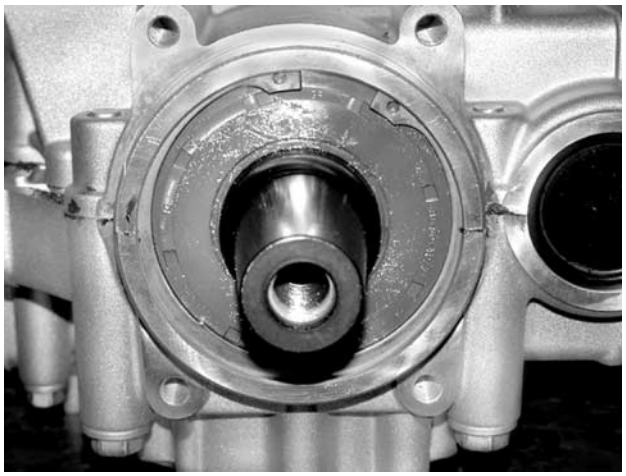
Remove rewind starter. Refer to REWIND STARTER.

Remove magneto flywheel and stator. Refer to MAGNETO SYSTEM.

PTO Seal

PTO seal **no. 1** may be removed without splitting up crankcase.

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



A35C19A

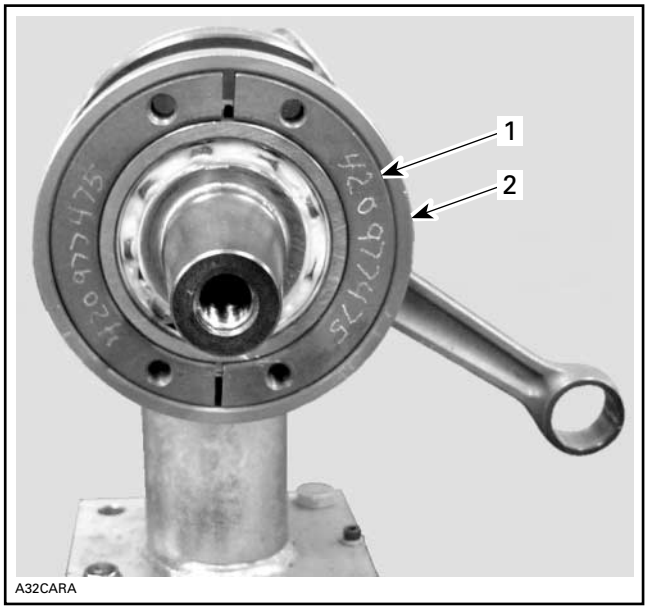
Crankcase

Remove crankcase screws and split up crankcase.

Withdraw crankshaft **no. 5** and counterbalance gears **no. 9**.

Crankshaft Bearing

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.

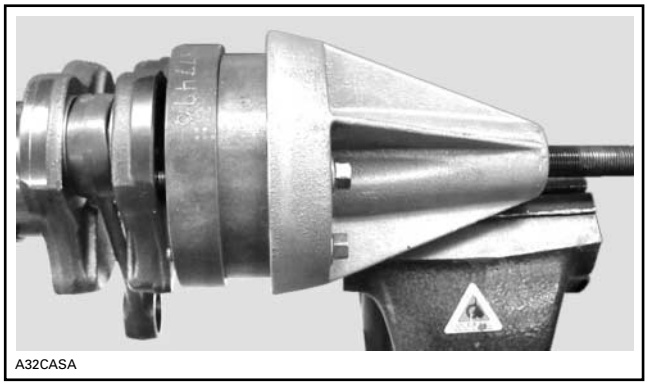


1. Half ring
2. Puller ring

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 BOMBARDIER LUBE (P/N 293 600 016) to avoid damaging the threads.

Screw in the puller bolt until the bearing comes out.

Counterbalance Drive Gear

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.

Coolant/Injection Oil Pump Shaft

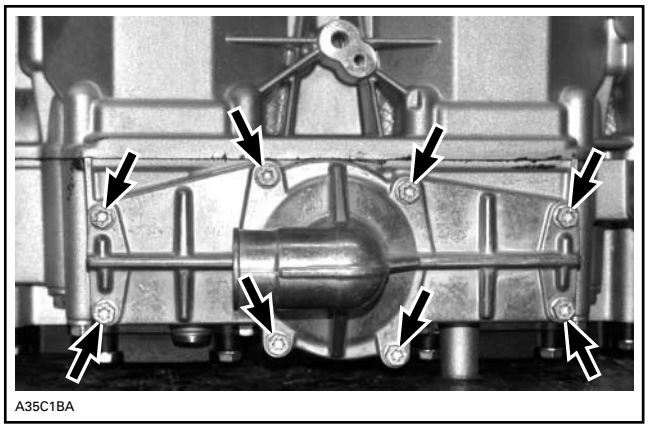
Removal

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

Remove:

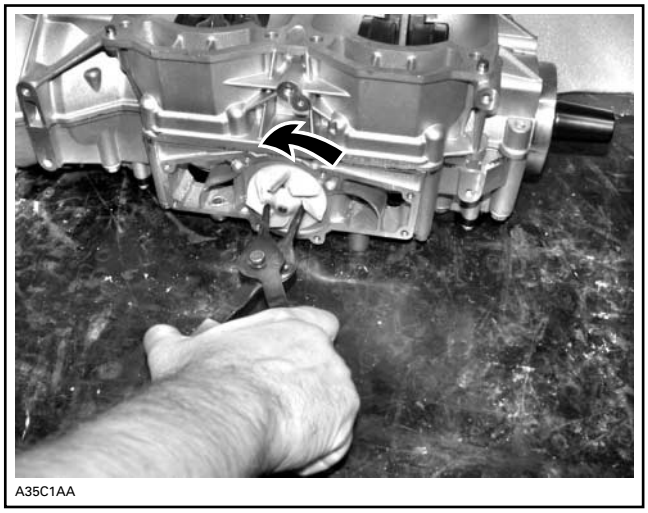
– Injection oil pump.

– Coolant pump housing **no. 10**.

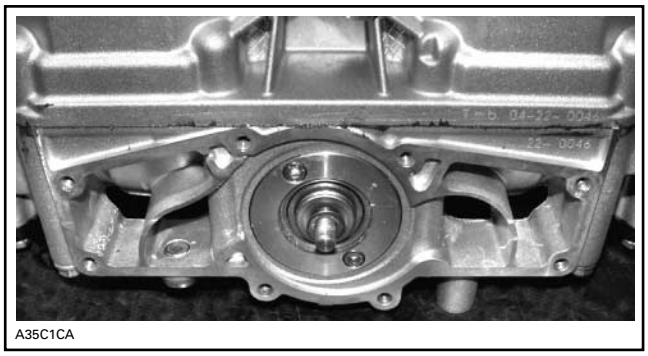


– Impeller **no. 11**.

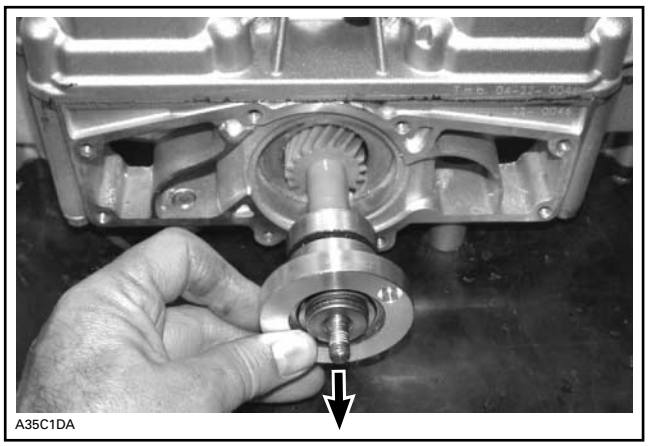
CAUTION: Be careful not to damage impeller fins.



– Bearing housing screws **no. 12**.


A35C1CA

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

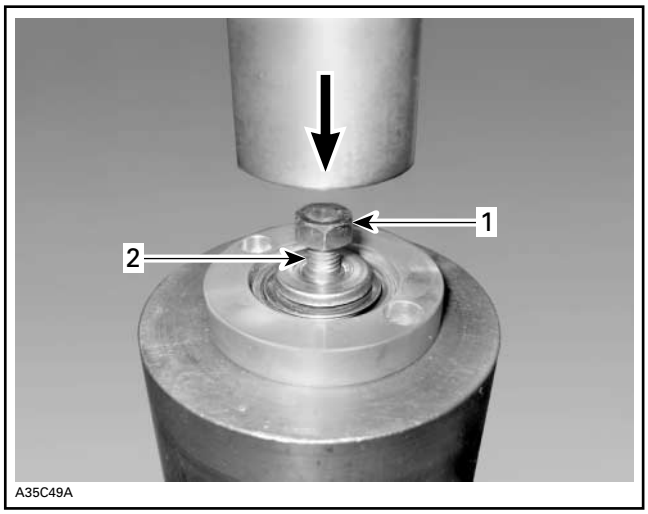

A35C1DA

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.

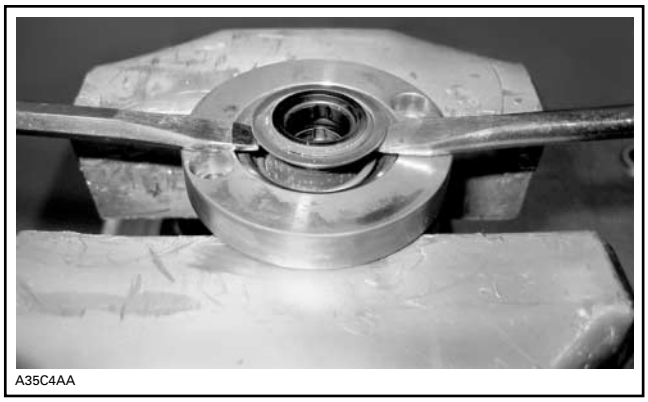


A35C49A

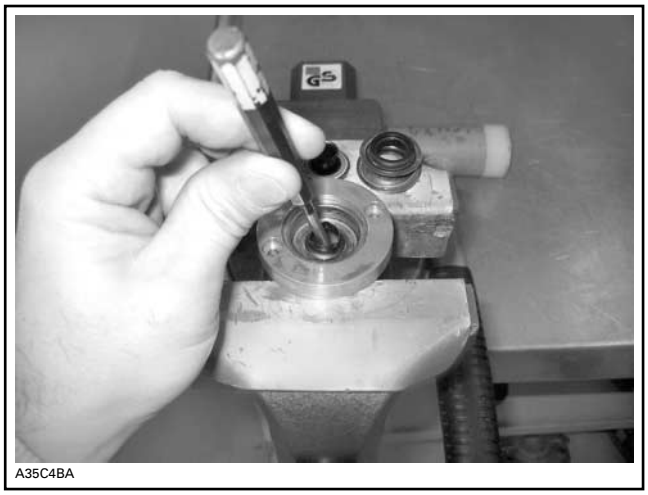
1. M8 nut
2. Shaft

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

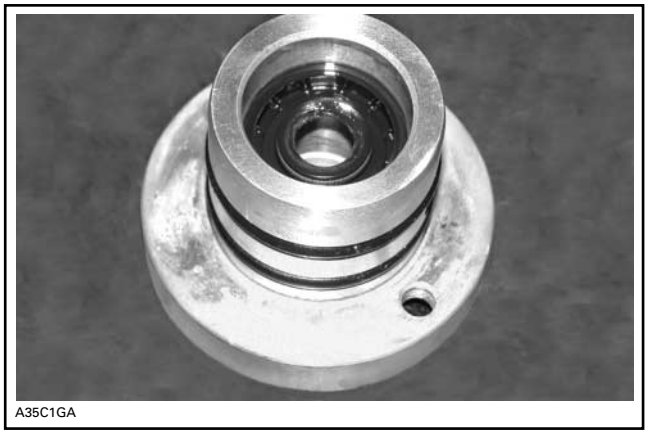
Pry inner part of ceramic seal **no. 14** out.


A35C4AA

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

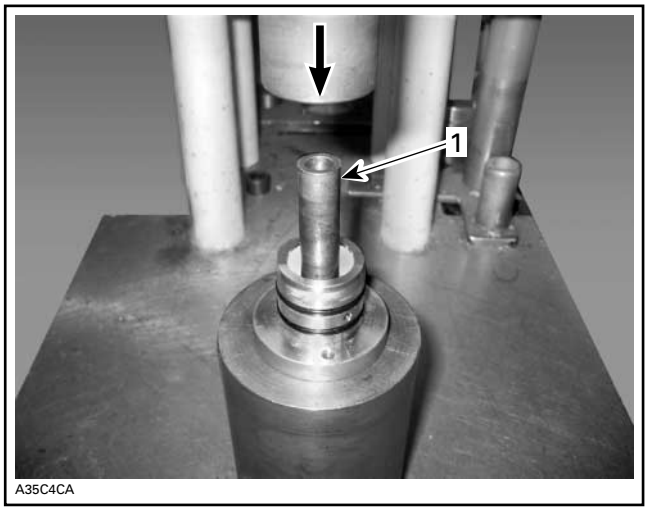

A35C4BA

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


A35C1GA

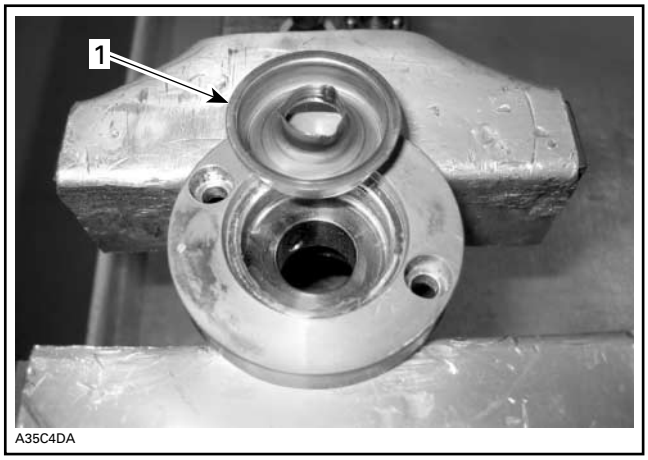
Carefully press the outer part of ceramic seal out.

NOTE: Use a mandrel with diameter of approximately 16 mm (0.63 in).



A35C4CA

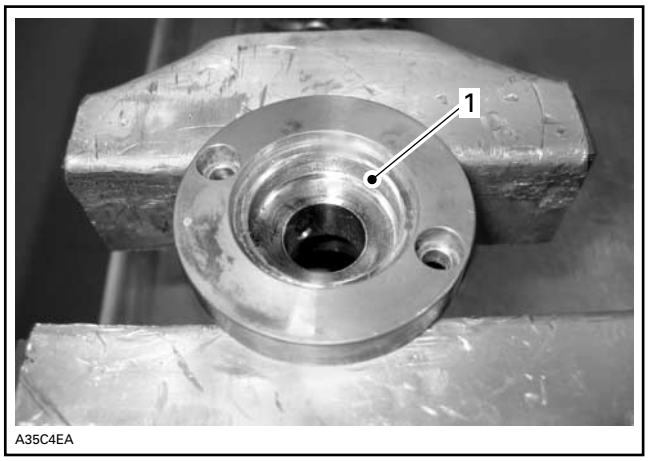
1. 16 mm (.63 in) mandrel



A35C4DA

1. Outer part of ceramic seal

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



A35C4EA

1. Remove sealant

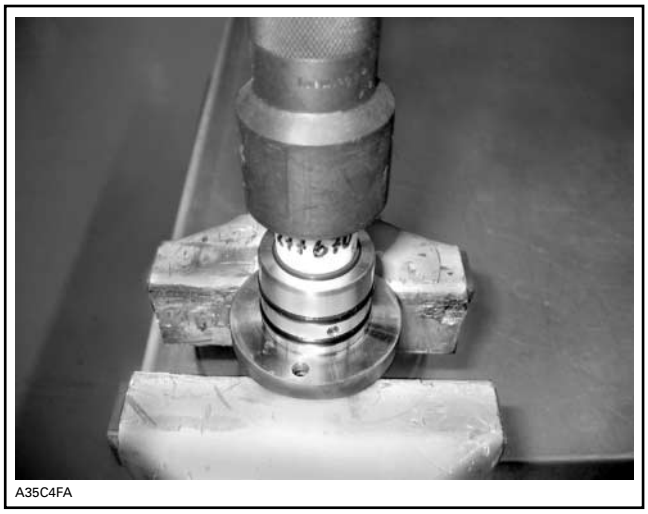
To extract bearing **no. 17** either use a hammer puller or an appropriate pusher.

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.

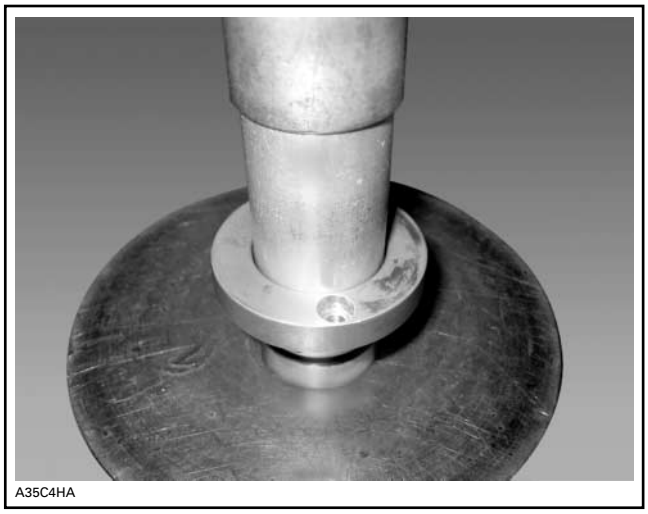
Push the new oil seal **no. 15** in bearing housing using the oil seal pusher (P/N 529 035 757).


A35C4FA

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

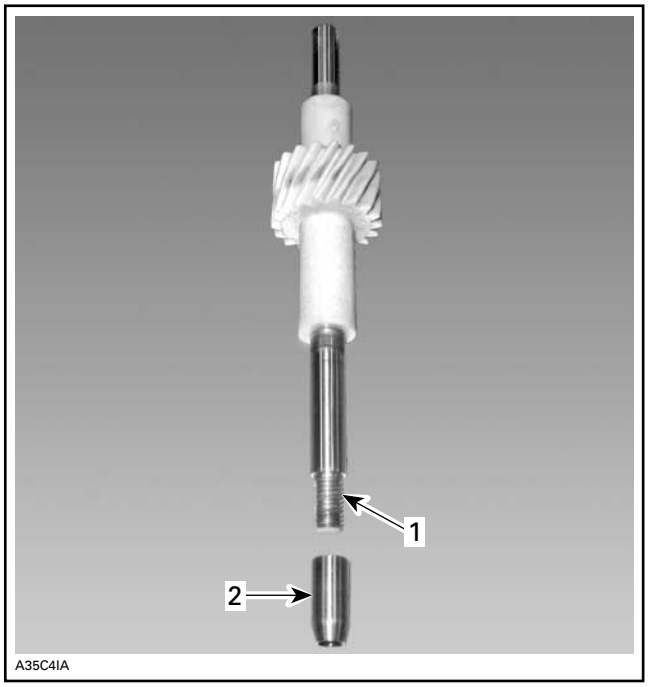

A35C4GA

Push the new ceramic seal **no. 14** in bearing housing **no. 13** using the coolant pump 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**.



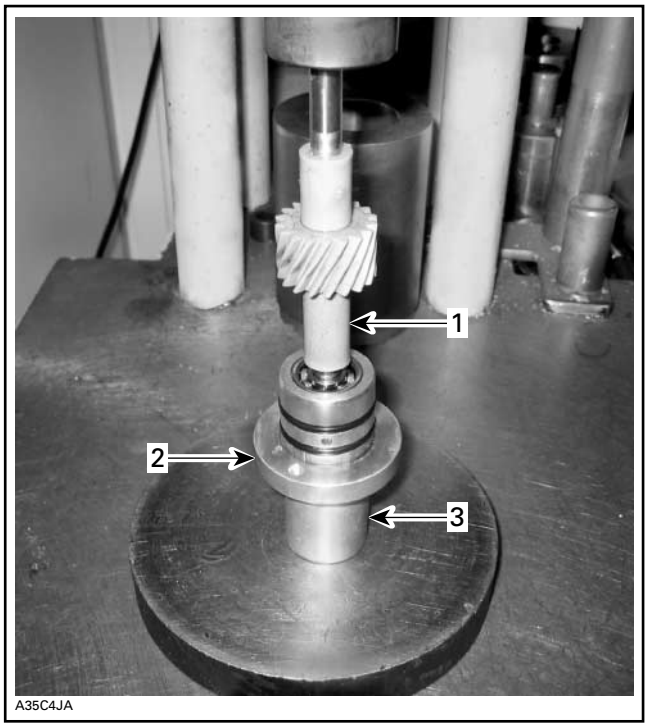
A35C4IA

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

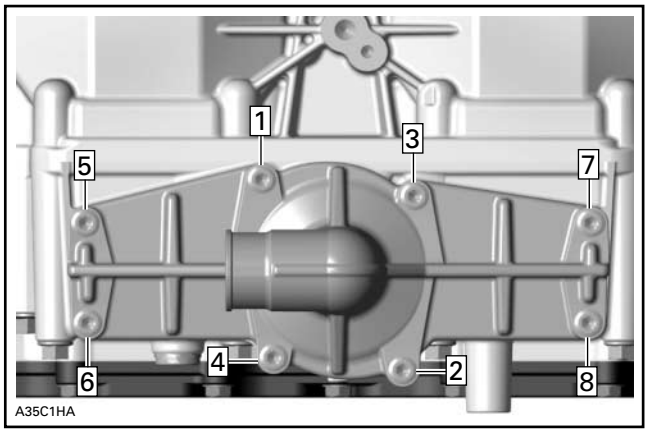
Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.

Install 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.

INSPECTION

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

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.

ASSEMBLY

Crankshaft Preparation

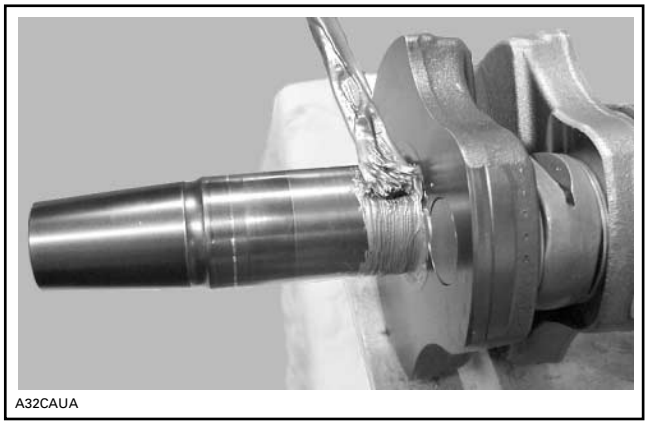
Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.


A32CB5A


A32CBWB

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

Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CAUA

Crankshaft Bearing Preparation

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

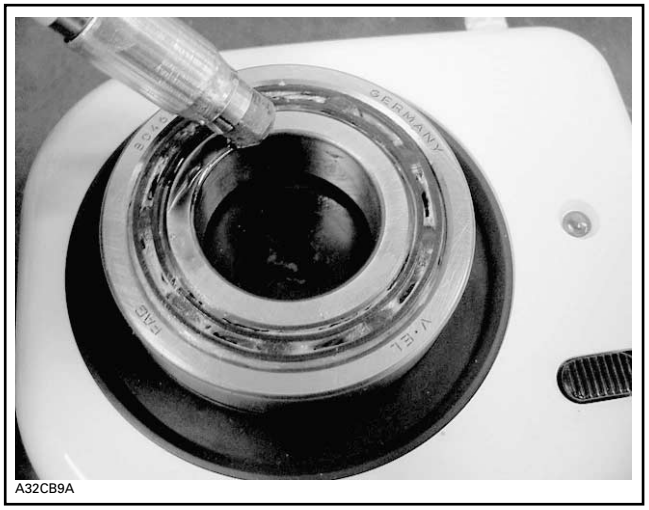
CAUTION: Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) on direct flame, or with a heat gun or in an oil bath. Inappropriate bearing(s) heating may result in inner seals or cage failure.

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.

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.



⚠ WARNING

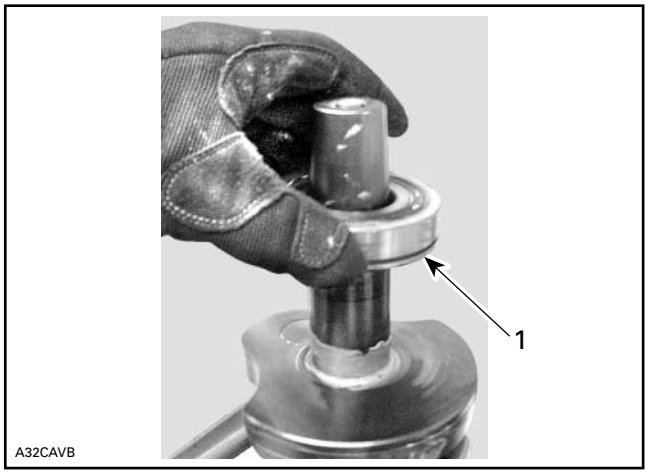
Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

Crankshaft Bearing Installation

CAUTION: Never reinstall a bearing that has been removed.

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.

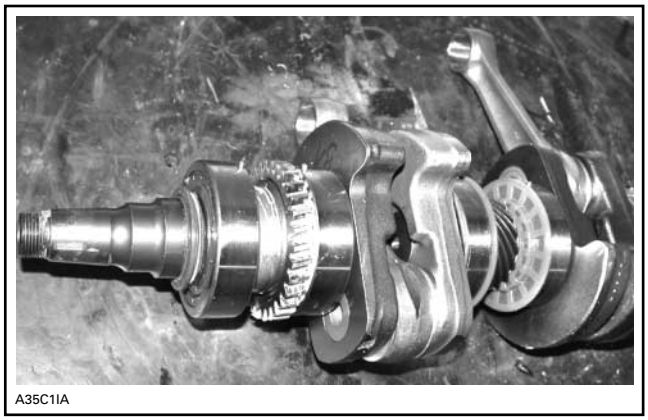
Slide bearings **no. 3** and **no. 4** with the integrated seal facing crankshaft. Push bearing to end position.

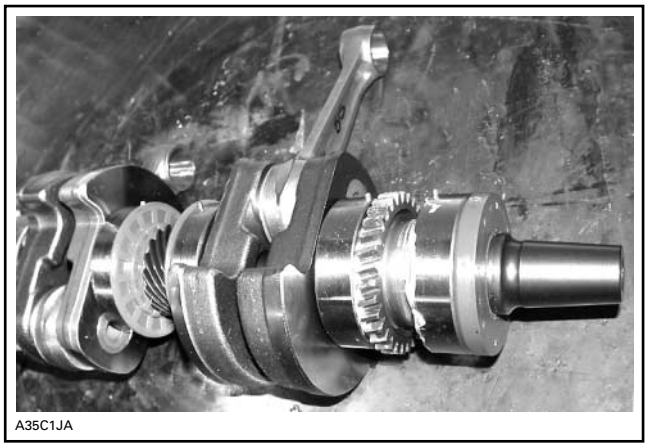


TYPICAL
1. Integrated seal this side

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.

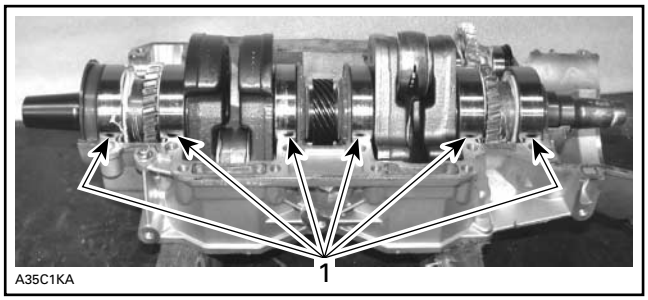



A35C1JA

Crankshaft Installation

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

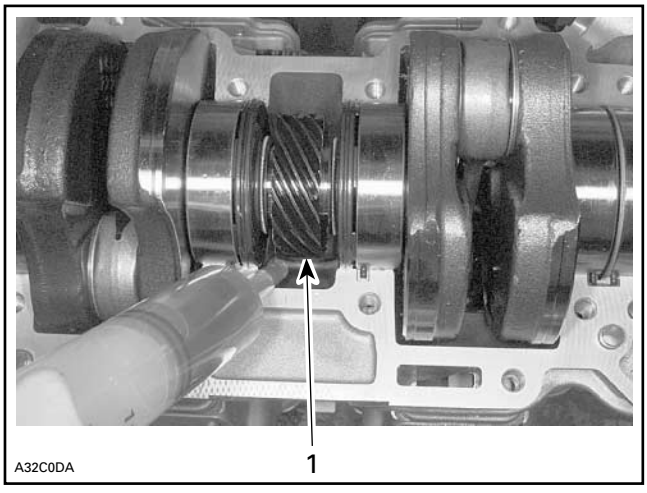
At crankshaft installation, position locating pins as illustrated.



A35C1KA

1. Locating pins

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



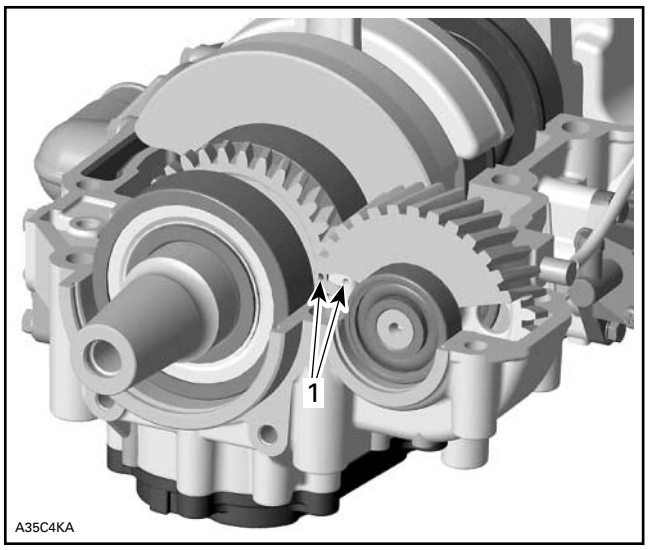
A32C0DA

TYPICAL
1. Oil bath

Counterbalance Gear

Make sure to properly index gears of crankshaft and counterbalance shaft with the aligning marks.

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



A35C4KA

1. Marks on gears aligned

Apply 40 mL (1.4 on) of Isoflex grease on counterbalance shaft gear **no. 9** and 5 mL (.2 on) 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**.

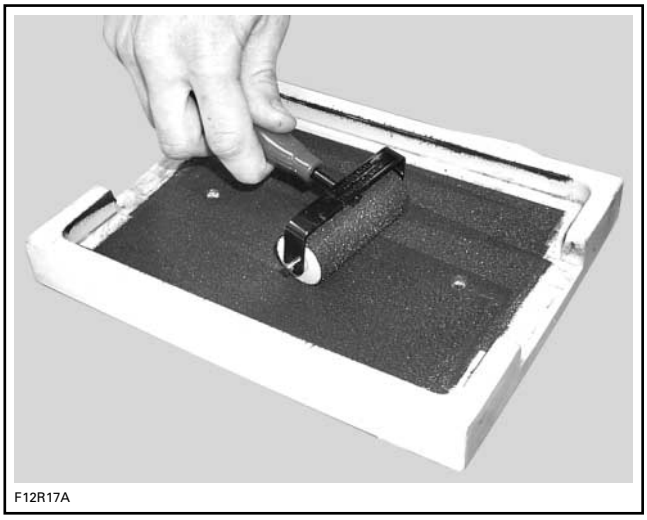
Crankcase Assembly

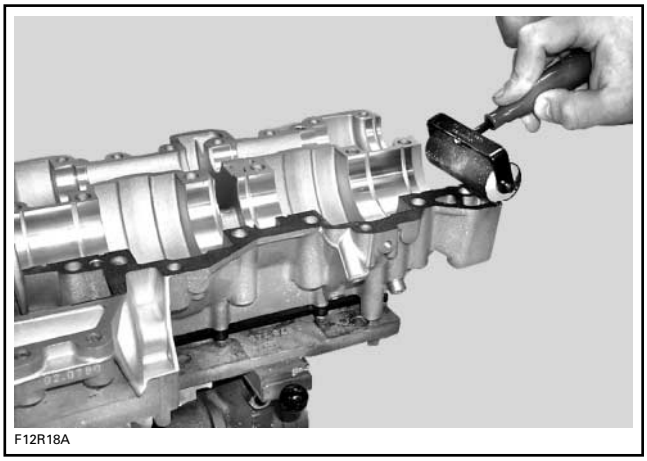
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence, must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

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.

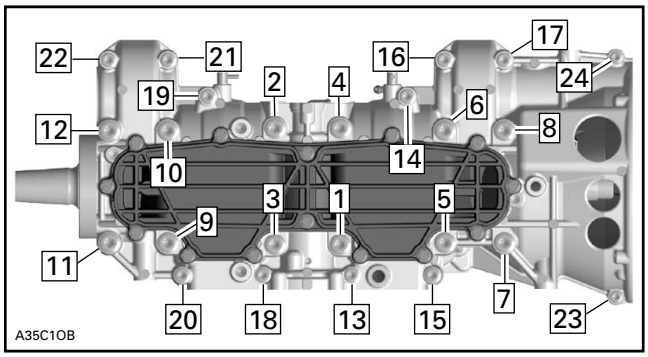
CAUTION: Do not use Loctite Primer N with the Loctite 5910. Do not use Dreibond to seal crankcase. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, these products 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.

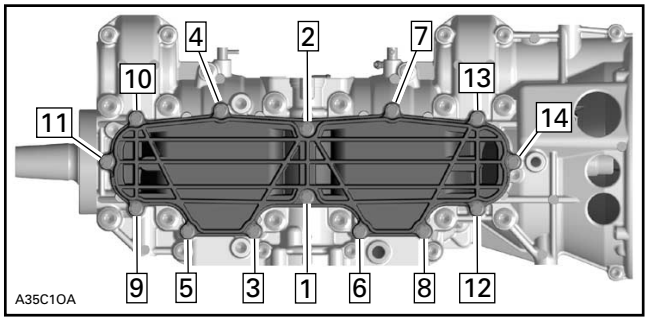

F12R17A


F12R18A

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



Torque heat exchanger cover screws **no. 19** following this sequence.



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

BREAK-IN

After rebuilding an engine, always observe a break-in period as described in *Operator's Guide*.

ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	80
TDC gauge	414 104 700	76, 80

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

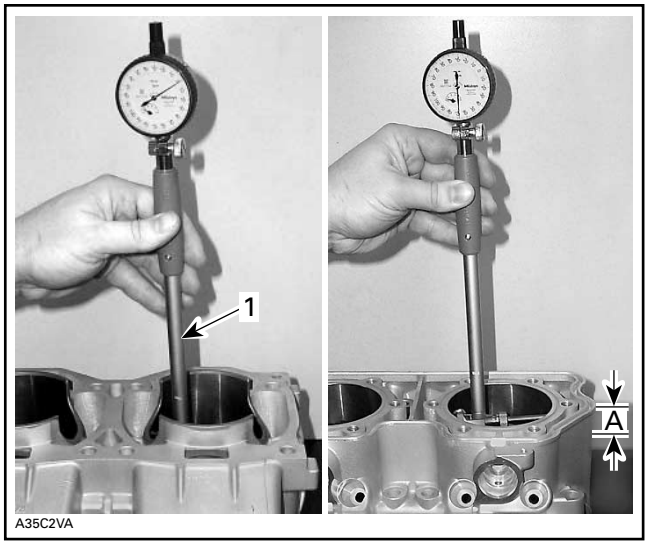
Check gasketed surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification. If cylinder head is out of specification, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

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.

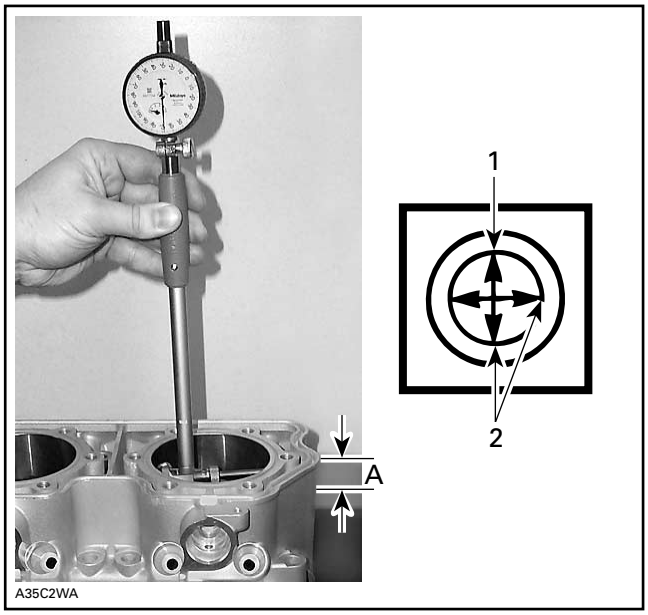


1. Below the intake port
A. .33 mm (1.3 in) from top

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.

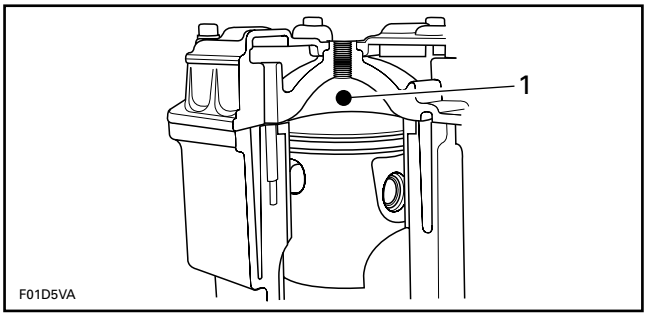
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



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

COMBUSTION CHAMBER VOLUME MEASUREMENT

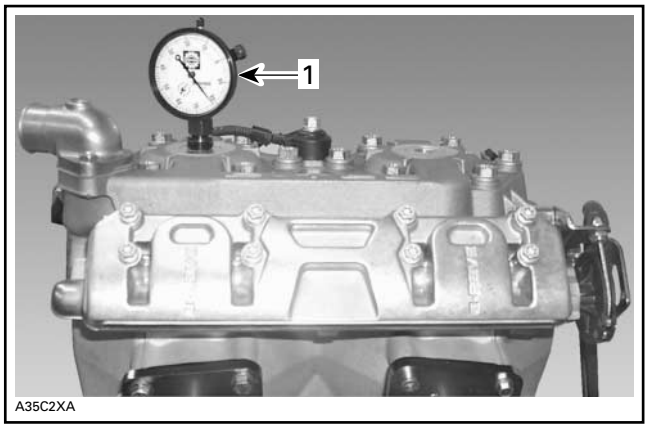
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



TYPICAL
1. Combustion chamber

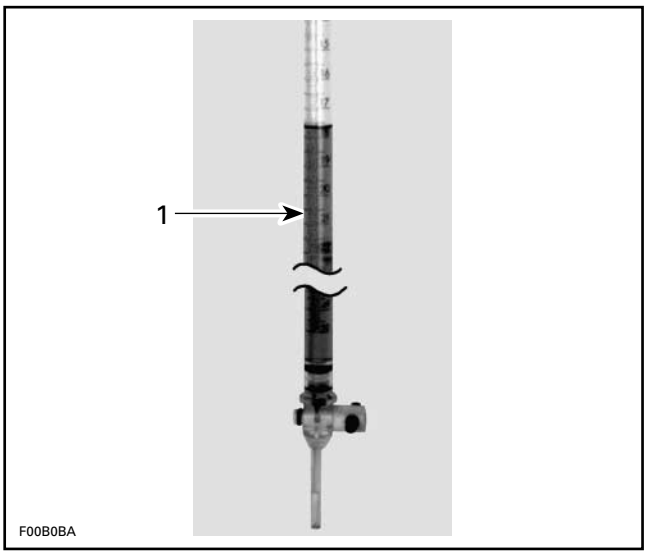
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

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



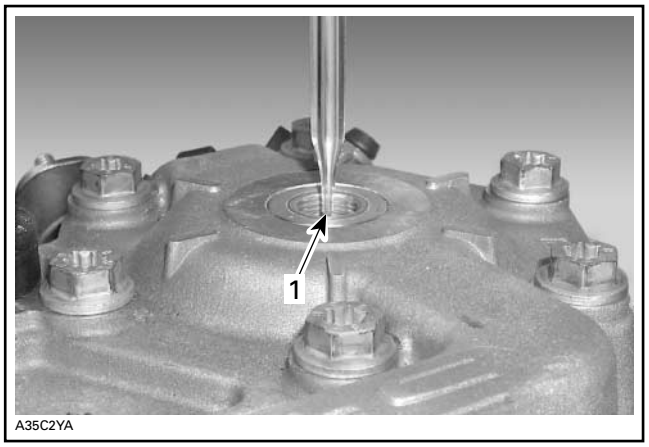
1. Bring piston to TDC

– 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.

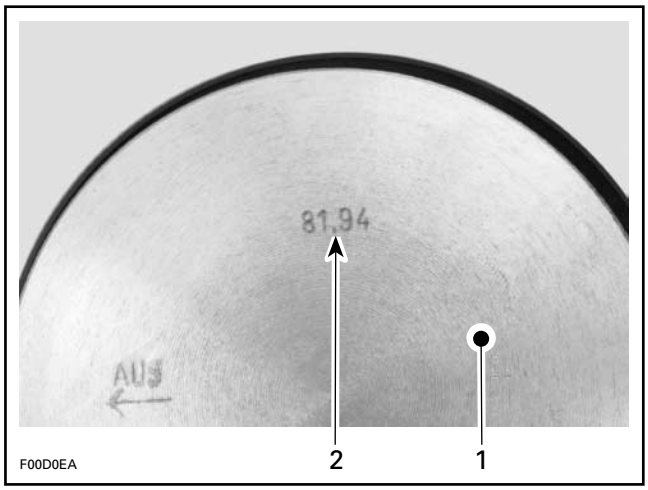
– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

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.

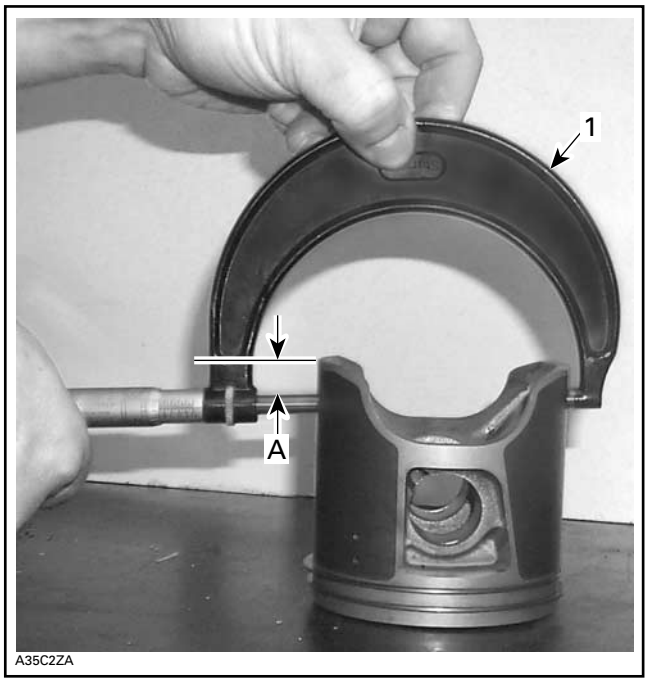
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

Using a micrometer, measure piston skirt at 29 mm (1.142 in) perpendicularly (90°) to piston pin.



1. Measuring perpendicularly (90°) to piston pin axis
A. 29 mm (1.142 in)

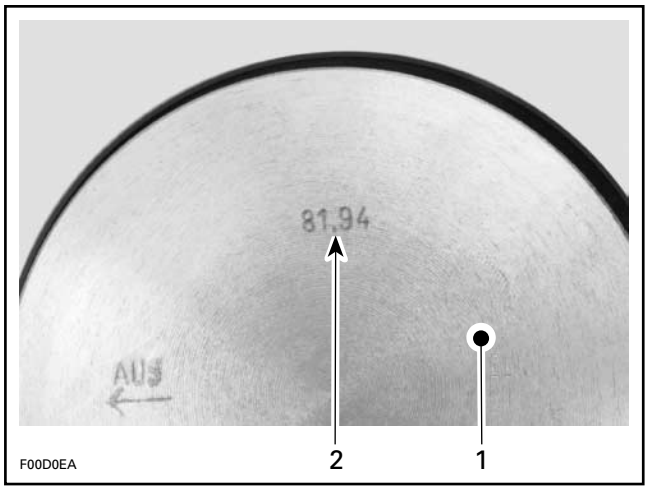
The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, replace piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

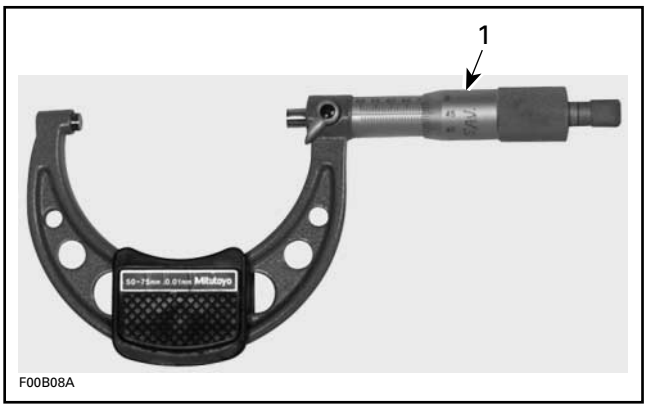
IMPORTANT: Make sure used piston is not worn more than specified. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



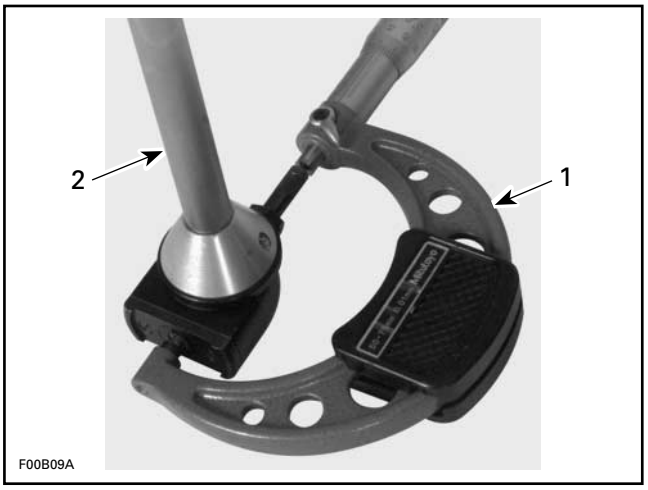
1. *Piston dome*
2. *Piston measurement*

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

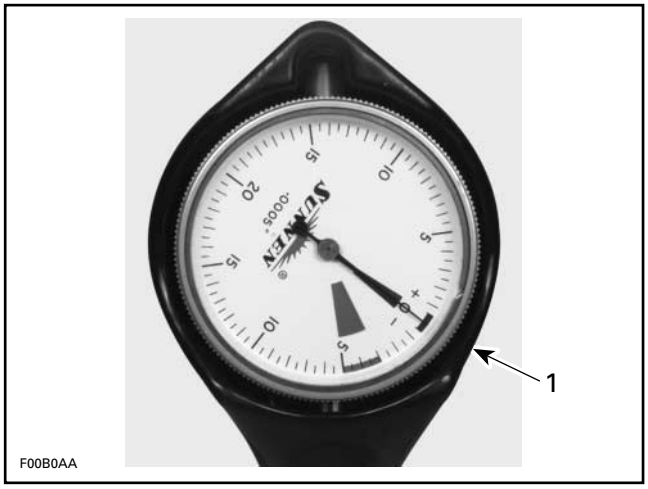


1. *Micrometer set to the piston dimension*

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



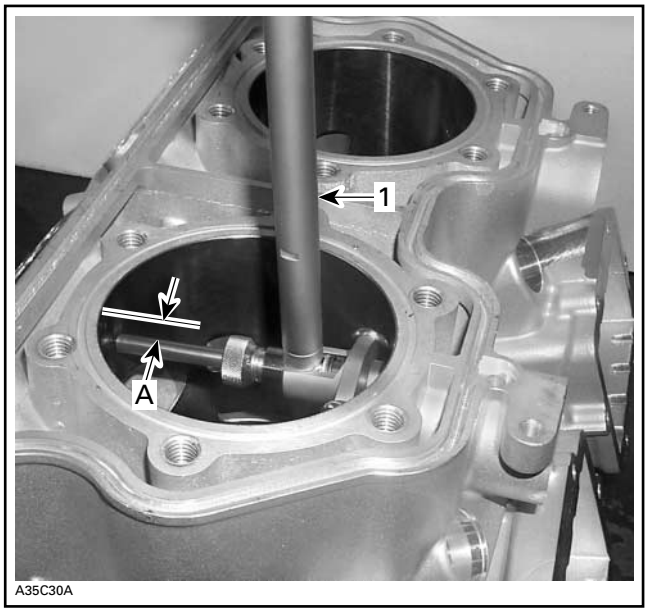
1. *Use the micrometer to set the cylinder bore gauge*
2. *Dial bore gauge*



1. *Indicator set to 0 (zero)*

IMPORTANT: Always remove cylinders from crankcase before measuring.

Position the dial bore gauge at 33 mm (1.3 in) below cylinder top edge.



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 or rebore and install oversize piston depending on engine.

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.

RING/PISTON GROOVE CLEARANCE

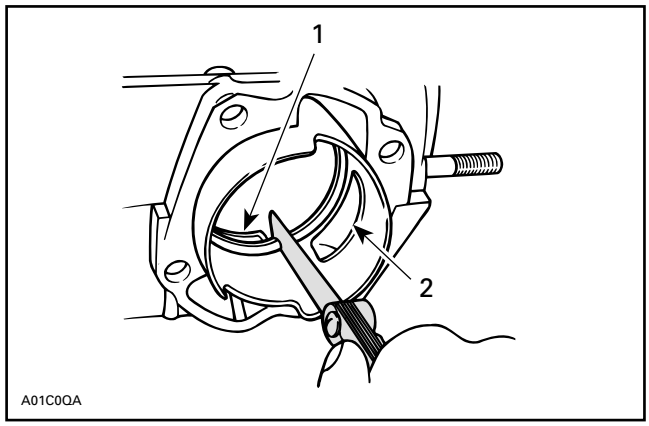
Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

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

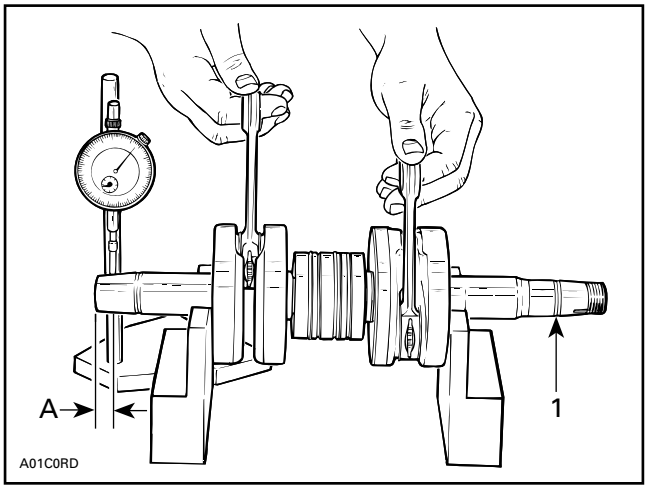
Crankshaft deflection is measured with a dial indicator.

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.



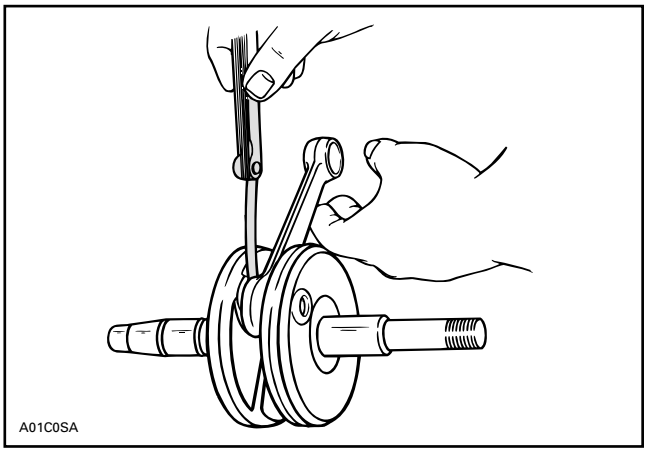
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured on 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.

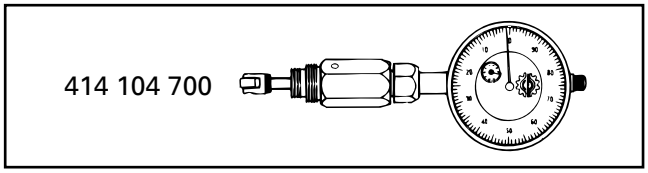


TYPICAL

CHECKING CRANKSHAFT ALIGNMENT

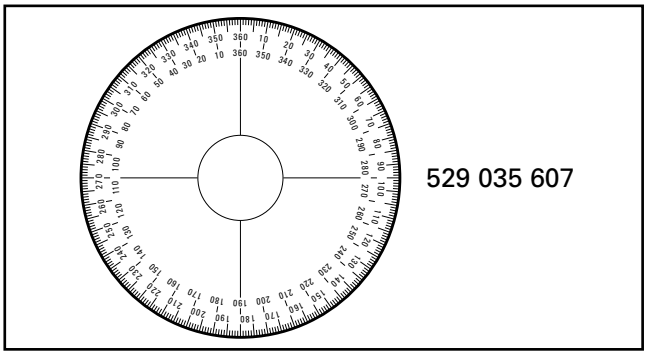
Remove both spark plugs.

Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.



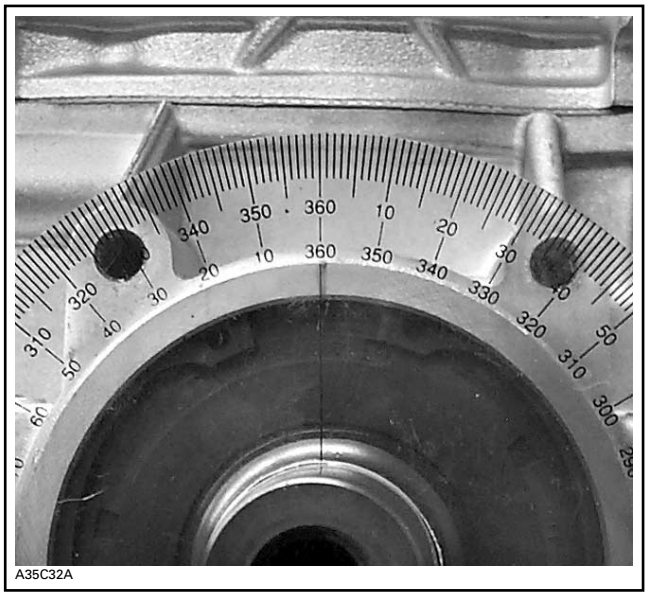
Bring MAG piston at top dead center.

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 TDC gauge and install it in spark plug hole on PTO side.

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

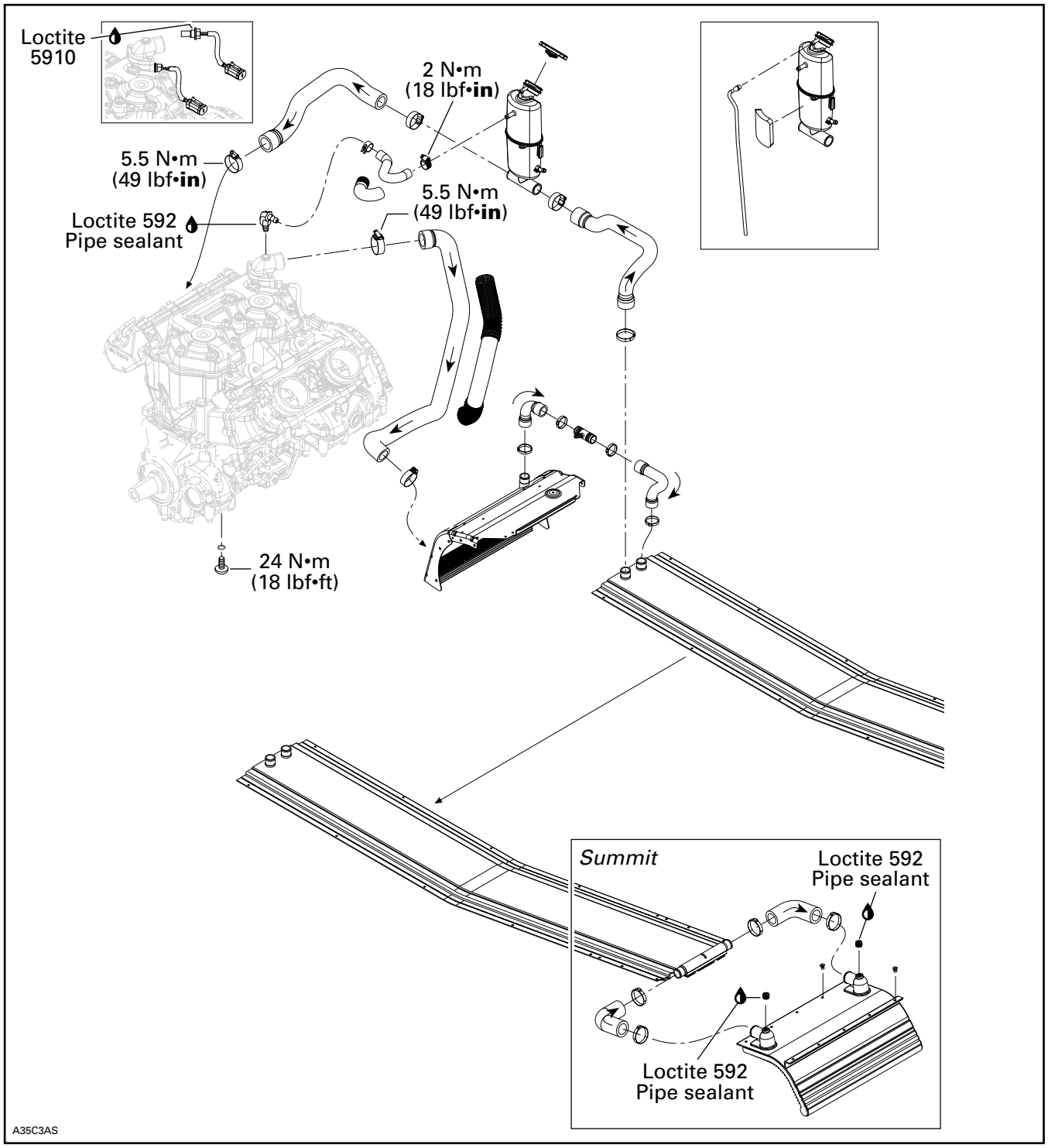
Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

COOLING SYSTEM

SERVICE TOOLS

SERVICE PRODUCTS



COOLING SYSTEM LEAK TEST

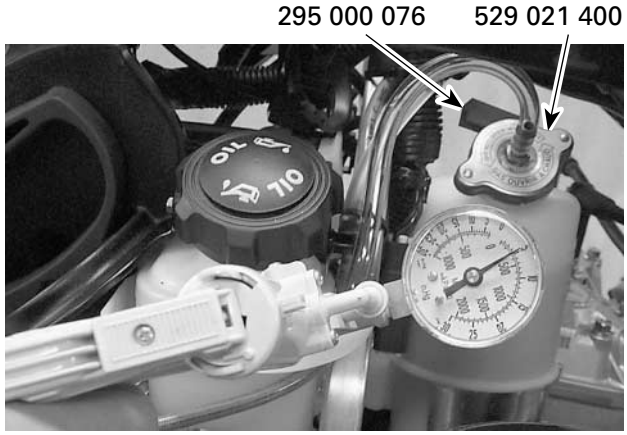
⚠ WARNING

To prevent burning yourself, do not remove the coolant tank cap if the engine is hot.

Install special coolant tank cap (P/N 529 021 400) included in the engine leak tester kit (P/N 861 749 100) on coolant tank.

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

Using pump also included in kit pressurize all system through coolant tank to 100 kPa (15 PSI).



TYPICAL

INSPECTION

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 weep hole for leaks.

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

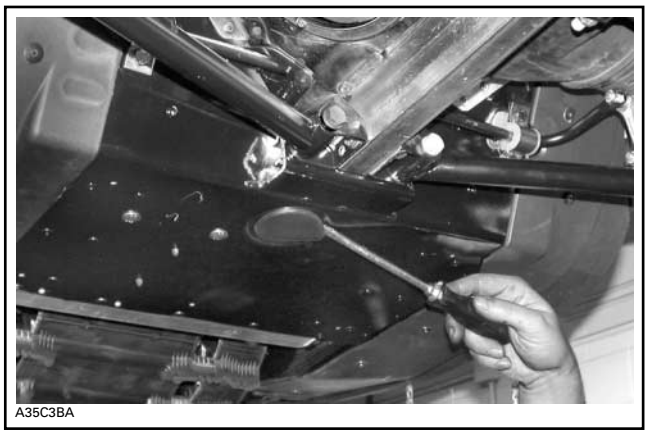
DRAINING THE SYSTEM

⚠ 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.

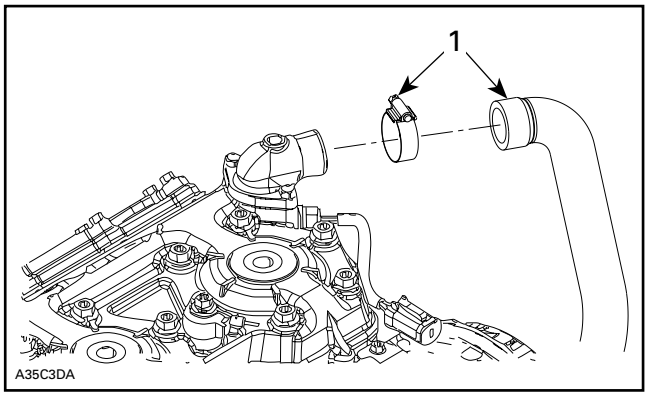


Place a drain pan under the drain hole.

Unscrew drain plug.

1. Drain plug

Disconnect engine outlet hose and siphon remaining of coolant mixture from heat exchangers using the siphon tool (P/N 529 035 880).



1. Disconnect engine outlet hose

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Engine drain plug	24 N•m (18 lbf•ft)

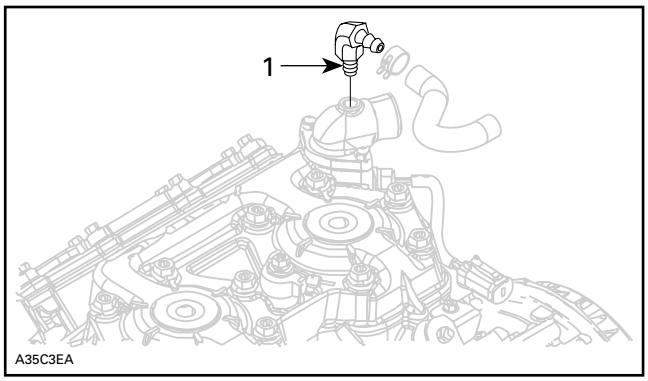
DISASSEMBLY AND ASSEMBLY

Coolant Pump

Refer to BOTTOM END section.

Bleed Hose Elbow Fitting

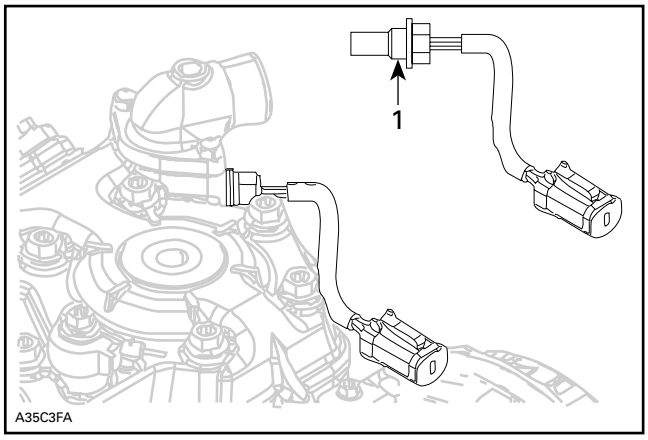
Apply Loctite 592 (P/N 293 800 018) thread sealant on elbow fitting.



BLEED HOSE ELBOW FITTING
1. Apply Loctite 592

Temperature Sensor

Apply some Loctite 5910 (P/N 293 800 081) on engine temperature sensor threads.



TEMPERATURE SENSOR
1. Apply Loctite 5910

Pressure 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).

Coolant Tank

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.

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

For installation, reverse the removal procedure.

Rear Heat Exchanger

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

Check if the heat exchanger fins are damaged. Replace heat exchanger if necessary.

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

For disassembly, drain cooling system.

Remove seat, refer to BODY/FRAME.

Remove trunk and rear luggage rack.

Remove Oetiker clamps and unplug hoses.

Drill all rivets retaining heat exchanger to frame.

Remove heat exchanger.

For installation, reverse the removal procedure and make sure to use new Oetiker clamps.

Rear Cap Heat Exchanger

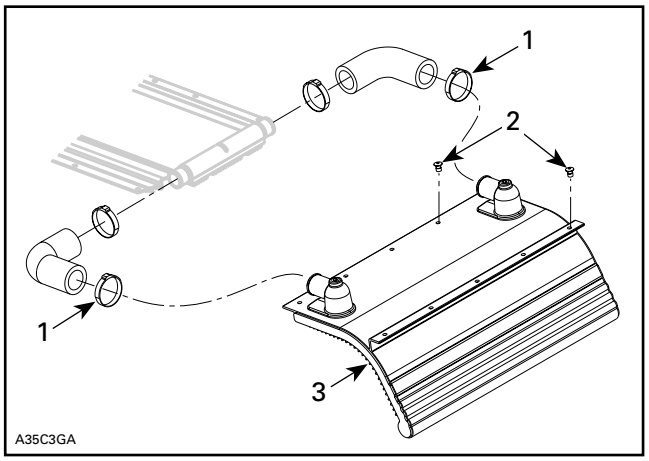
Summit Models Only

For disassembly, drain cooling system.

Remove rear hose cover.

Remove Oetiker clamps and unplug rear cap heat exchanger hoses.

Drill all rivets retaining rear cap heat exchanger to frame.



REAR CAP HEAT EXCHANGER
1. *Remove Oetiker clamps*
2. *Drill all rivets*
3. *Rear cap heat exchanger*

Remove rear cap heat exchanger.

For installation, reverse the removal procedure.

Heat Exchanger Protector

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

Thermostat

There is no thermostat on those models.

COOLING SYSTEM REFILLING PROCEDURE

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Pure antifreeze without water freezes (like slush ice). Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

System Capacity

Refer to TECHNICAL DATA.

Refilling Procedure

IMPORTANT: USE THE PREMIXED COOLANT (P/N 293 600 038). Do not reinstall pressure cap.

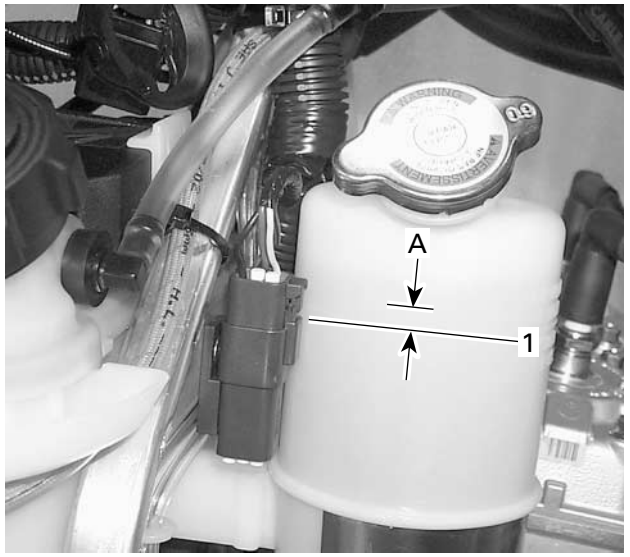
With engine cold, refill coolant tank up to COLD LEVEL line. Start engine. Refill up to line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes). Always monitor coolant level while filling tank to avoid emptying. Install pressure cap.

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.



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.

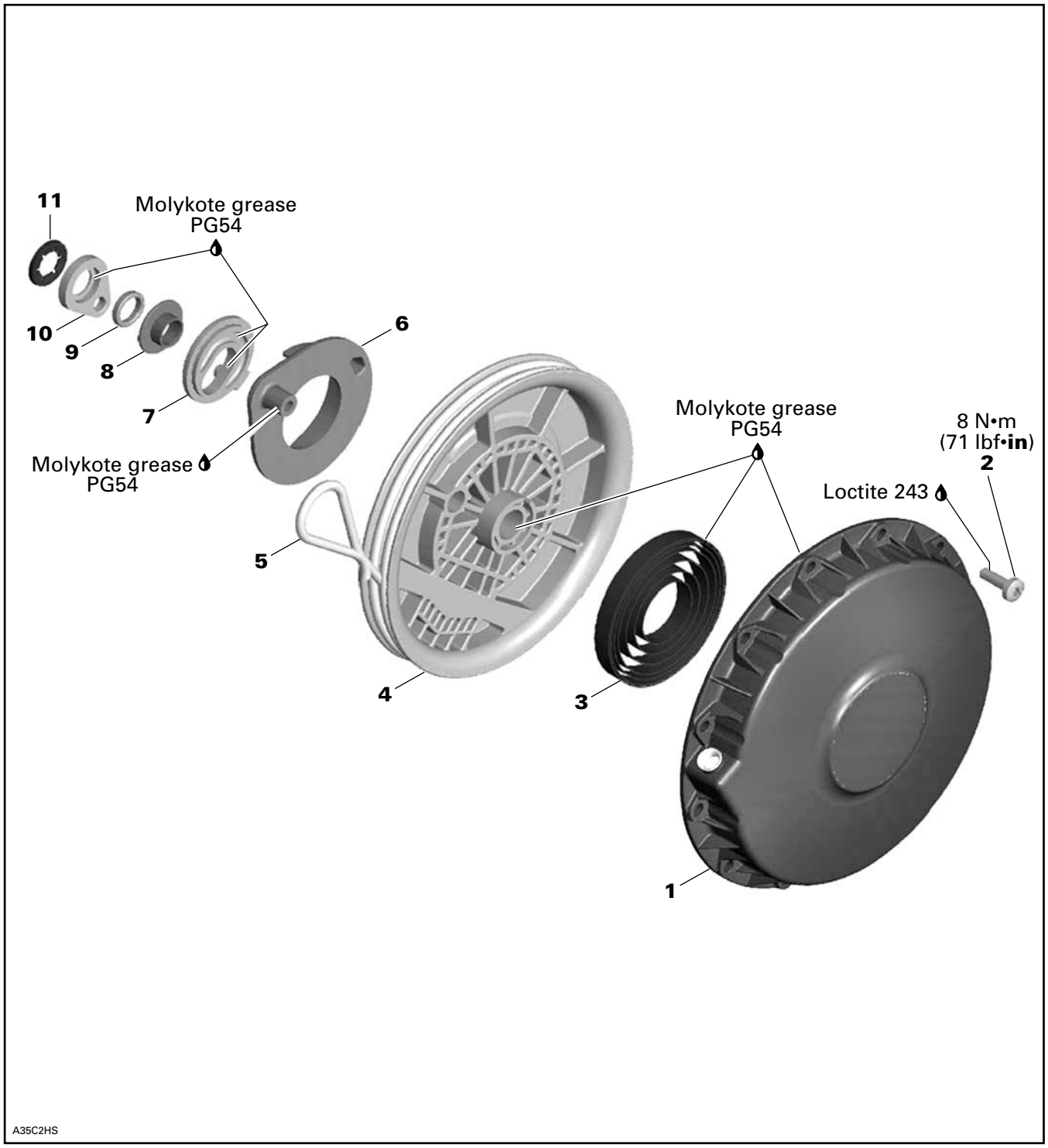
When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.

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

REWIND STARTER

SERVICE PRODUCTS

Description	Part Number	Page
Molykote PG 54	420 899 763	92–93



GENERAL

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.

INSPECTION

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 disassembled.

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.

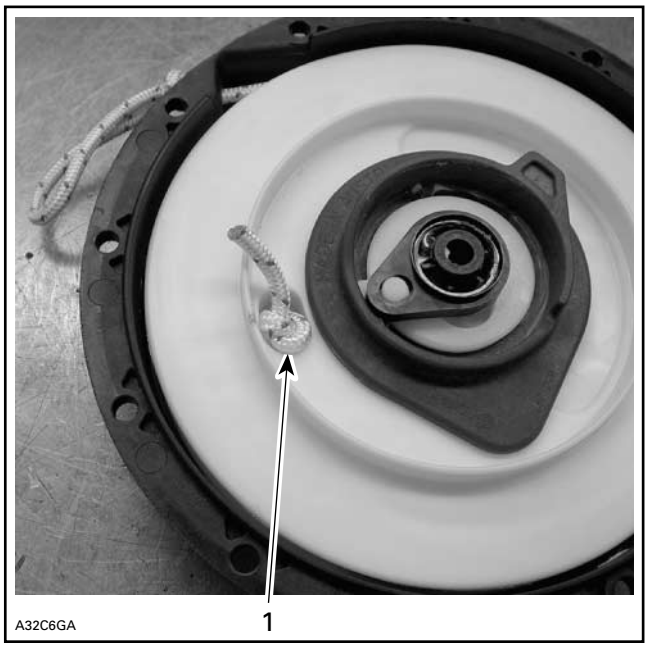
REMOVAL

Using a small screwdriver, extract rope knot from starter grip. Cut rope close to knot. Tie a knot near starter.

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

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

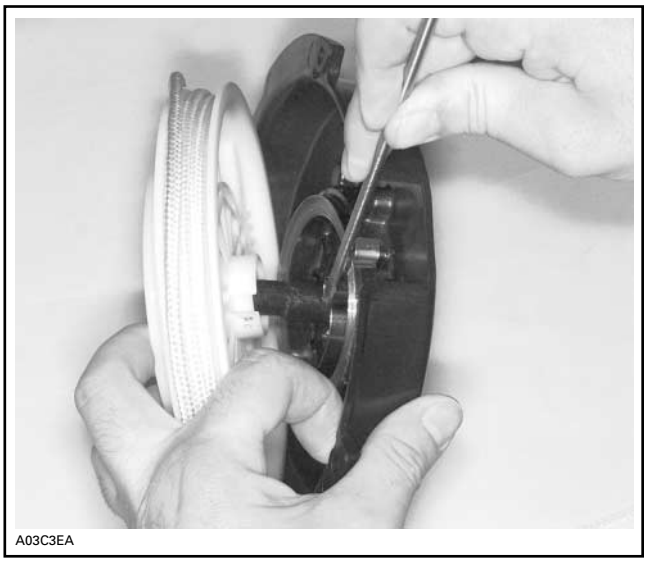
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

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

Cut push nut **no. 11** and discard. Remove locking element **no. 10**, O-ring **no. 9**, step collar **no. 8**, pawl lock **no. 7** and pawl **no. 6**.

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


A03C3EA

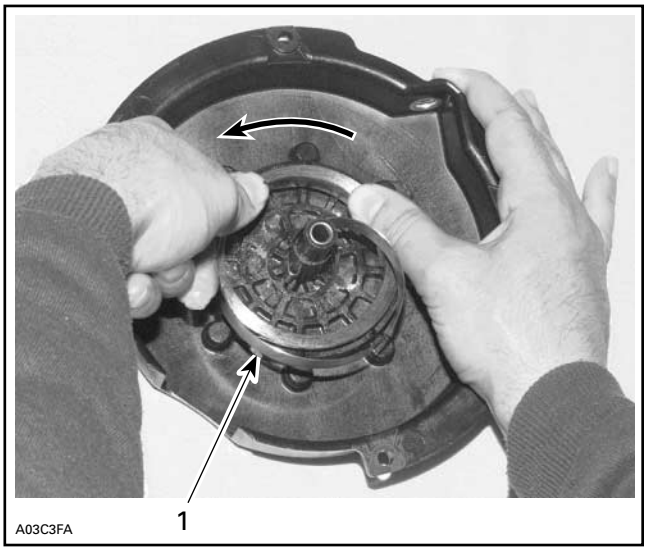
Take out the knot and then rope **no. 5**.

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.

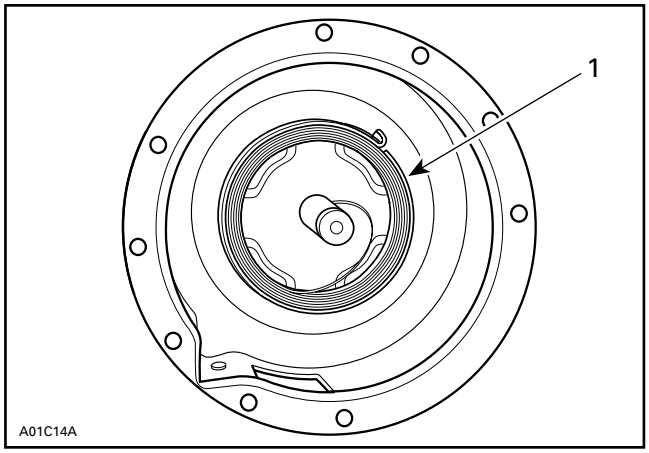


A03C3FA

1. Outer end into guide notch

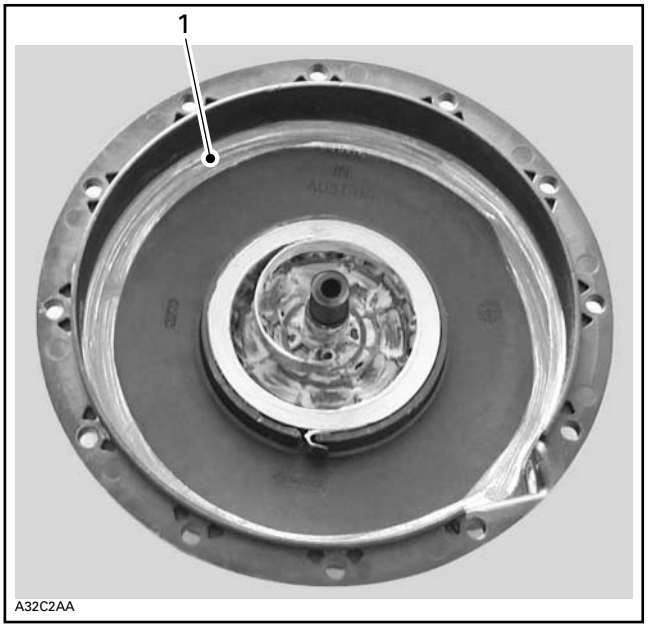
CAUTION: **It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.**

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



A01C14A

TYPICAL
1. Molykote PG 54 inside spring guide

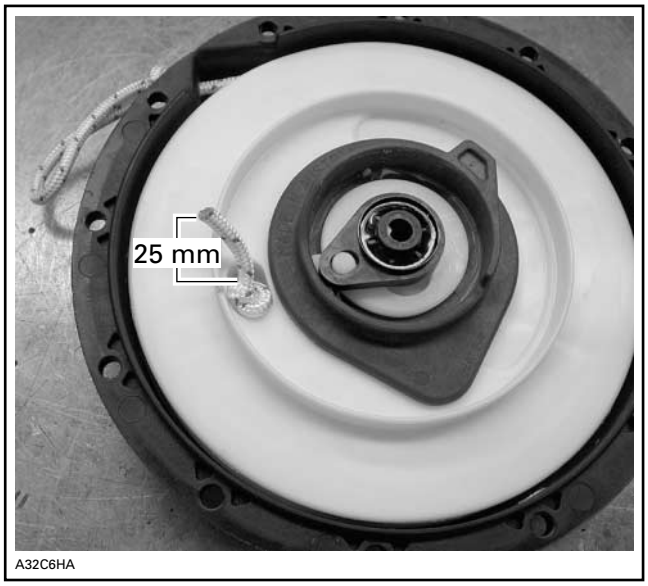


A32C2AA

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

CAUTION: **The use of standard multipurpose grease could result in rewind starter malfunction.**

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



FREE PORTION

FREE PORTION INSERTED INTO SHEAVE

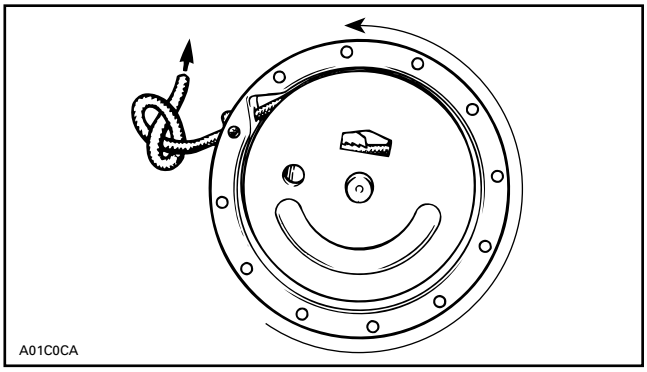
Lubricate housing post with silicone compound grease. Install sheave.

To adjust rope 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.

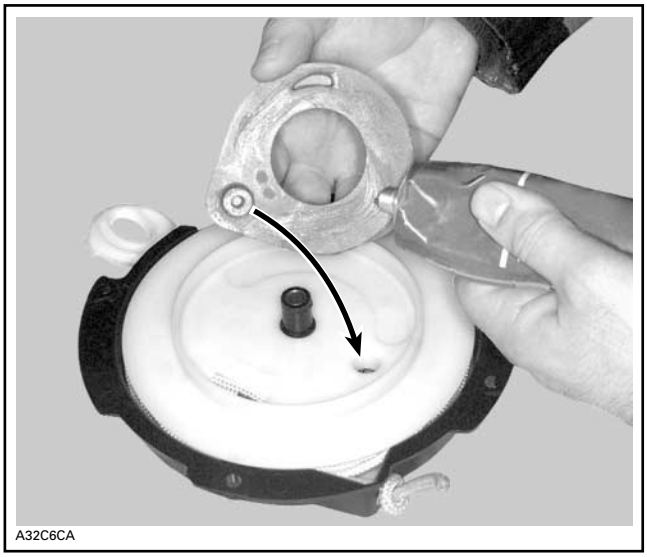
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

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

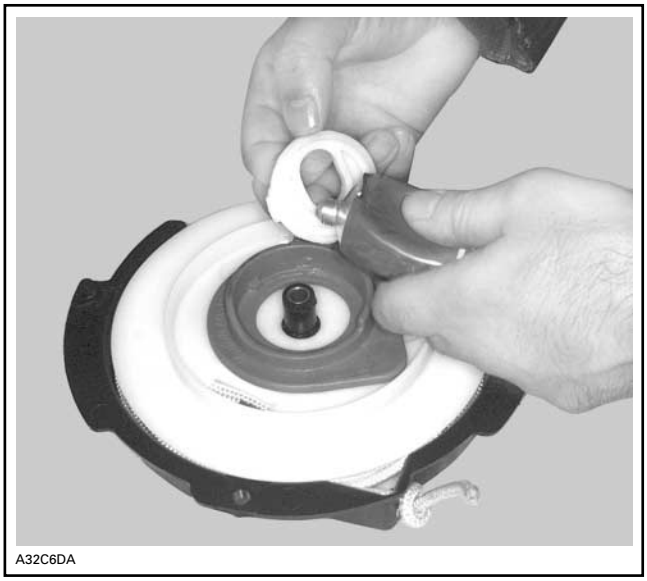


TYPICAL

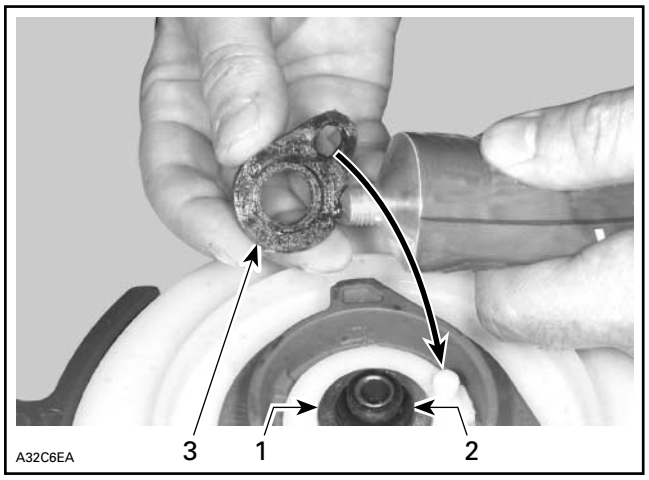
Lubricate pawl **no. 6** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



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



Install step collar **no. 8** with its sleeve first. Lubricate a new O-ring **no. 9** and locking element **no. 7** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.

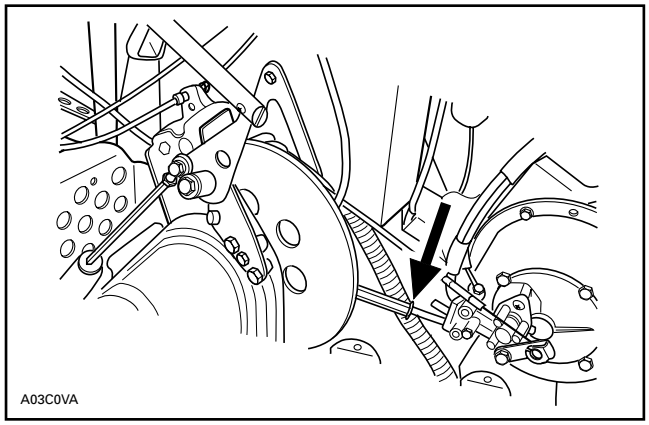


1. *Step collar*
2. *O-ring*
3. *Locking element*

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

INSTALLATION

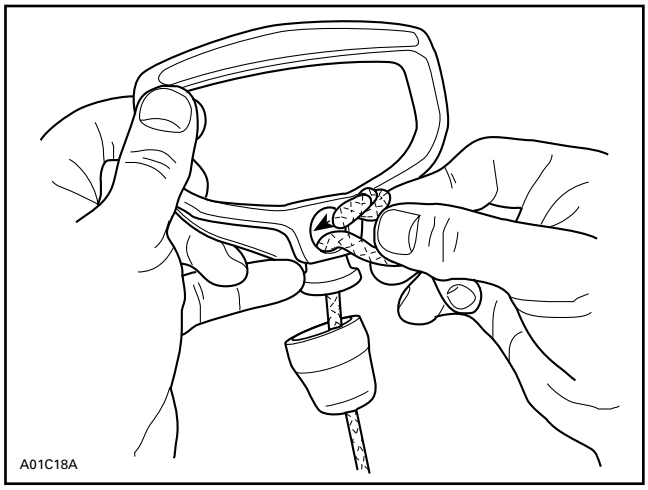
Thread starter rope **no. 5** through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

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

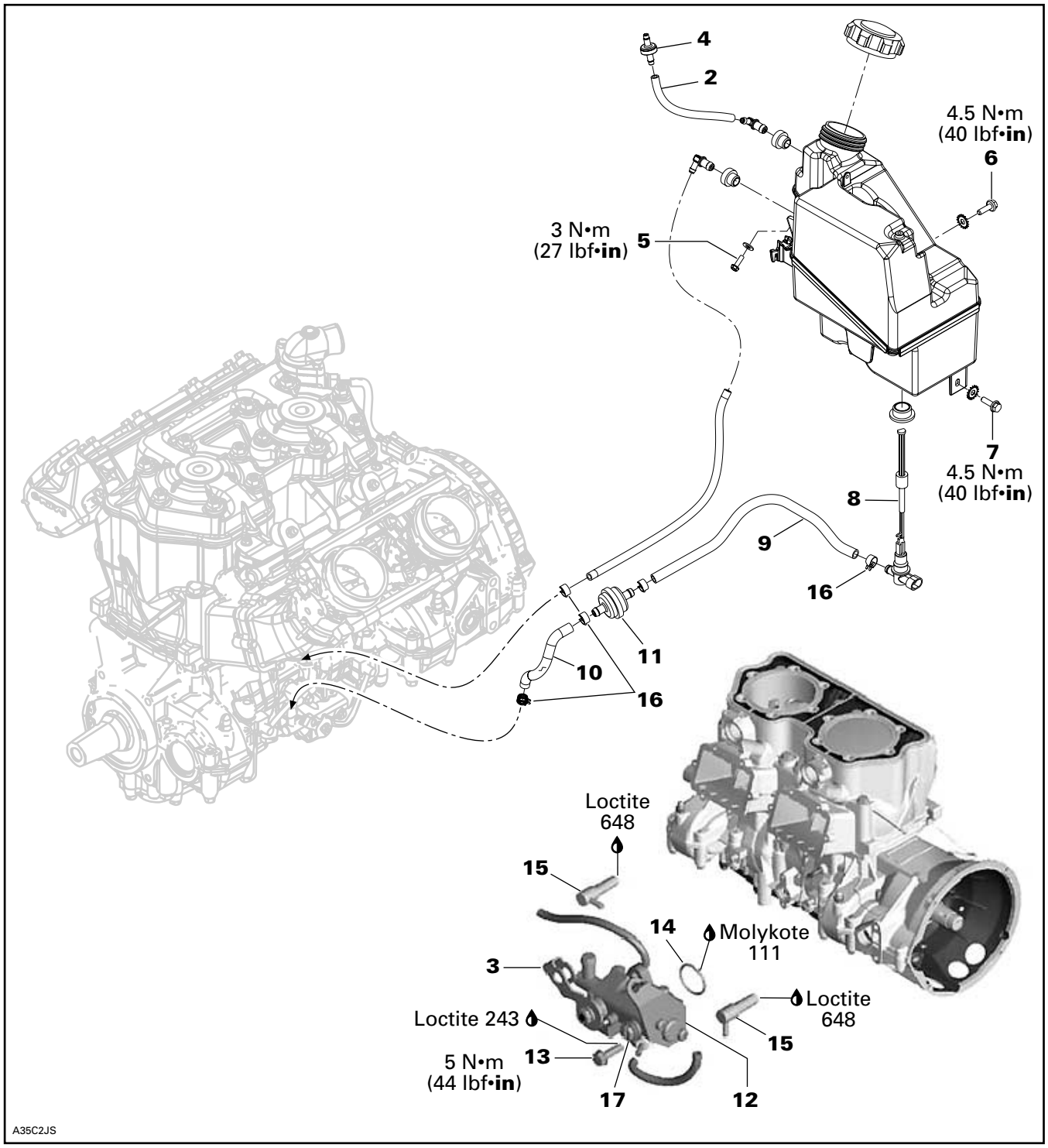


TYPICAL

OIL INJECTION SYSTEM

SERVICE TOOLS

SERVICE PRODUCTS



GENERAL

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.

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.**

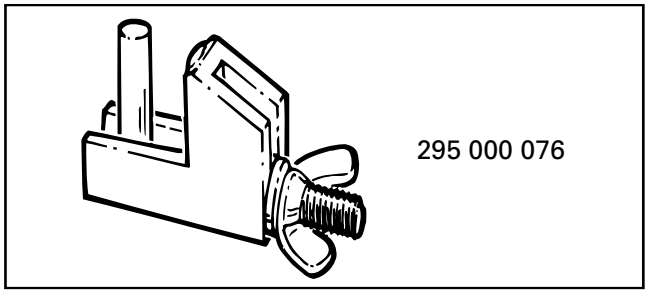
OIL SYSTEM LEAK TEST

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

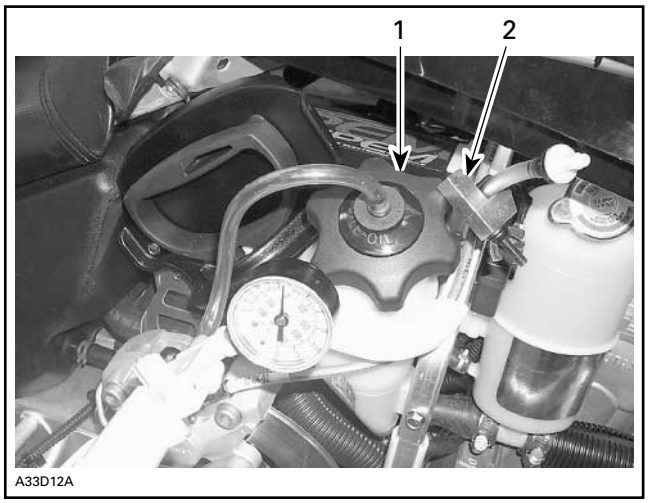
Install on oil reservoir special cap of leak testing kit (P/N 529 033 100).

529 033 100

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

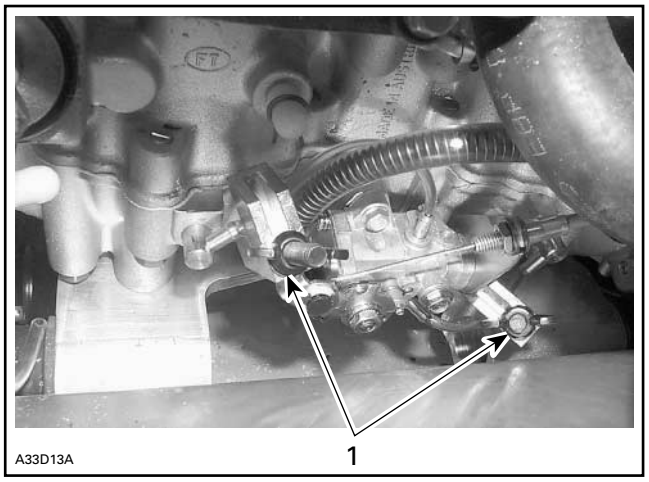


295 000 076



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

Connect leak testing kit pump to special cap.

Pressurize oil system to 21 kPa (3 PSI). That pressure must not drop during 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 AND ENGINE DIMENSION MEASUREMENT for the procedure.

OIL PUMP IDENTIFICATION

Different engines need different pumps. See identification on lever **no. 3**.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
995	07

CLEANING

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

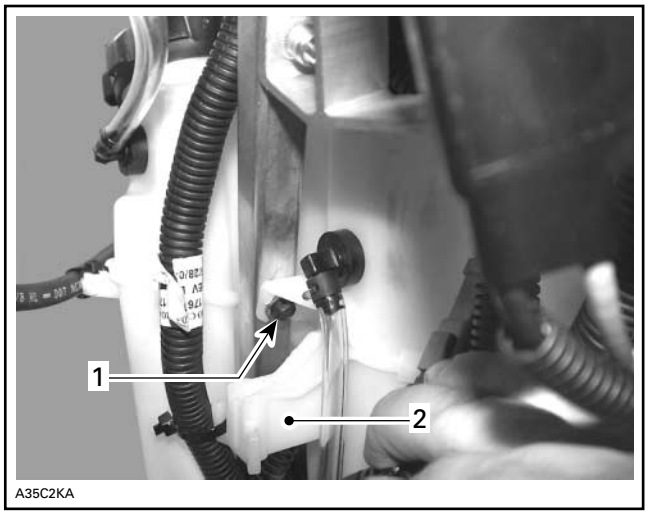
REMOVAL

Injection Oil Reservoir

On Left Side of Vehicle:

Remove air box and throttle body.

Remove upper screw **no. 5** that attach oil injection reservoir **no. 1** to frame.



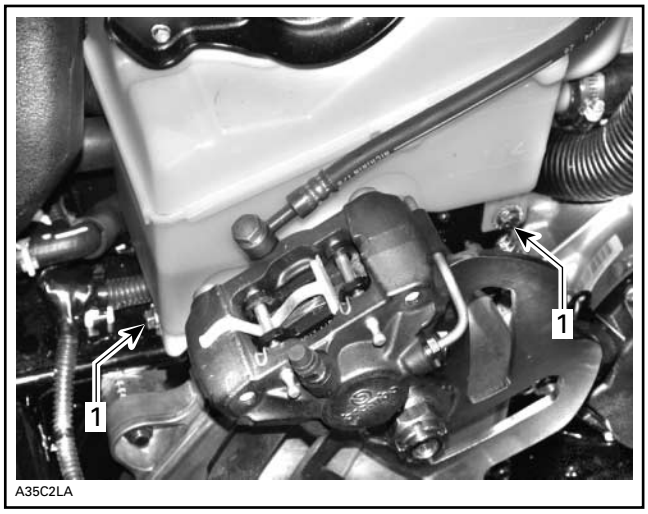
1. Upper reservoir screw
2. Location of cooling reservoir

On Right Side of Vehicle:

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

Remove:

– rewind starter handle
– lower screws **no. 6** and **no. 7**.



1. Lower reservoir screws

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

Injection Oil Level Sensor

To remove the sensor **no. 8**, use the following procedure.

Remove injection oil reservoir, as mentioned above.

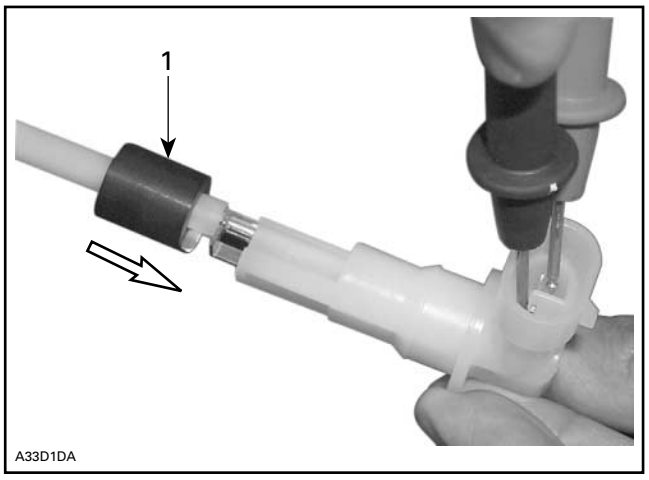
Unplug sensor connector.

Pull injection oil level sensor **no. 8** out of reservoir.

Before replacing the injection oil level sensor **no. 8**, check it according to the following procedure:

CAUTION: Do not remove or bend the reed switch protective float lock. 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

Reading below 0 ohm reflects the proper switch function. Replace the injection oil level sensor if reading above 0 ohm.

Injection Oil Filter

Lift engine. Use the following procedure:

- Remove drive and driven pulleys.
- Remove air box and throttle body.
- Unscrew engine support nuts.
- Remove the first 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. 9** from the injection oil level sensor **no. 8**.

Disconnect oil hoses **no. 9** and **no. 10** from the oil filter **no. 11** and remove it.

Injection Oil Pump

Lift engine.

Remove oil pump screws **no. 13**

Unplug all hoses connected to oil pump **no. 12**.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

Remove oil pump and its O-ring **no. 14**.

Check Valve

NOTE: Before removing check valve **no. 15**, check its operation. Refer to the end of this section.

Remove air box and throttle body.

Clean check valve area to remove oil or dirt.

Heat check valve **no. 15** then pull it out of crankcase.

CHECKING OPERATION

Oil Pump

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. If not replace pump.

Oil Reservoir Check Valve

It allows air to get into the reservoir. To verify this one-way check valve **no. 4**, remove it along with the hose. Make sure that it holds pressure and that it does not let air go through.

While installing this check valve make sure that the black side is inserted in the hose.

INSTALLATION

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

NOTE: During installation, always check for spring clips **no. 16** tightness.

Injection Oil Reservoir

For installation, reverse the removal procedure.

Injection Oil Level sensor

For installation, reverse the removal procedure.

Injection Oil Filter

For installation, reverse the removal procedure.

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

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. 14** before installation.

Torque the oil pump screws **no. 13** 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.

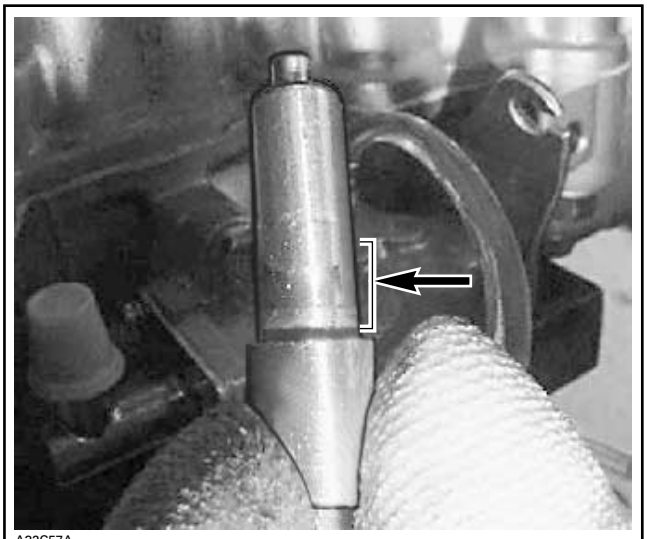
Install cable lock washer on left side of support.

Verify cable and oil pump lever operation then adjust cable.

Check Valve

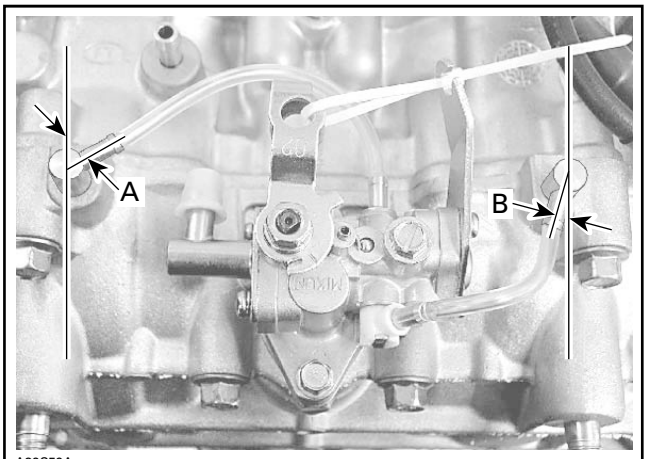
Prior to coating the check valve **no. 15** with Loctite, make sure check valve body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

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


A32C57A

APPLY LOCTITE ON THIS AREA ONLY

Install the check valve in the correct position as described on next photos into the crankcase lower side.



A32C59A

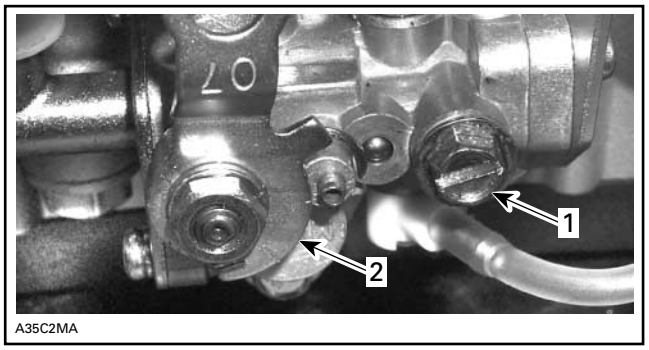
TYPICAL
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the check valve carefully with a plastic hammer.

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

BLEEDING PROCEDURE

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw **no. 17** 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

No ensure not operate carburetor throttle mechanism. Secure the rear of the vehicle on a stand.

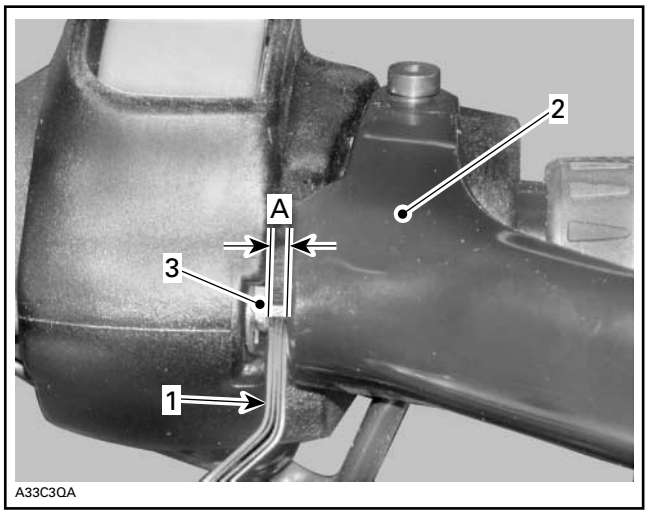
ADJUSTMENT

Oil Pump Cable

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

Depress the throttle lever lightly until the cable is under tension but throttle body are not yet opened.

Using a feeler gauge, measure the visible distance between throttle lever and the end of cable housing.



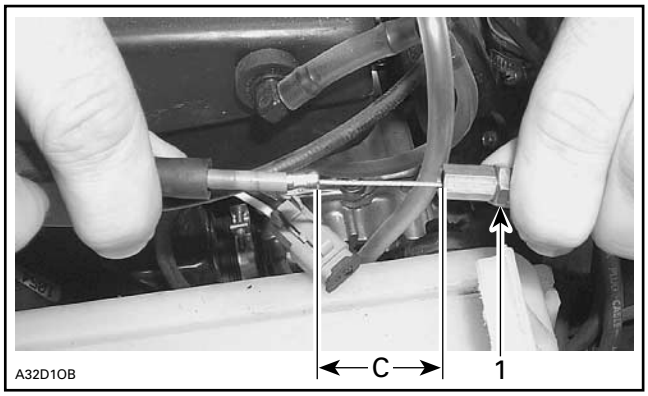
TYPICAL
1. Feeler gauge
2. Throttle lever
3. End of cable housing
A. Visible distance

Note this measure.

Next, add to measurement "A" the appropriate specification "B", using the chart below.

MODELS	SPECIFICATION "B"
Mach Z, Summit Highmark and Summit Highmark X	16.5 mm (.650 in)

Stretch oil pump cable with a force of 34 N (7.6 lbf) and measure the length of its visible distance "C".



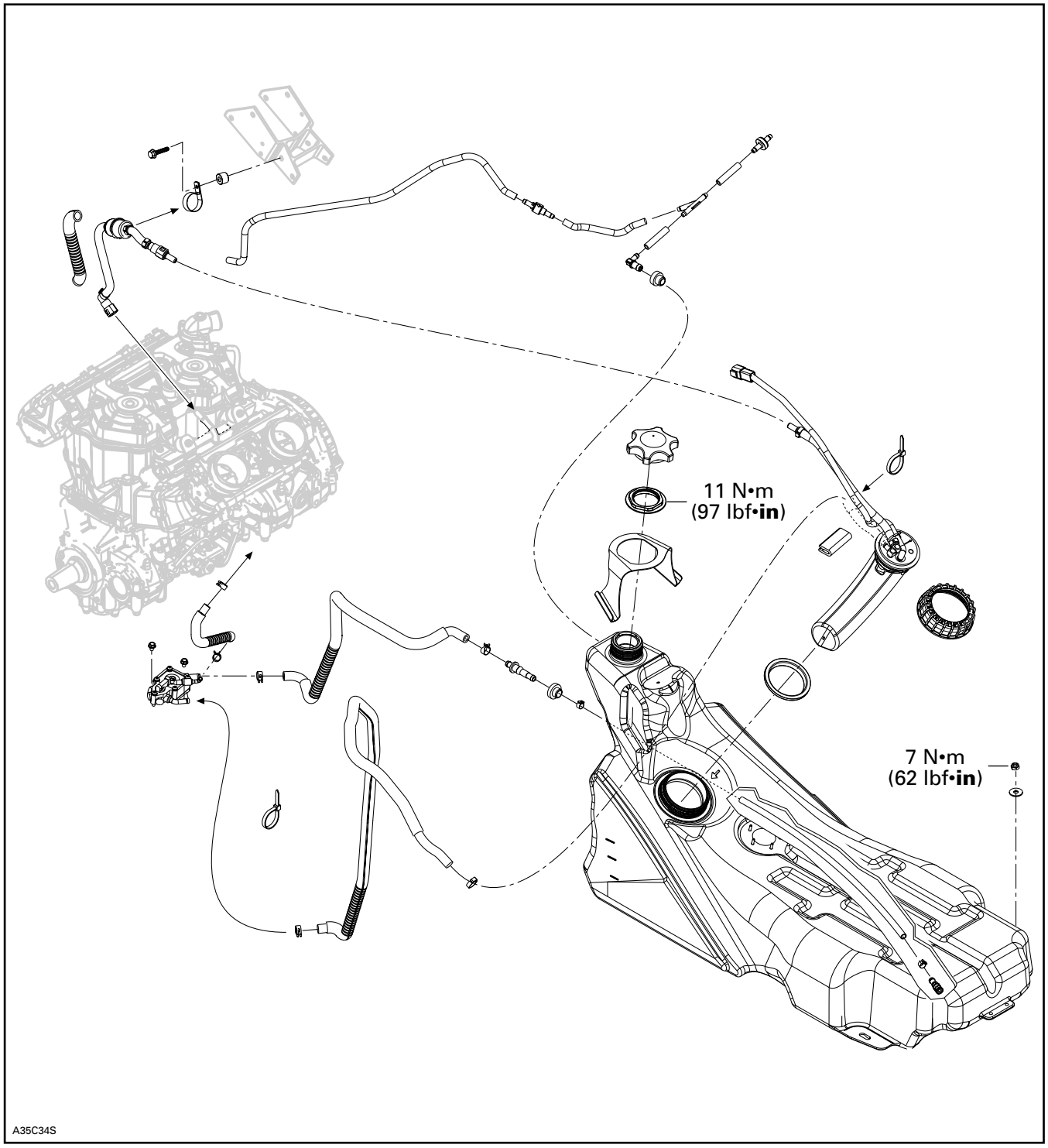
TYPICAL
1. Adjusting screw lock nut
C. Visible distance for oil pump adjustment

If the visible distance "C" is less or more than "A" + "B", adjust cable distance. To do so, loosen lock nut, turn adjusting screw in or out and retighten lock nut.

FUEL TANK AND FUEL PUMPS

SERVICE TOOLS

FUEL TANK



⚠ 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 VCK 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

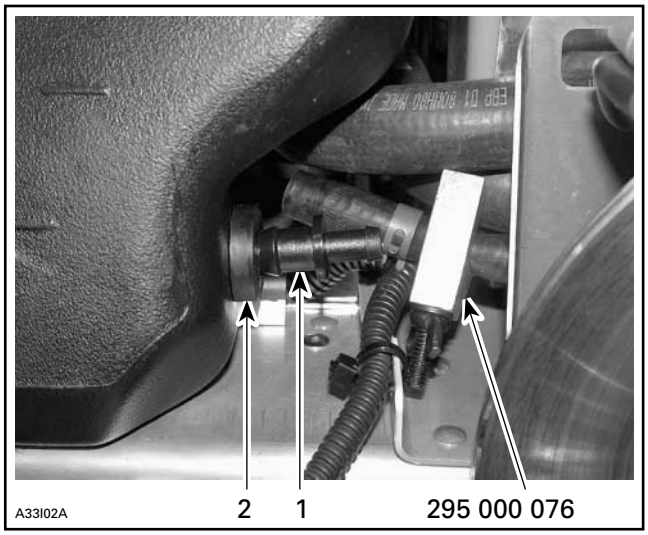
Whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or (P/N 529 032 500). Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or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

IN-TANK FUEL FILTER REMOVAL

Drain fuel tank.

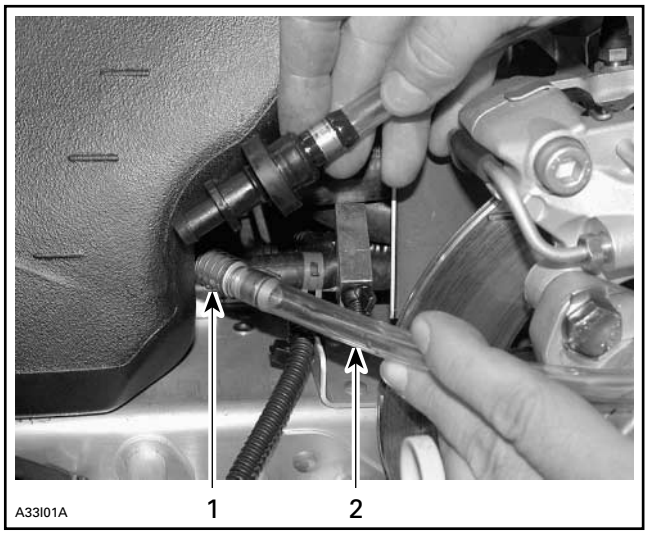
Install a hose pincher (P/N 295 000 076) on supply hose then, unplug hose.

Pull out male connector from grommet.



TYPICAL
1. *Male connector*
2. *Grommet*

Pull out grommet from fuel tank then, pull out pick-up hose and fuel filter.



TYPICAL
1. *Fuel filter*
2. *Pickup hose*

Replace fuel filter and grommet.

IN-TANK FUEL FILTER INSTALLATION

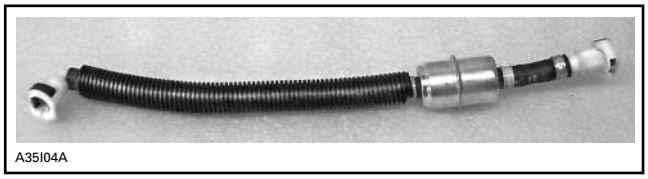
Installation is reverse of removal procedure. Pay attention to the following details.

To facilitate the installation, grommet should be on smaller diameter of male connector.

Install grommet on fuel tank and push male connector through grommet.

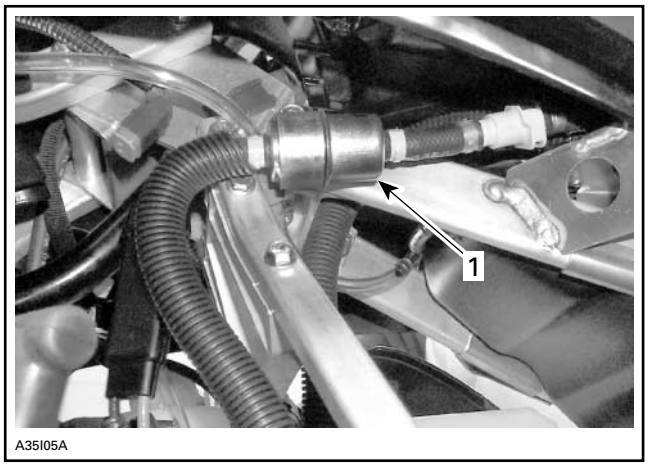
IN-LINE FUEL FILTER REMOVAL

Fuel filter, inlet and outlet hoses come as an assembly.


A35I04A

FUEL FILTER LINE ASS'Y

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



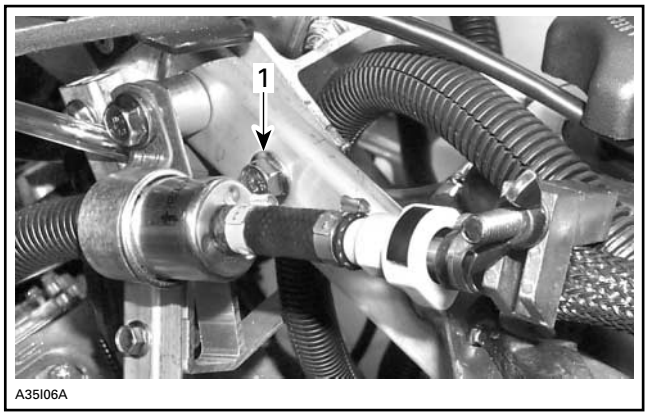
A35I05A

1. Fuel filter line ass'y

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

Disconnect both ends of fuel filter line ass'y.

Unscrew fuel filter support nut then remove the filter.



A35I06A

1. Unscrew fuel filter support

IN-LINE FUEL FILTER INSTALLATION

Installation is reverse of removal procedure.

FUEL TANK REMOVAL

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

Remove seat, refer to BODY.

Remove fuel tank cap.

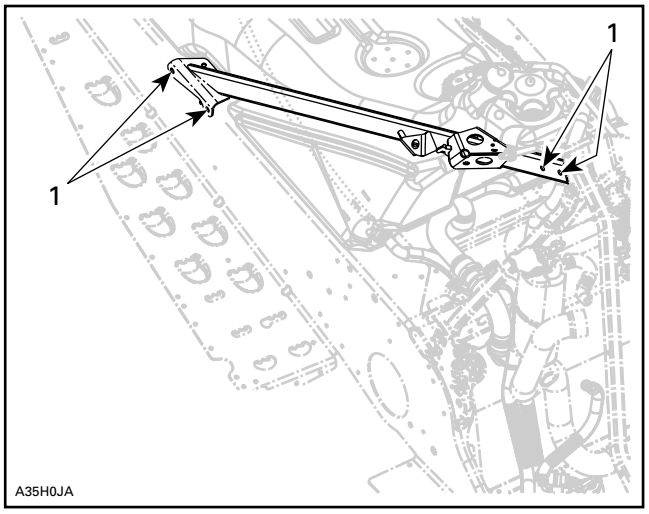
Remove filler neck plastic nut using wrench (P/N 529 035 891).

A33C1TA

TYPICAL

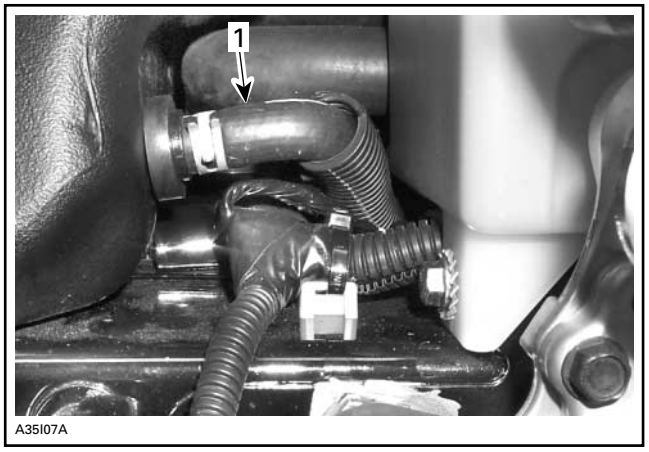
Remove on both sides, fuel tank aluminum braces and discard the following:

– Torx screws M8 x 13
– elastic flanged nuts M8.

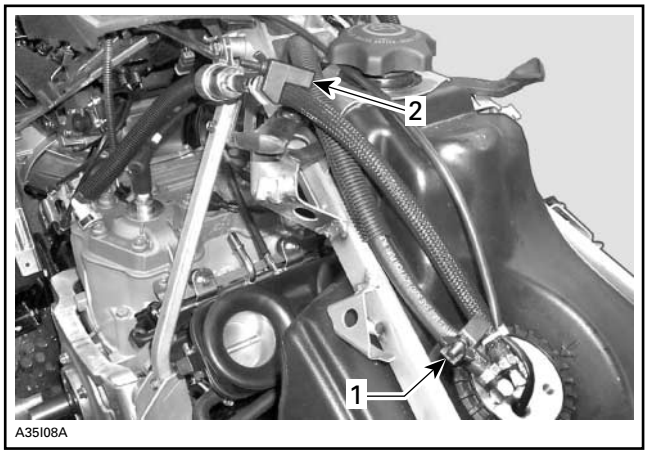


1. Unscrew the following on both sides

Install a hose pincher on the following hoses:



1. Fuel tank outlet hose

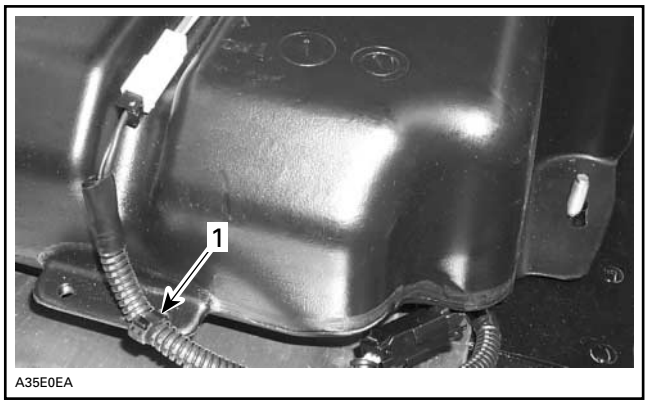


1. Fuel pump module INLET hose
2. Fuel pump module OUTLET hose

Unplug the following hoses:
- fuel tank outlet hose
- fuel pump module inlet hose
- fuel pump module outlet hose from fuel filter line ass'y
- fuel tank vent hose.

Unplug fuel pump module connector.

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



1. Cut locking tie

Slightly lift console then remove fuel tank.

FUEL TANK INSTALLATION

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

Replace clip on fuel pump module 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**)

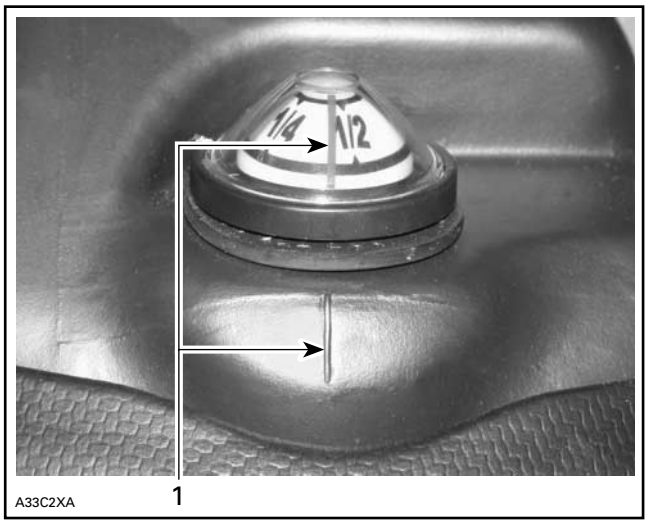
FLOAT-TYPE FUEL LEVEL GAUGE REMOVAL/INSTALLATION

Summit Highmark

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 INSPECTION

Mach Z

Fuel level sensor is integrated to the fuel pump. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

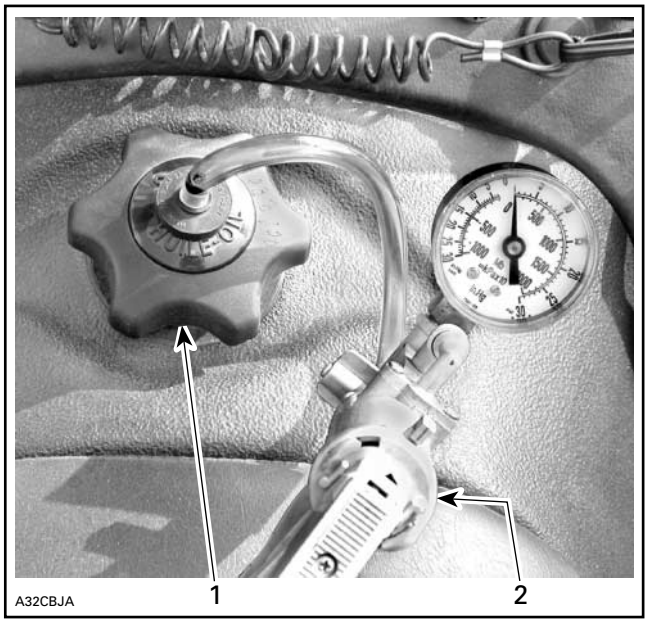
A 0.5 amp. fuse protects fuel level sensor circuity in fuse box.

FUEL SYSTEM PRESSURIZATION

Fill up fuel tank.

Install on fuel tank, the special cap of leak tester kit (P/N 529 033 100).

Using vacuum/pressure pump kit (P/N 529 021 800), inject air into fuel tank. See next photo.



TYPICAL
1. Special cap on tank
2. Air pump

Pressurize fuel system to 21 kPa (3 PSI). The pressure must not drop during 3 minutes.

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

To ease locating leak(s) at fuel tank vent fitting, fuel gauge or fuel cap, spray soapy water on components; bubbles will indicate leak location(s).

High Pressure Test (Electric Fuel Pump Circuit)

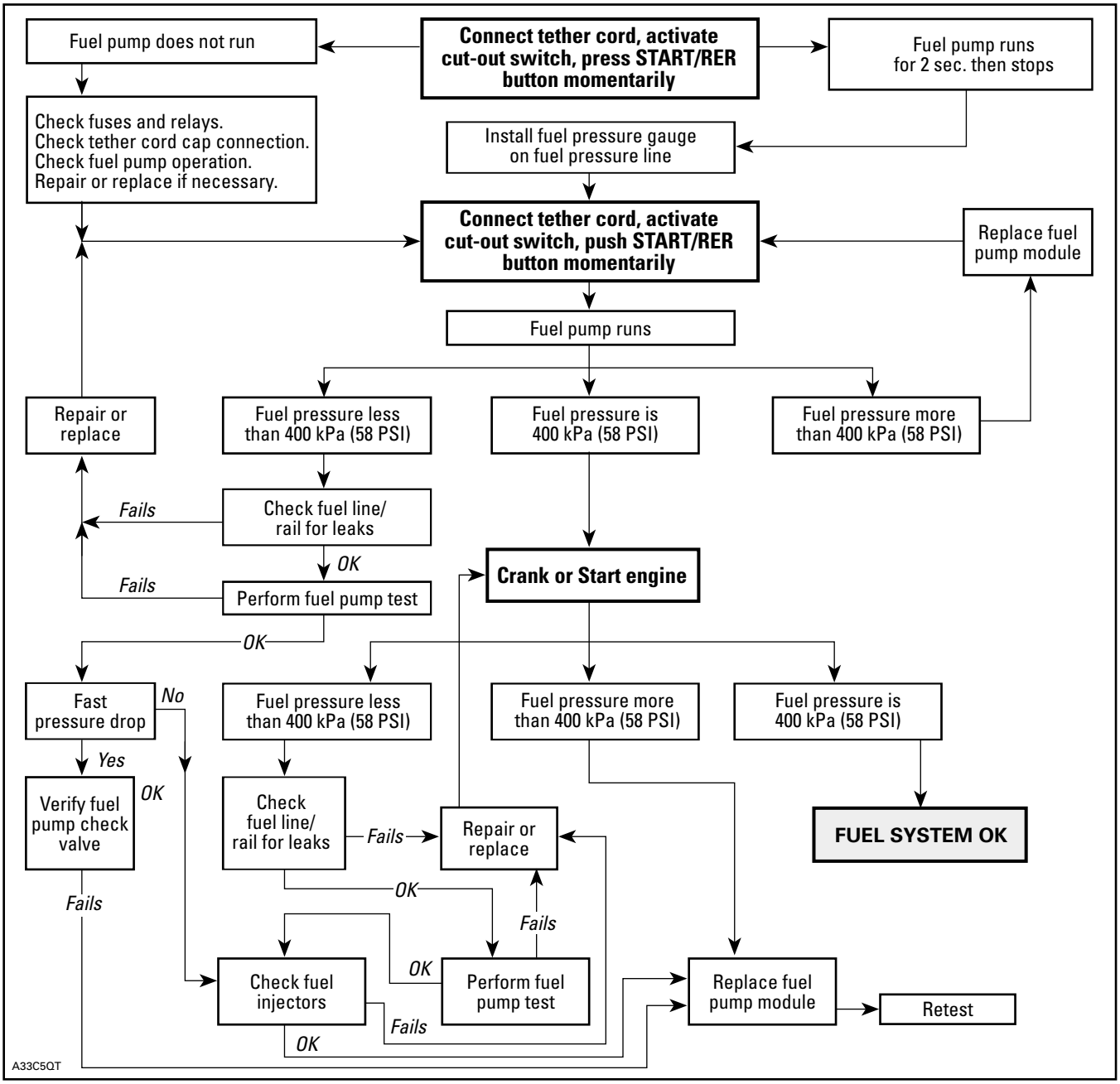
Install tether cord on DESS post. Push the emergency switch to OFF position. Push on start button to activate fuel pump.

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

ELECTRIC FUEL PUMP

DIAGNOSTIC FLOW CHART

NOTE: Before proceeding with any test, make sure that diaphragm fuel pump works properly.



ELECTRIC FUEL PUMP 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 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 fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

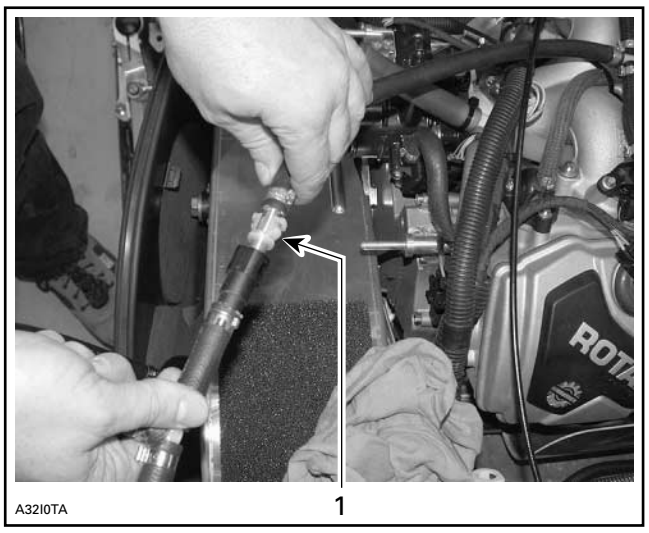
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

Remove plastic clip (P/N 275 500 429) from male fitting of pressure gauge (P/N 529 035 591).

Install the clip on male fitting of fuel rail inlet hose.



TYPICAL
1. Clip installed on male fitting of fuel rail inlet hose

Install fuel pressure gauge (P/N 529 035 591) between disconnected hoses (in-line installation).

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, fuel pump and pressure regulator are working adequately.

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

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

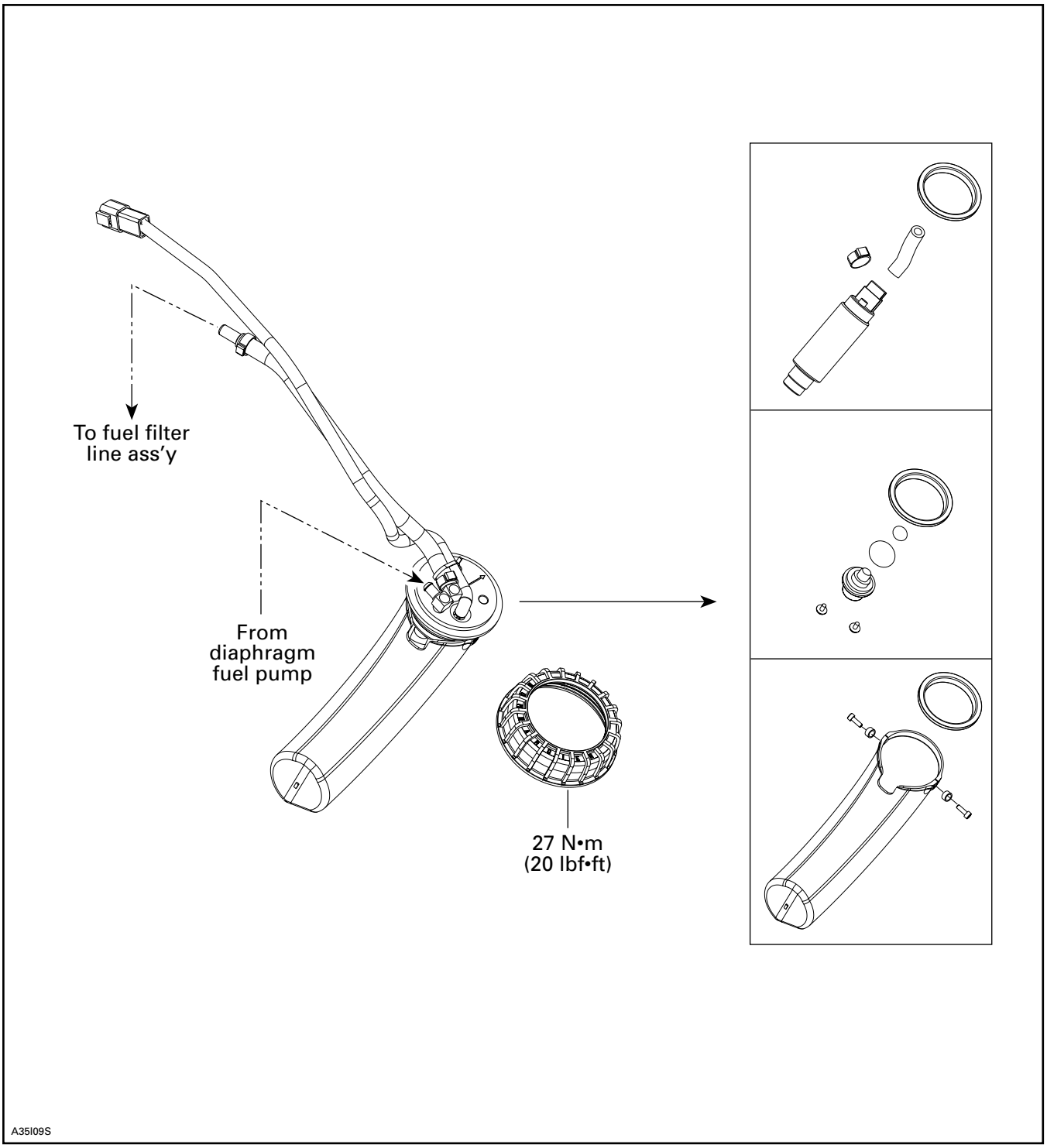
Remove pressure gauge and plastic clip from inlet hose. Reinstall fuel hose.

⚠ 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.

ELECTRIC FUEL PUMP



ELECTRIC FUEL PUMP REMOVAL

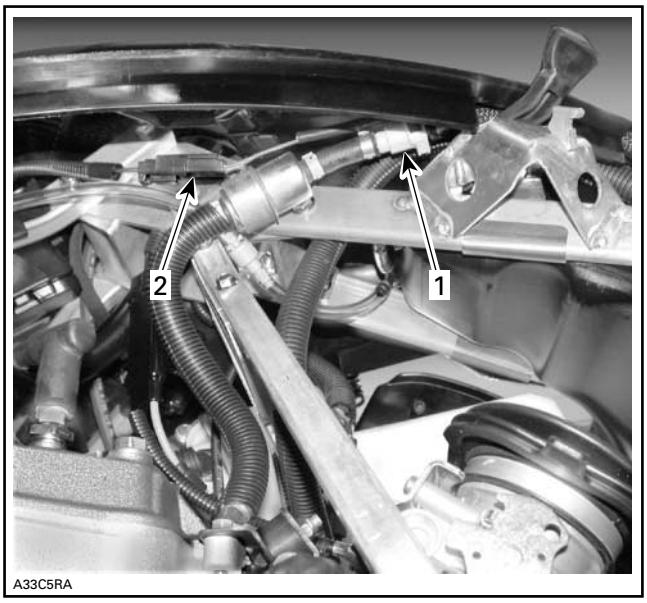
Remove seat, refer to BODY.

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

Drain fuel tank as much as possible.

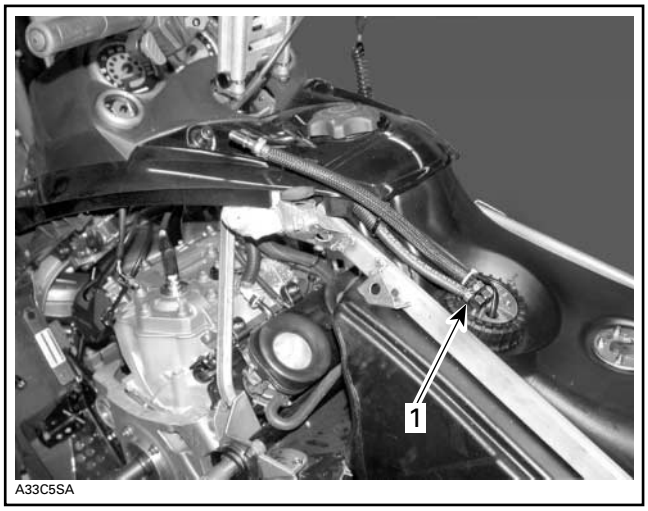
Disconnect fuel supply hose from fuel filter line ass'y.

Disconnect fuel pump electrical connector.



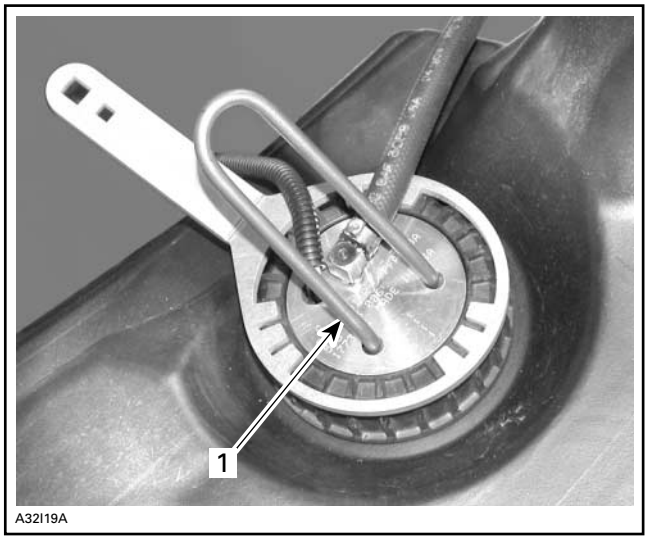
1. Disconnect fuel filter line ass'y
2. Unplug connector

Disconnect hose coming from diaphragm pump.



1. Disconnect hose

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



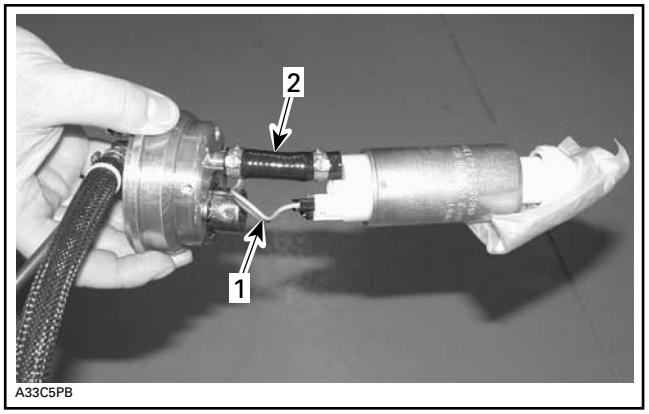
1. Bent rod

Remove fuel pump assembly.


A33C5TA

Disconnect pump electric connector.

Disconnect hose from pump.



A33C5PB

1. *Electrical connect*
2. *Pump hose*

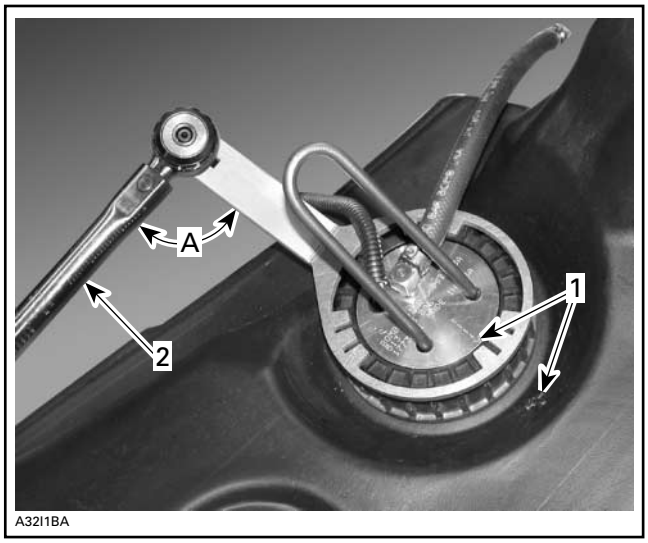
ELECTRIC FUEL PUMP INSTALLATION

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.

Manual Start Models

NOTE: When fuel tank is completely emptied, it may require up to 25 - 30 pull on rewind starter to fill the electric fuel pump reservoir. Filling the fuel tank will solve this problem. The fuel inside the fuel tank will flow through the bypass hole of the electric fuel pump reservoir.

ELECTRIC FUEL PUMP PRESSURE REGULATOR REMOVAL/INSTALLATION

Remove fuel pump assembly as explained above.

Remove 2 screws retaining regulator to pump assembly flange.

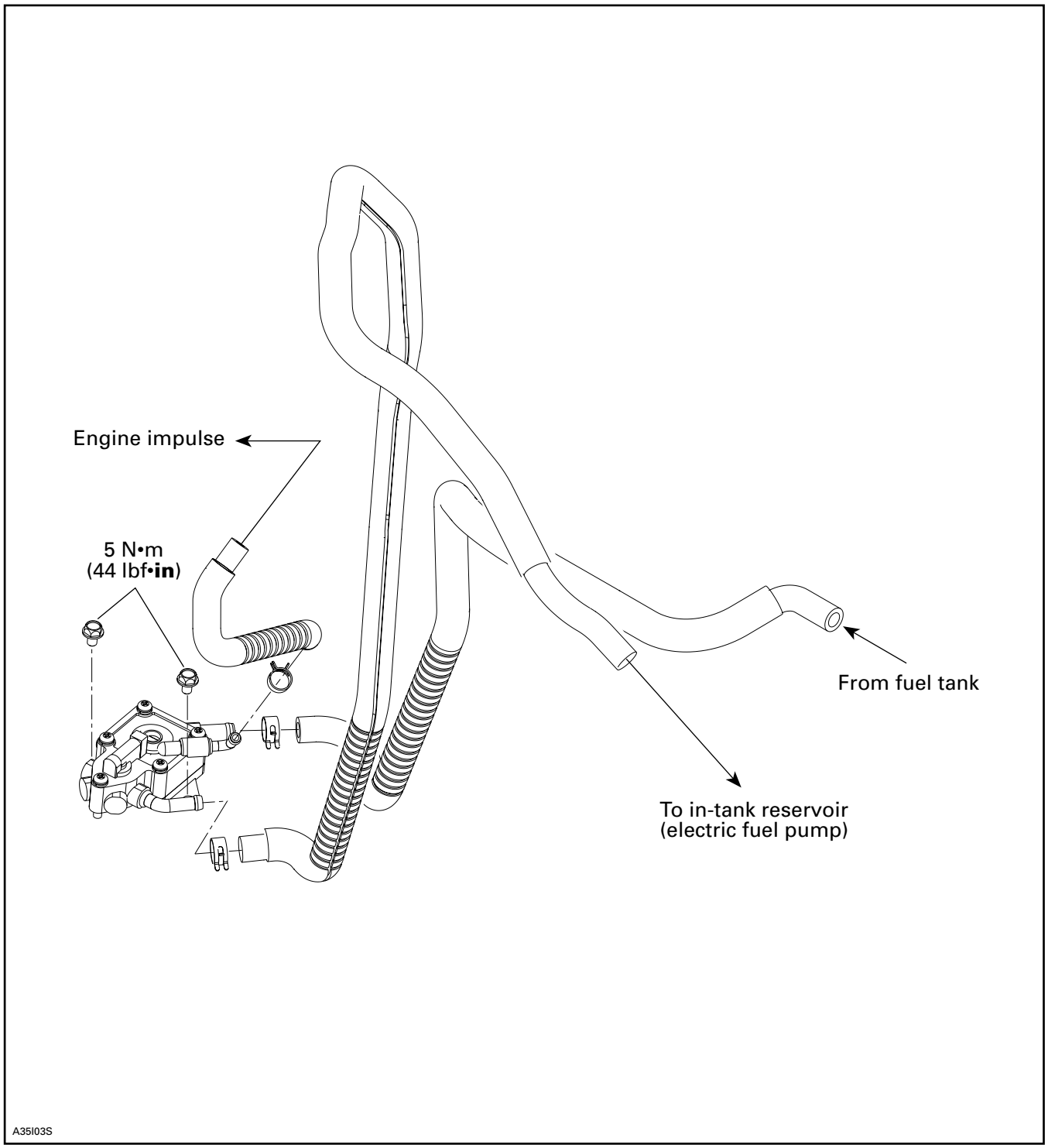
Replace O-rings with new ones. Install them in pump assembly flange bore.

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.

DIAPHRAGM FUEL PUMP



DIAPHRAGM FUEL PUMP REMOVAL

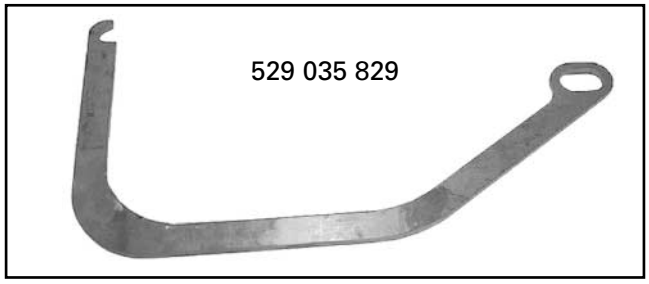
Remove the following:
- muffler, refer to ENGINE
- belt guard
- air silencer (engine side), refer to ENGINE
- engine supports elastic nuts.

Unplug magneto connector.

Remove both spark plugs.

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

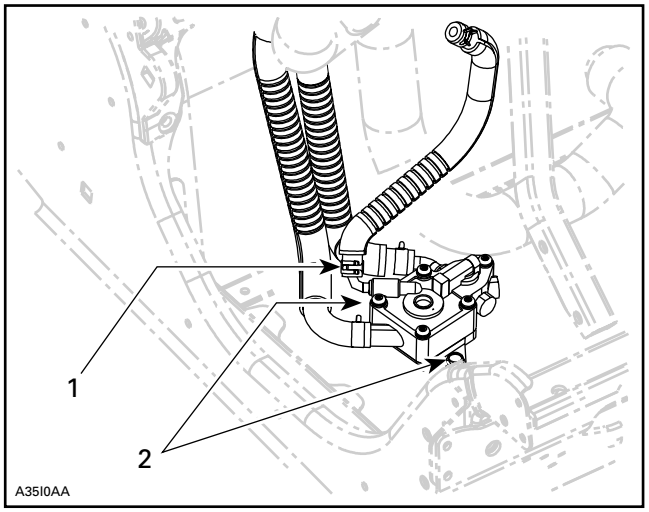
Using the engine removal hook (P/N 529 035 829), lift engine until engine supports are free from rubber mount studs.



Unplug engine vacuum hose from pump.

Cut locking tie holding fuel pump inlet and outlet hoses.

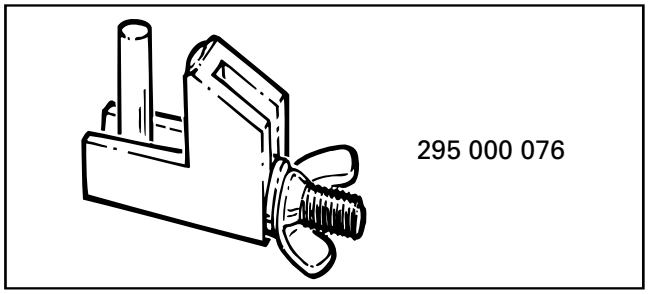
Remove screws retaining fuel pump to frame.



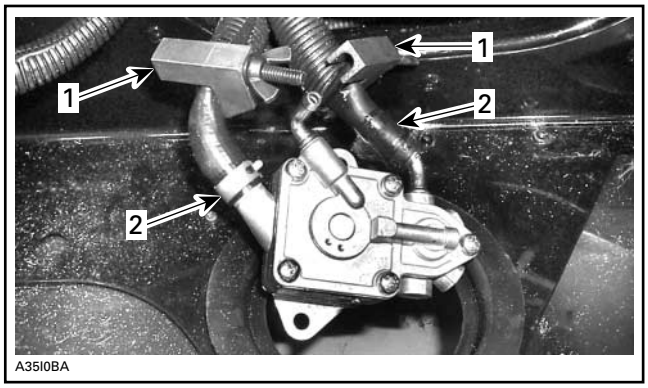
1. Unplug vacuum hose
2. Remove screws

Pull out fuel pump from under the engine.

Install a hose pincher (P/N 295 000 076) on inlet and outlet hoses.



Unplug inlet and outlet hoses then remove fuel pump.



1. Install hose pincher
2. Unplug hoses

DIAPHRAGM FUEL PUMP VERIFICATION

Check fuel pump valves operation as follows:

Connect a clean plastic tubing to the inlet nipple and alternately apply pressure and vacuum with pump of leak test kit. The inlet valve should release with pressure and hold under vacuum.

Repeat the same procedure at the outlet nipple. This time the outlet valve should hold with pressure and also under vacuum.

NOTE: Plug remaining outlet with finger while checking outlet valve.

Check impulse diaphragm and gasket on fuel pump with twin outlets as follows:

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover on so equipped models. Either apply pressure or vacuum. The diaphragm/gasket must not leak.

DIAPHRAGM FUEL PUMP CLEANING AND INSPECTION

The entire pump should be cleaned with general purpose solvent before disassembly.

Fuel pump components should be cleaned in general purpose solvent and dried with compressed air.

⚠ WARNING

Solvent with low flash point such as gasoline, naphtha, benzol, etc, should not be used as each is flammable and explosive.

Inspect diaphragm. The pumping area should be free of holes, tears or imperfections. Replace as needed.

DIAPHRAGM FUEL PUMP INSTALLATION

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

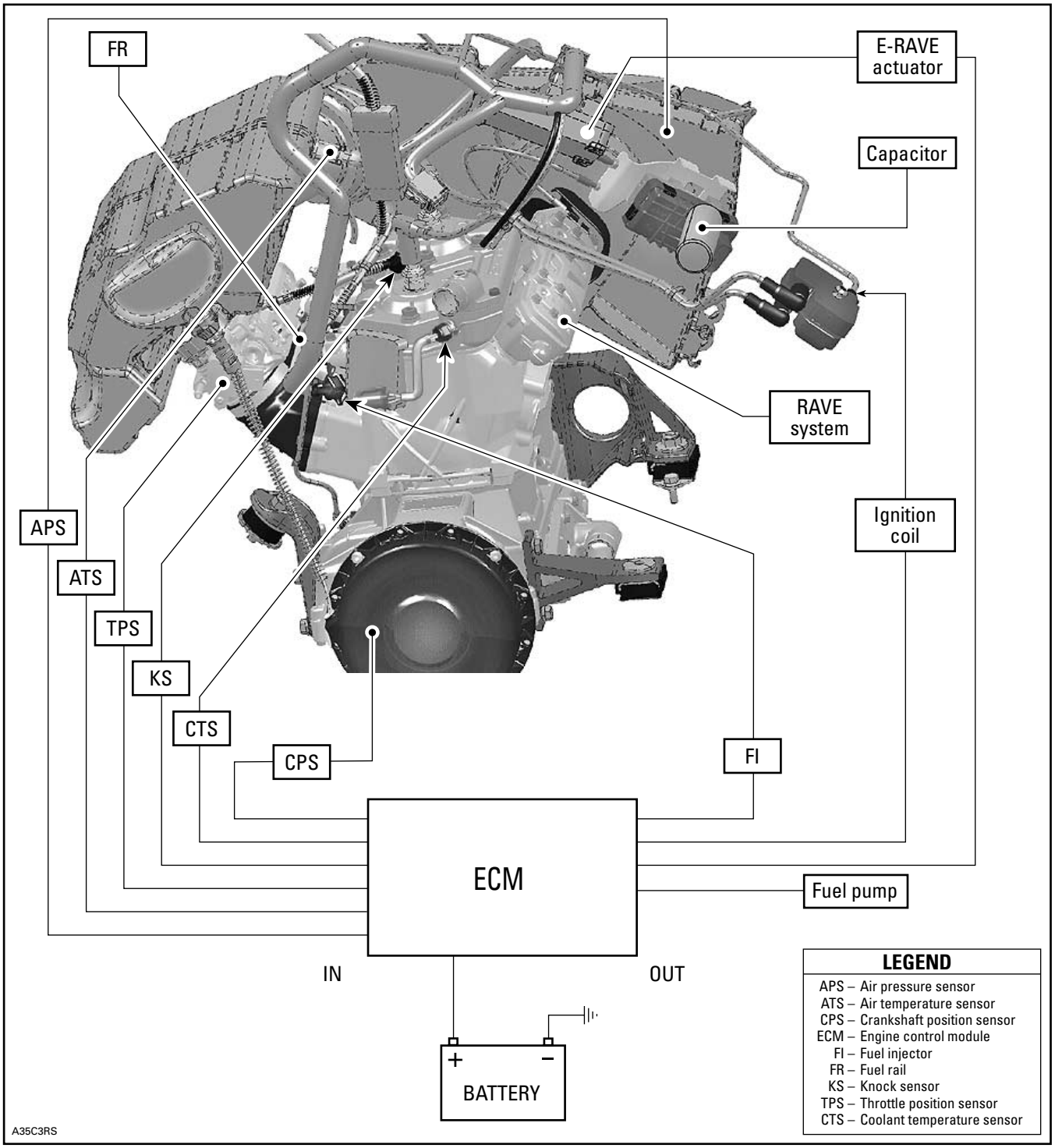
⚠ WARNING

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

Respect the following tightening torque specification:

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

OVERVIEW



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.

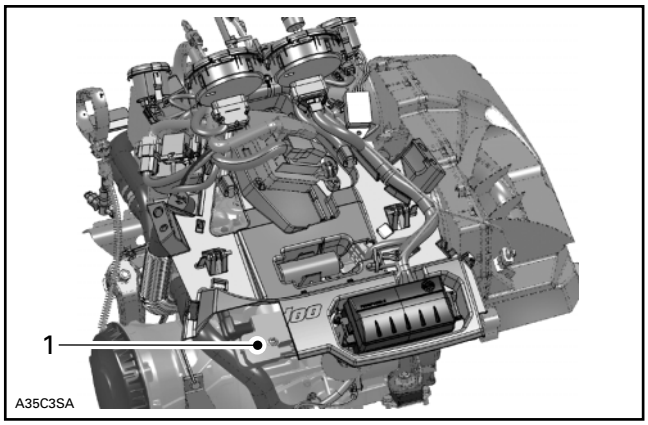
Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

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.

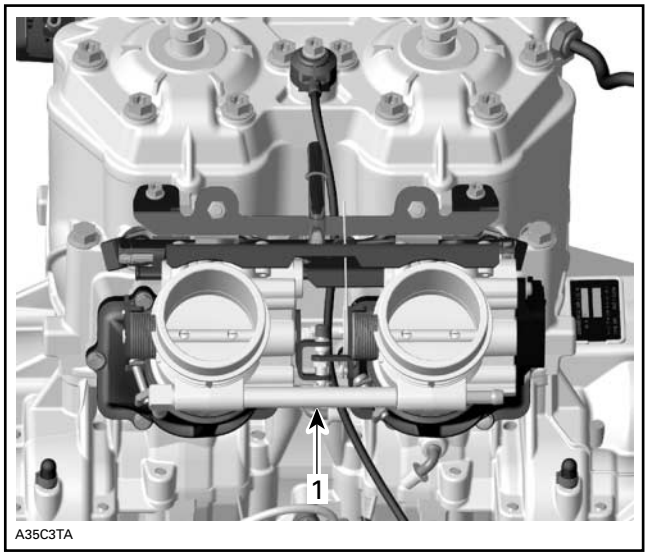
Double ignition coil is located underneath multi function plate.



1. Ignition coil

AIR INDUCTION

Through air filter mounted LH side panel, air goes into air silencer. The ECM measures at this point air pressure and temperature. Then, air for combustion is drawn through two throttle bodies. The air flow is controlled by two throttle plates. The air continues through the reed valves into the cylinder base then the crankcase.



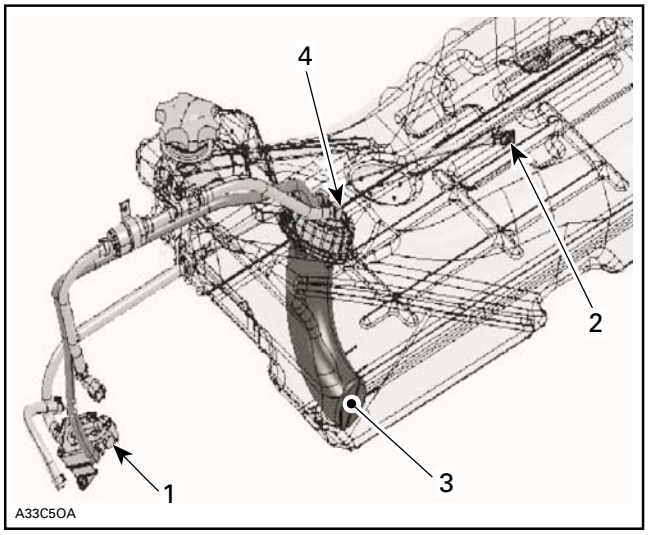
THROTTLE BODY ASSEMBLY
1. Coolant-heated line

FUEL DELIVERY SYSTEM

Diaphragm Fuel Pump

A conventional diaphragm 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.

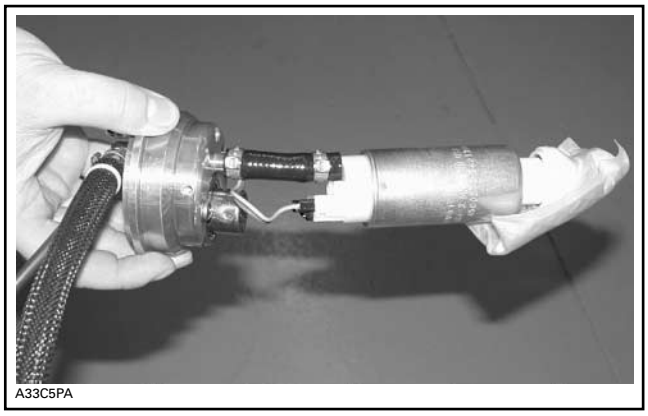


1. Diaphragm pump
2. Fuel pick-up
3. Pump reservoir
4. Electric fuel pump

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.



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).

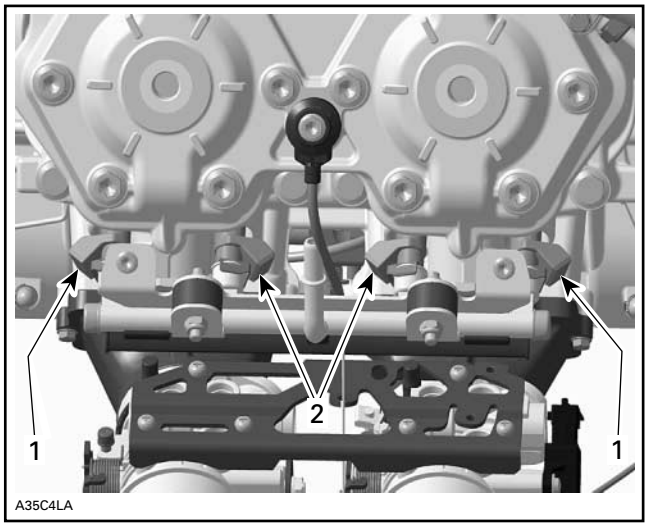
Fuel Rail

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.



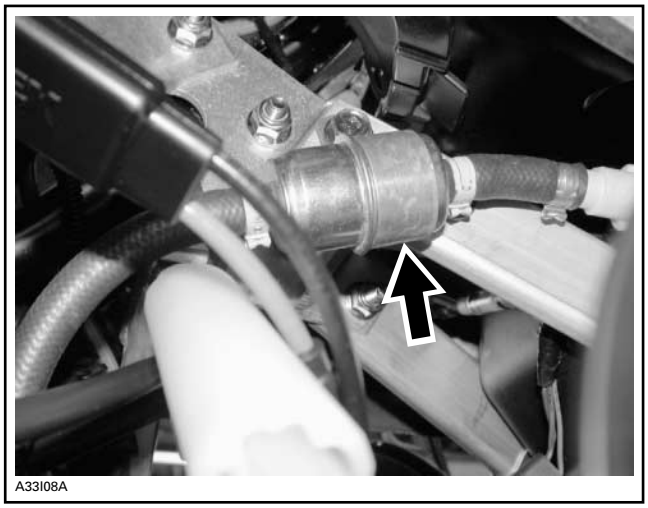
1. Outer injectors (blue)
2. Inner injectors (brown)

Throttle Body

It is a dual throttle body 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.

In-Line Fuel Filter

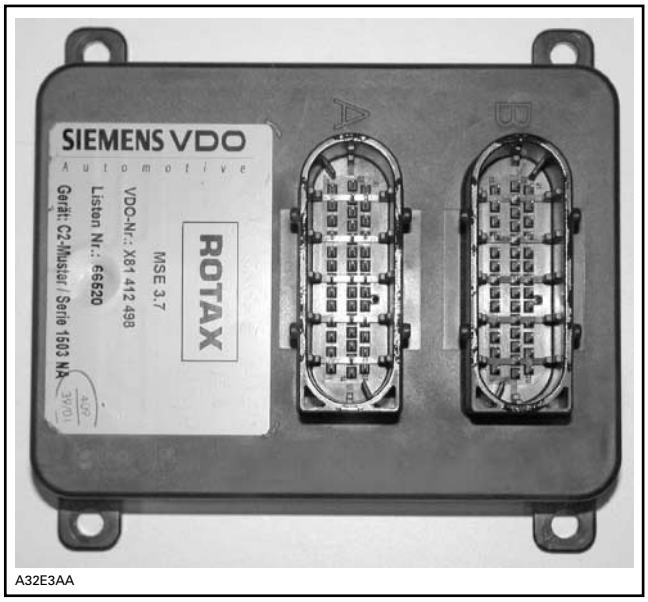
The in-line 10 micron fuel filter is fastened under the steering console. It should be replaced annually.



TYPICAL

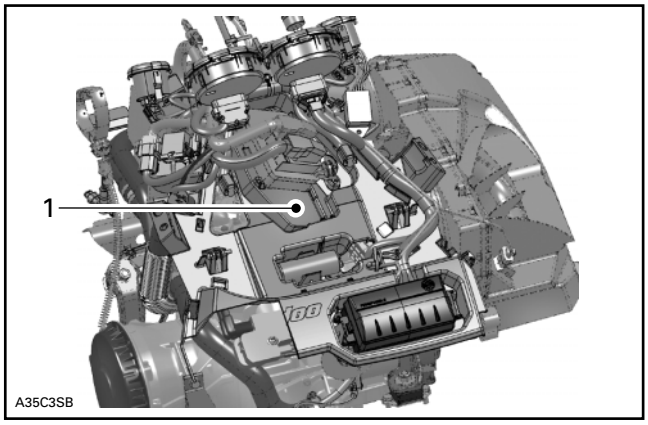
ENGINE MANAGEMENT SYSTEM (EMS)

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 system
- start/stop functions
- E-RAVE actuator control
- DESS (Digitally Encoded Security System)
- RER (Rotax Electronic Reverse)
- monitoring system
- diagnostic mode

The ECM also stores general informations such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) code, fault codes and other vehicle information, even when the battery is removed from the vehicle.

As shown in the SDI CONTROL 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 proper engine management.

Manual Start Models

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 pump, the ignition coil, the injectors, and the gauges.

The battery is required to supply current mainly to the fuel pump 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).

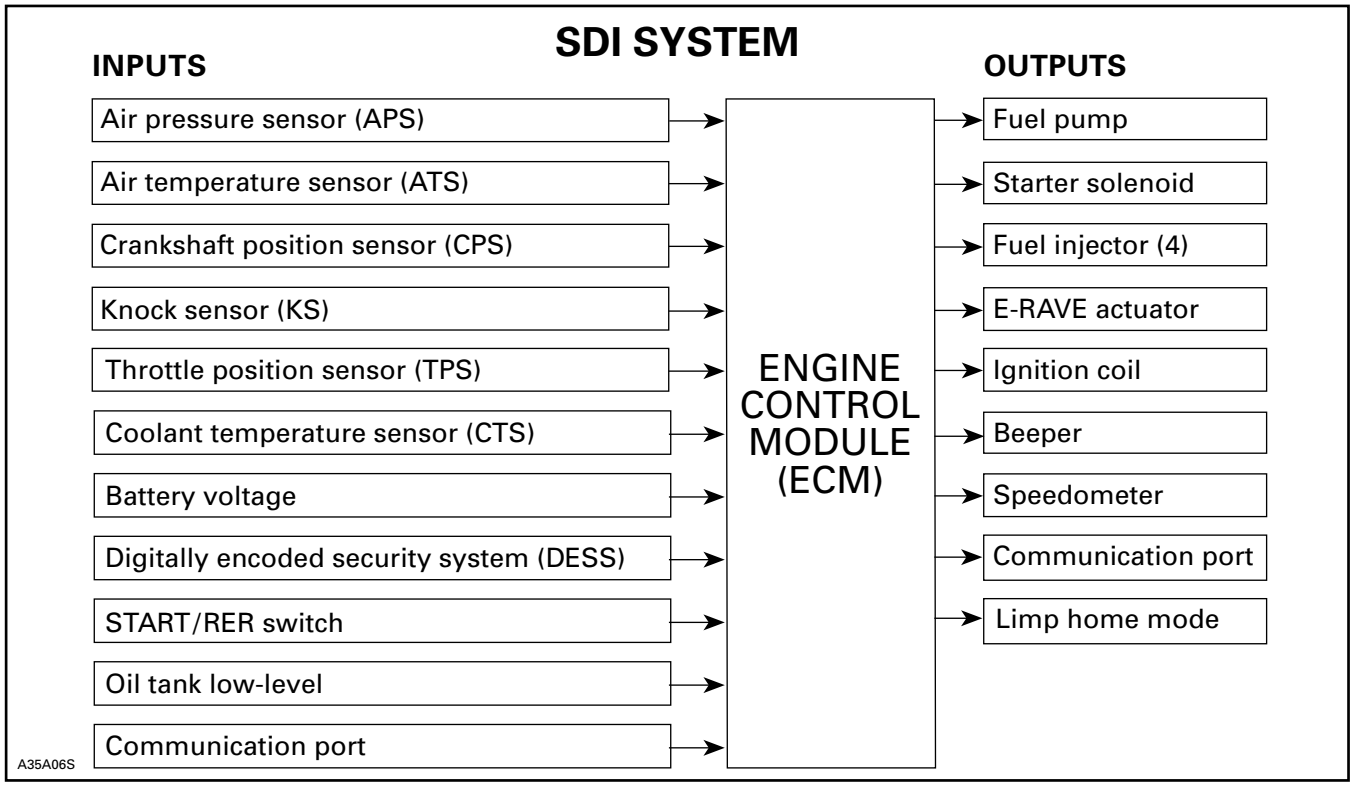
Electric Start Models

When the START/RER switch is activated, it wakes up the EMS and power the starting system relay (R1), the ECM, the fuel pump, 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).

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



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 pump and starting system relay (R1), a second for the lighting system and the accessories (R2) and a third for the capacitor circuit (R4).

Electric Start Models

The system uses 2 relays: an ignition/injectors, fuel pump and starting system relay (R1) and a headlights and accessories 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 pump 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.

Flooded Engine Mode (Drowned Mode)

If the engine does not start and it is fuel-flooded, this special 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.

Manual Start Models

Crank engine several times.

Electric Start Models

Press the START/RER button.

The engine should be cranked for 20 seconds. Release START/RER button.

All Models

In the engine drowned mode, engine cannot start. It is required to release throttle lever and to start/crank engine again to allow starting.

NOTE: If the engine does not start, it may be necessary to replace the spark plugs.

IGNITION SYSTEM

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.

Engine RPM Limiter

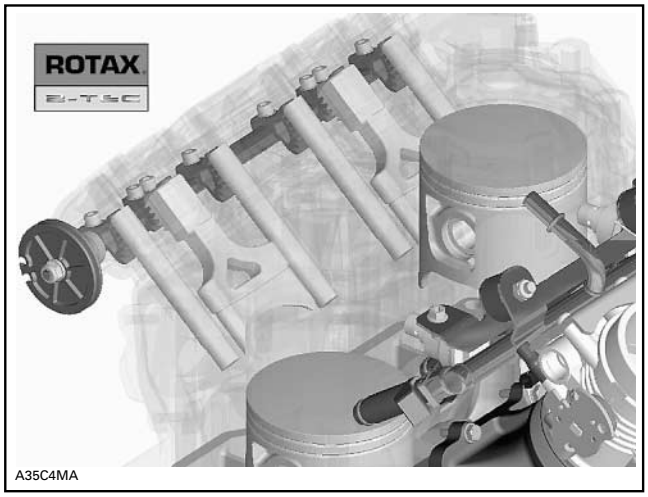
The ECM will limit the maximum engine speed.

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.

ELECTRONICALLY CONTROLLED RAVE (E-RAVE)

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.

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

The following components are specially designed for this system: ECM, tether cord cap and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post.

The tether cord cap 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 tether cord cap. This is achieved with the VCK (Vehicle Communication Kit) (P/N 529 035 981). Refer to their operation manual or help system to program a tether cord cap.

529 035 981

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap 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 tether cord cap on the post, the DESS is activated and will emit audible signals:

– 2 short beeps indicate a working tether cord cap. Vehicle can be driven.
– short repetitive beeps indicates a wrong tether cord cap is being used or that something is defective. Vehicle can not be driven.

Engine Starting

If the ECM recognizes a valid tether cord cap, it allows engine to rev above 3000 RPM.

ROTAX ELECTRONIC REVERSE (RER)

There is 3 main components used for the RER system: the START/RER switch, the ECM and the crankshaft position sensor.

The ECM receives signals from the crankshaft position sensor (CPS) for the following functions:

– Forward engine rotation.
– Reverse engine rotation.
– Crankshaft position and engine RPM.

The ECM recognizes a signal sent by the START/RER switch.

When switch is activated and engine is not running, ECM allows normal engine starting.

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 START/RER button.

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.

Limp Home Mode

Besides the signals as seen above, 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.

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.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
GRAY diagnostic key	529 035 896	134
supply harness	529 035 869	133
VCK (Vehicle Communication Kit)	529 035 981	132

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

- Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
- Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
- Check all fuses, relay(s), battery and capacitor (on so equipped models).
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT section for procedures.

TROUBLESHOOTING

The following chart is provided to help in diagnosing the probable source of simple troubles.

Monitoring Beeper Coded Signals

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above clutch engagement.	No problem detected. Good ride.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection. Defective tether cord cap. Dirt or snow in tether cord cap. Defective DESS post.	Reinstall tether cord cap correctly over post. Use another programmed tether cord cap. Clean tether cord cap. Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into ECM.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
1 long beep (2 seconds) every 15 minutes.	Low battery voltage.	Check battery and charging system.
4 short beeps every 2 minutes. Oil pilot lamp also lights up.	Low oil level on 2-TEC models.	Check oil level and replenish as soon as possible.

Many other codes use the engine pilot lamp and the beeper to indicate a problem. Refer to B.U.D.S. for possible causes and service actions.

EMS FAULT CODES

General

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 VCK. This will properly reset the appropriate counter(s). This will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first, etc.) and report, refer to B.U.D.S. online help.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTATION FAILURE.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS.	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.

Supplemental Information

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred to as DA-41, which means connector "A" on the ECM and the circuit 41.

Manual Start Models

Fault code P0616: 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.

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.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
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.
P0078	BLINK	OFF	E-RAVE actuator functional problem.
P0107	BLINK	OFF	Air pressure sensor voltage too low.
P0108	BLINK	OFF	Air pressure sensor voltage too high.
P0600	BLINK	OFF	E-RAVE actuator communication problem.
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.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
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.
P0562	OFF	2 s beep/min.	Battery voltage too low.
P0563	BLINK	2 s beep/min.	Battery voltage too high.

VCK (Vehicle Communication Kit)

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management and fuel injection related problems.

529 035 981

NOTE: The MPEM programmer does not work on **SDI models**.

Ensure to use the latest version of B.U.D.S. available on BOSSWeb.

B.U.D.S. (BRP Utility and Diagnostic Software) is designed to allow actuators, sensors and electronic equipments inspection, diagnostic options and reset such as the closed throttle.

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 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.

VCK Supply

The VCK (MPI box) 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.

Connecting VCK to Vehicle

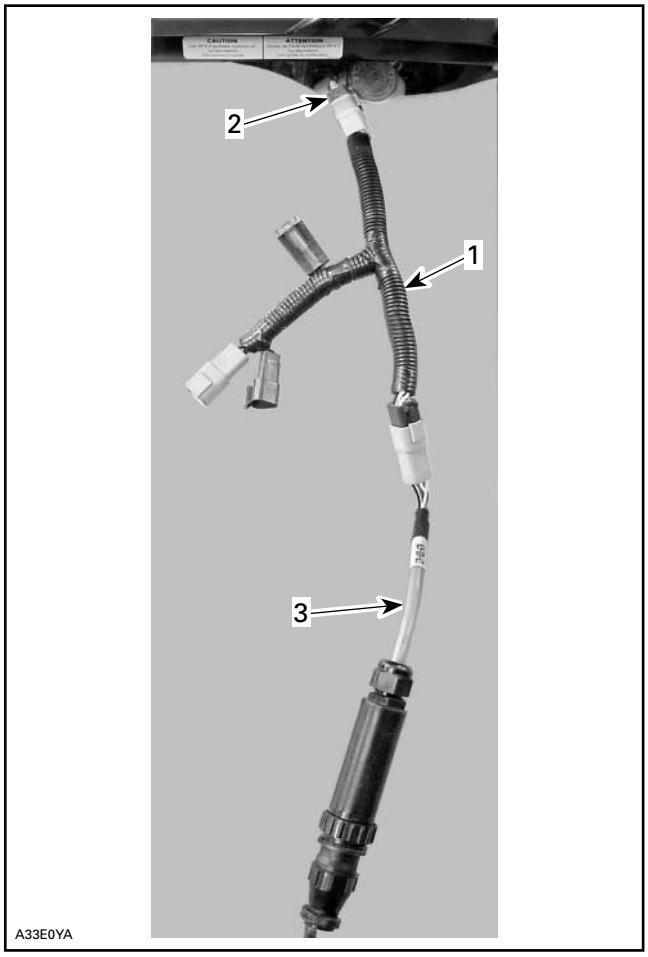
Remove the 6 pin connector from the protective cap on the right side of the vehicle.

1. Remove connector from cap

Connect supply harness (P/N 529 035 869), to vehicle 6-pin connector.

Connect the 6 pin diagnostic cable from VCK to supply harness.

NOTE: SDI engines already have a 12 V battery; they do not need any external 9 V or 12 V power to allow programming and 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 if no communication takes place.



1. Supply harness
2. Vehicle 6-pin connector
3. VCK cable

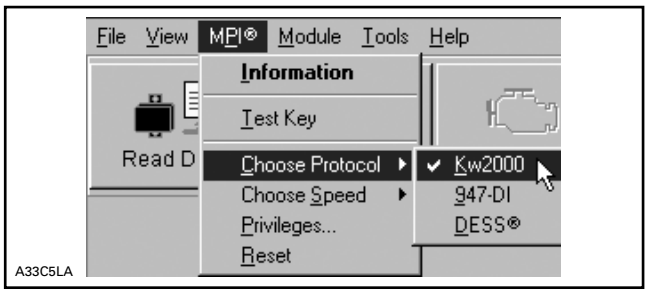
CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Set engine cut-out switch to OFF.

Install the GRAY diagnostic key (P/N 529 035 896) or any DESS cap onto the vehicle DESS post.

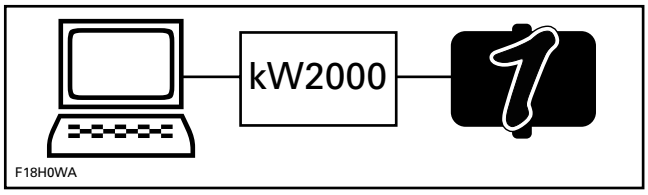
When using the software B.U.D.S., with the SDI:

– 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 means that one module is connected with the PC.



ONE MODULE IS CONNECTED

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 module.

Writing in ECM

When writing in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove the tether cord cap from its post and wait until the message disappears (it lasts approximately 5 seconds after tether cord cap removal).

COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	138
Fluke 111	529 035 868	137
hose pinchers	295 000 076	146
VCK (Vehicle Communication Kit)	529 035 981	135

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	143
Loctite 5910	293 800 081	151, 154
pulley flange cleaner	413 711 809	147

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 VCK (Vehicle Communication Kit) (P/N 529 035 981) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S. (ensure to use the latest version available on BOSSWeb).

529 035 981

⚠ 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 VCK 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 30 A fuse prior to working on the fuel system. After performing a pressure test, release the pressure.

– Always disconnect battery properly or remove 30 A fuse prior to working on the fuel system. Refer to BATTERY 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, a good quality multimeter such as Fluke 111 (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 Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES for proper connectors/adaptors.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. Do not touch the sensor itself. It may cause wrong result during measurement, because of body heat.

The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, some of our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

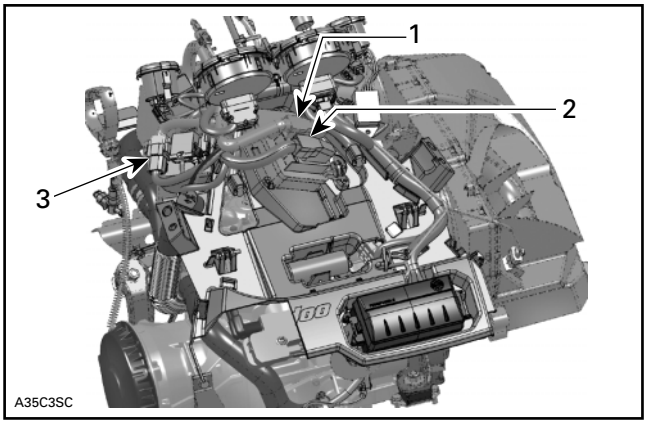
TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
- 40	- 40			72412
- 35	- 31			52637
- 30	- 22	28000		38681
- 25	- 13			28718
- 20	- 4	14500	733.8	21529
- 15	5		587.7	16288
- 10	14		474	12431
- 5	23		384.8	9565
0	32	5500	314.3	7418
5	41		258.4	5807
10	50		213.7	4582
15	59		177.7	3644
20	68	2500	148.7	2919
25	77		125	2355
30	86		105.6	1912
35	95		98.69	1562
40	104	1200	76.5	1284
45	113		65.54	1062
50	122		56.38	882.6
55	131		48.72	738.9
60	140	600	42.28	622
65	149		36.82	526.3
70	158		32.19	447.5
75	167		28.24	382.3
80	176	320	24.86	328.1

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
85	185		21.95	282.8
90	194		19.45	244.8
95	203		17.28	212.8
100	212	180	15.4	185.6
105	221			162.4
110	230			142.7
115	239			125.9
120	248			111.5
125	257			99.02
130	266	90		88.26
135	275			78.93
140	284			70.81
145	293			63.71
150	302			57.49

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at 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 while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

Connector Identifications



1. ECM A-connector
2. ECM B-connector
3. Engine/vehicle connector

ECM Connectors

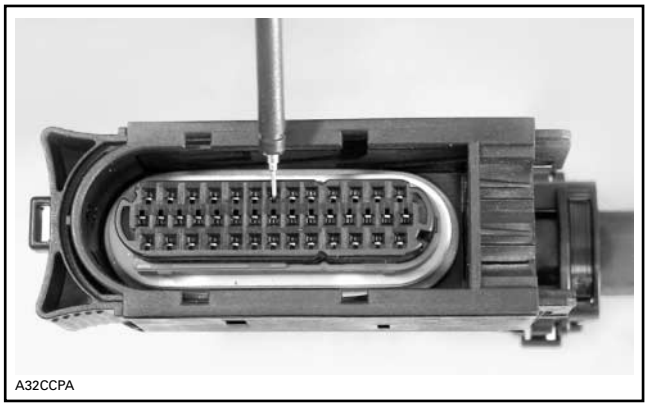
The most recommended and safest method to probe ECM connector terminals is to use the ECM adapter (P/N 420 277 010). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.

420 277 010

Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool holes.

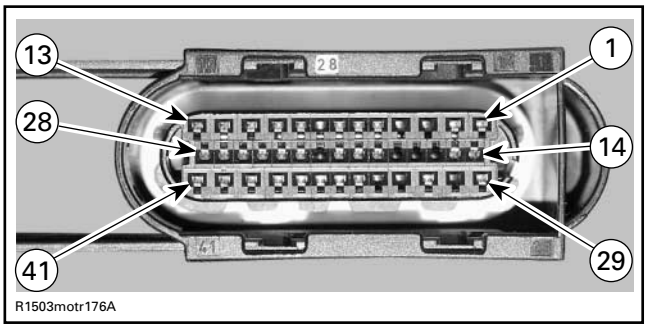

A35C3UA

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.


A32CCPA

PROBE ONLY TOP OF TERMINAL

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.



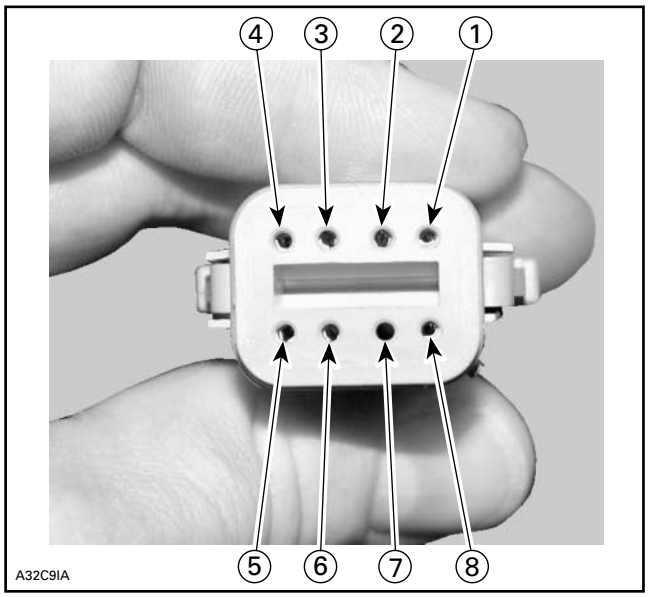
R1503motr176A

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.



A32C9IA

TERMINAL IDENTIFICATION OF ENGINE/VEHICLE CONNECTOR (WIRING HARNESS SIDE)

Relay 2

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **relay 2** from **Activation tab**.

Listen to or touch relay to feel it click.

If the relay does not work, disconnect the connector from 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 voltage reads 12 V, check continuity of ORANGE/GREEN wire between relay connector and terminal B-16 of ECM connector. If faulty, repair wire/connector. If wire/connectors test good, try a new ECM.

If voltage does not read 12 V, check continuity of wire on supply side of relay. If faulty, repair wire/connector. If wire/connectors test good, refer to ELECTRICAL SYSTEM to test output side or relay.

TESTING PROCEDURES

ELECTRIC FUEL PUMP

Electrical Test

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work and there is no fault codes, disconnect the plug connector from the fuel pump.

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

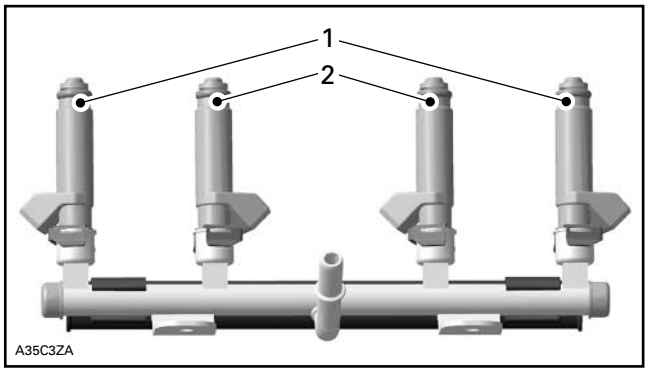
If pump does not run, replace the fuel pump module. Refer to FUEL SYSTEM section.

Otherwise, probe terminal 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 terminal 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.

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 REMOVAL in FUEL RAIL 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

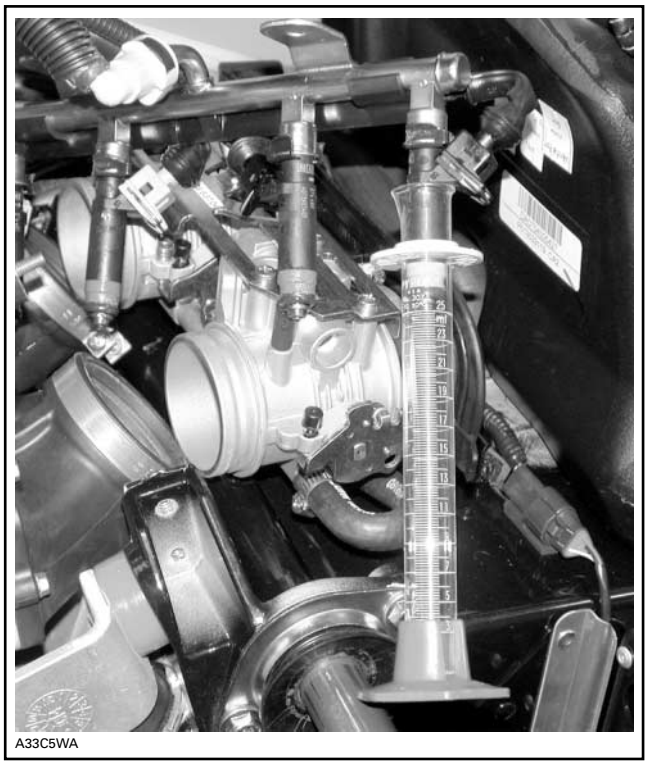
To continuously supply the electric fuel pump for the tests, an external 12 V battery is required. The small battery on the vehicle is not sufficient.

All Models

Use an appropriate burette graduated for 25 mL (.85 US on). The Pirex® no 3075 (or equivalent) works fine.


A33C5VA

Place injector inside top of burette.


A33C5WA

Connect vehicle communication kit (VCK) and 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 (US 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.

Using the vehicle communication kit (VCK) with the 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

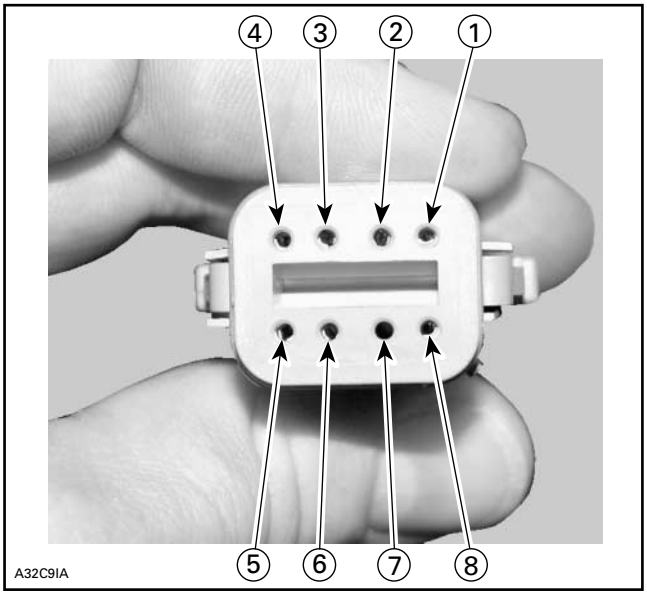
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

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 ECM REPLACEMENT procedures 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.

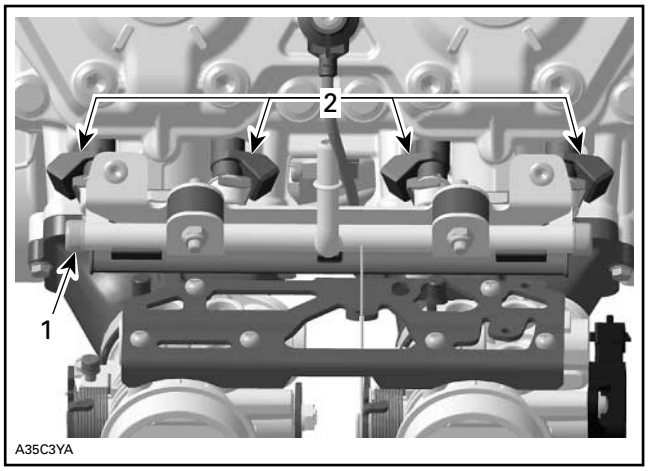
Fuel Injector Replacement

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.

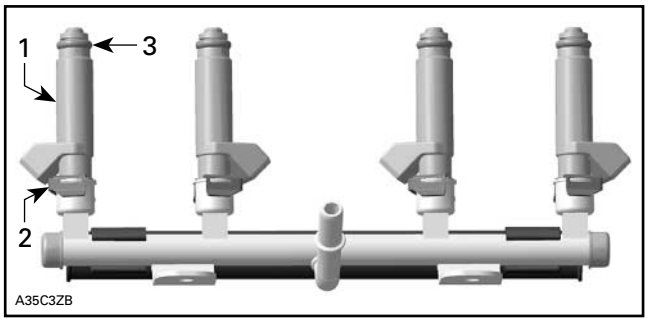
Remove the harness support from the fuel rail.

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.



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.

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**).

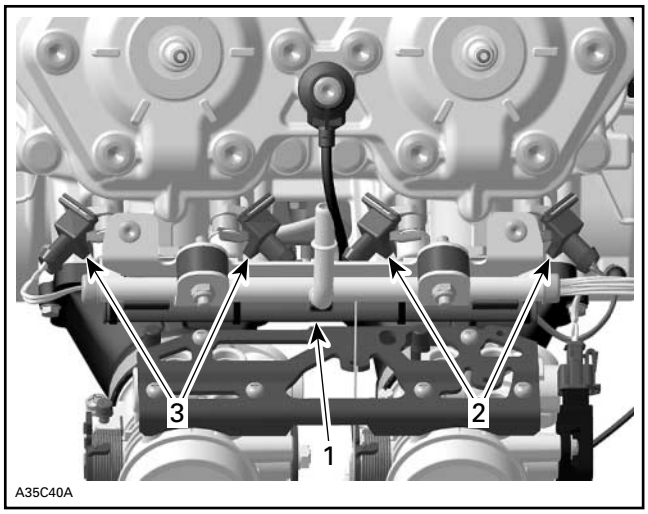
When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

Attach the harness support to the fuel rail.

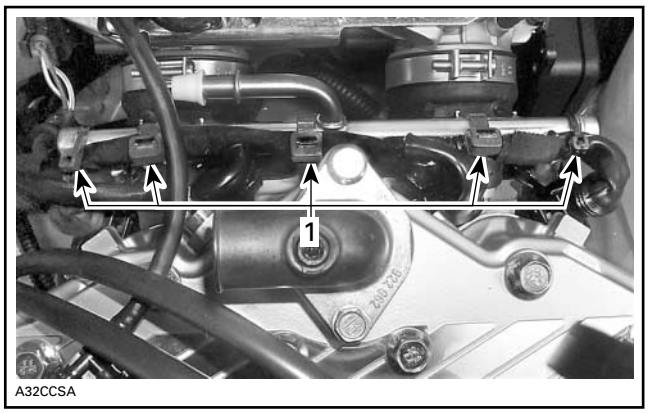
Add dielectric grease (P/N 293 550 004) to injector electrical connector.

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

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 vehicle communication kit (VCK) with 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.

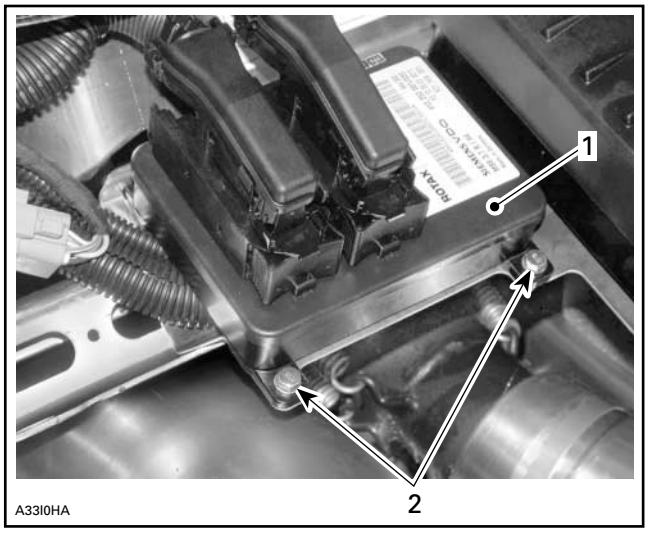
ECM Replacement

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.

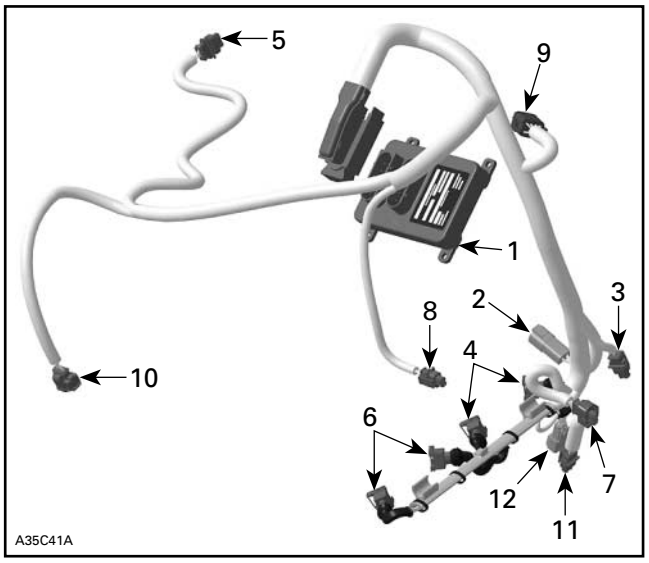
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

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.

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.

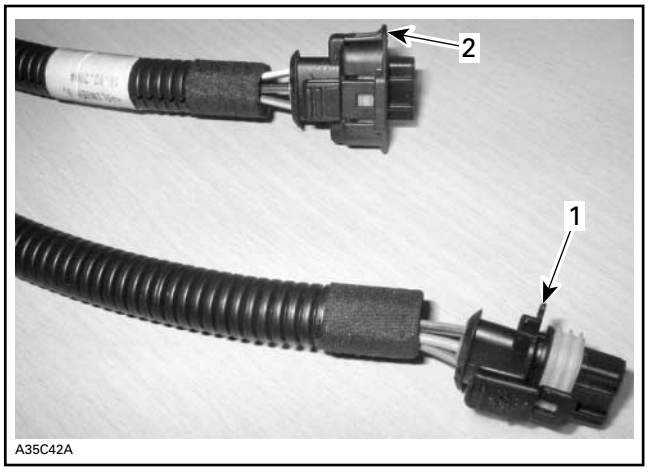
Remove complete wiring harness.

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.

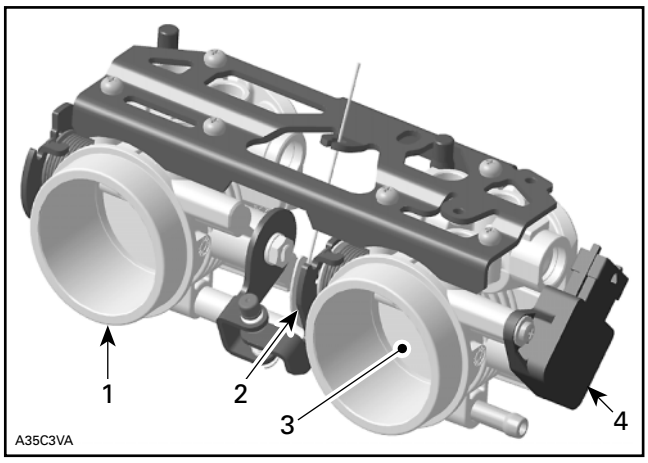
NOTE: Pay attention not to mix the ignition coil connector and the APS connector. Refer to the illustration below for visual difference.



1. *Ignition coil connector — open housing*
2. *APS connector — closed housing*

Install all remaining parts, which have been removed.

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 has been replaced and the **Closed Throttle** reset has not been performed.
- ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

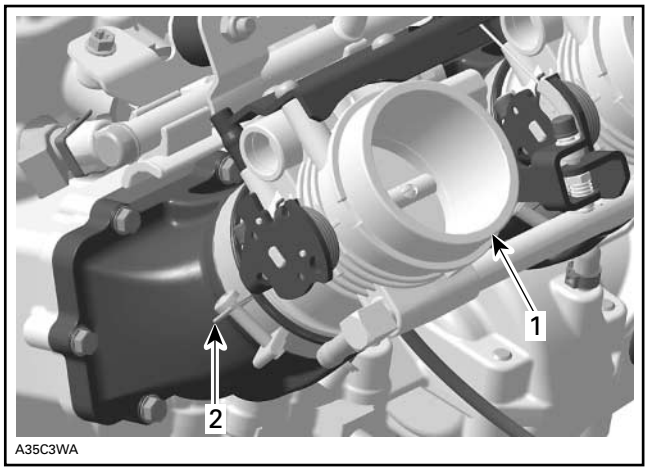
Refer to THROTTLE POSITION SENSOR (TPS) in this section.

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.



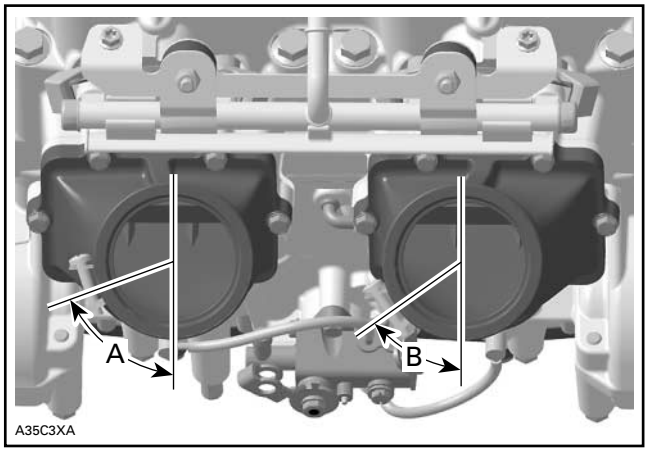
1. Throttle body
2. Clamp

- 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.

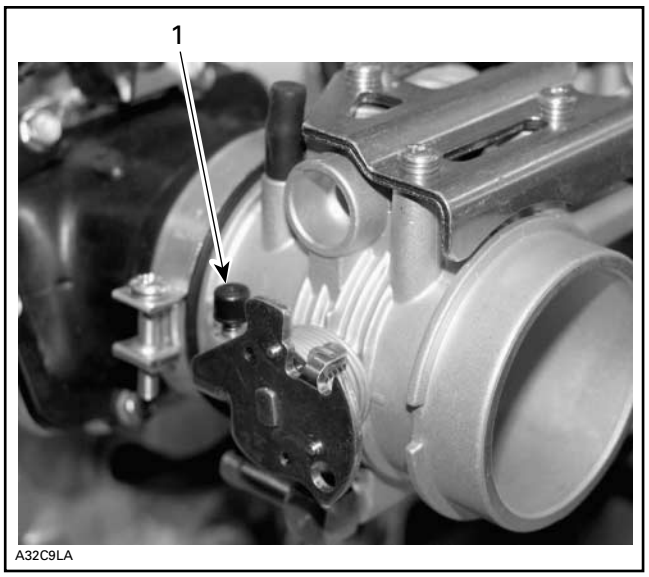
Adjustment

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.

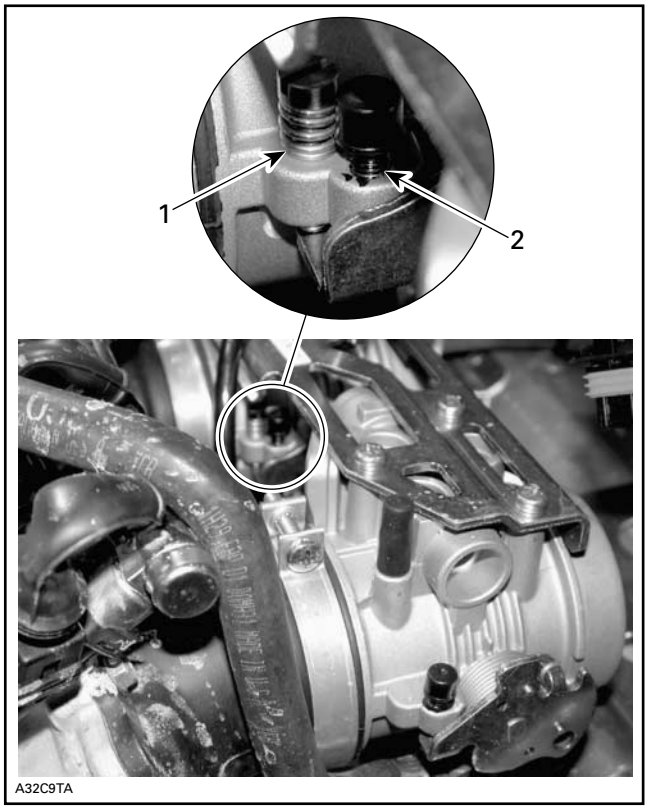


THROTTLE BODY
1. Zero position stopper screw

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.

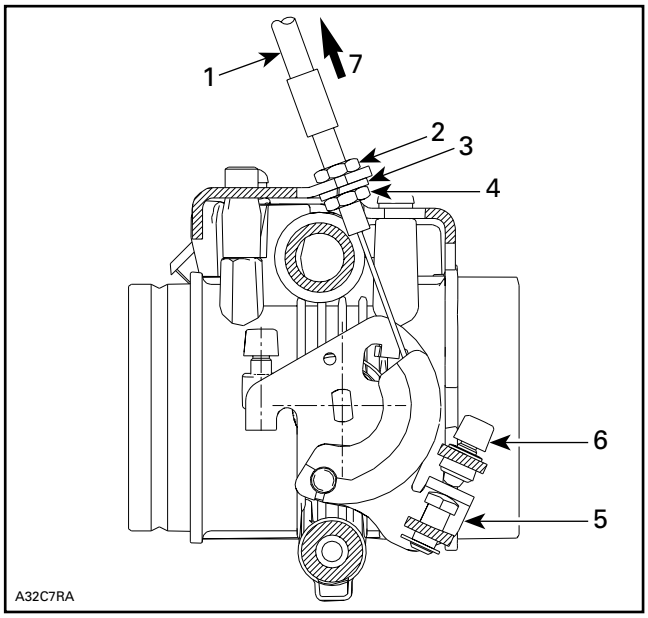
The only screw that has to be adjusted is the idle speed screw and it has to be adjusted only with the closed throttle reset procedure or for high altitude application. This has to be done only if the ECM or throttle body are replaced or if screw has been tampered with by mistake. Refer to THROTTLE POSITION 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.

Using the VCK with B.U.D.S., 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.

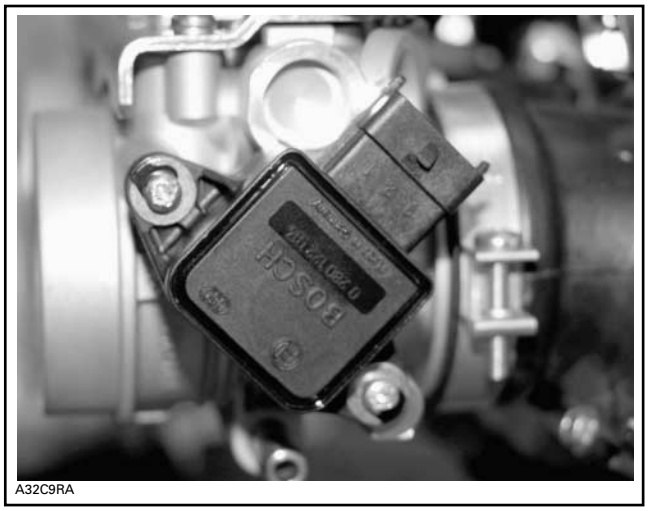
Closed Throttle Reset

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 FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

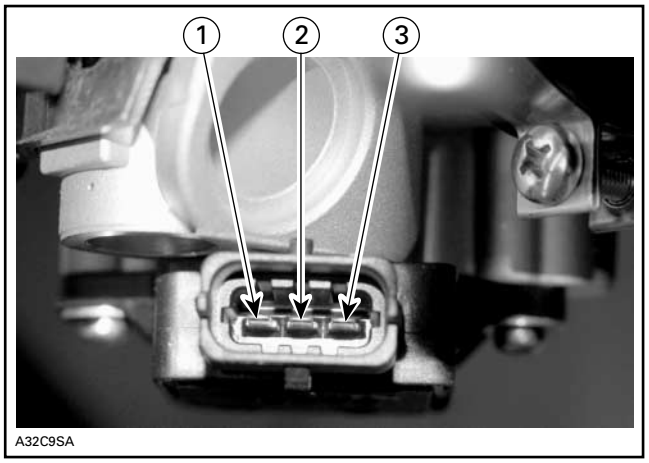
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the 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.



TPS

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.

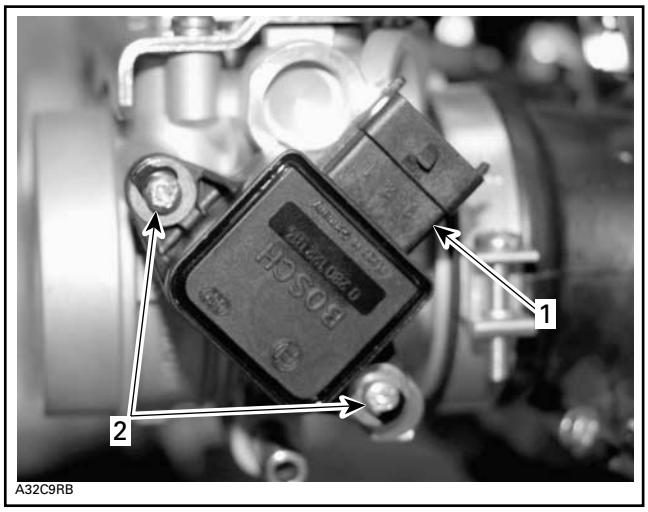
If resistance values are incorrect, replace TPS.

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.

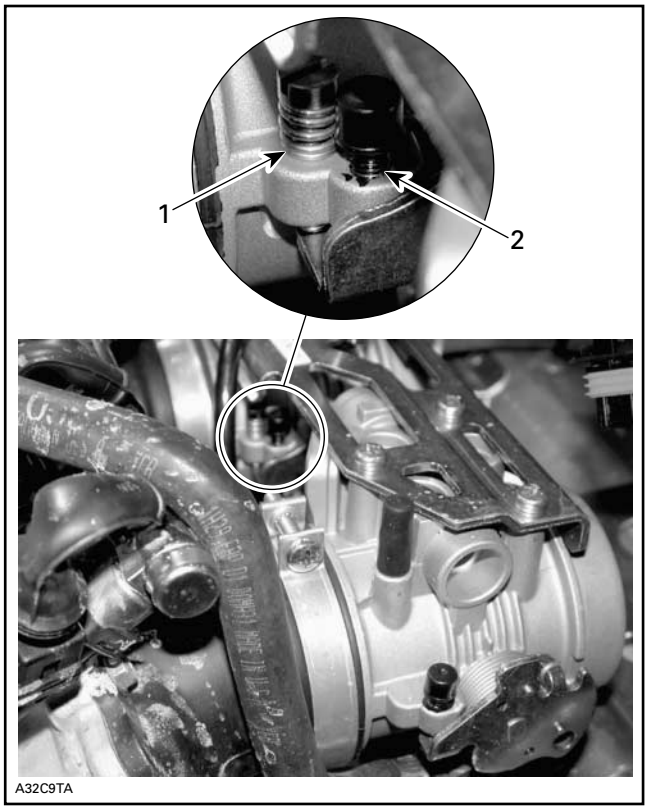
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

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 vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

Unscrew idle speed screw until the throttle body plate stop lever rest against its zero position 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.

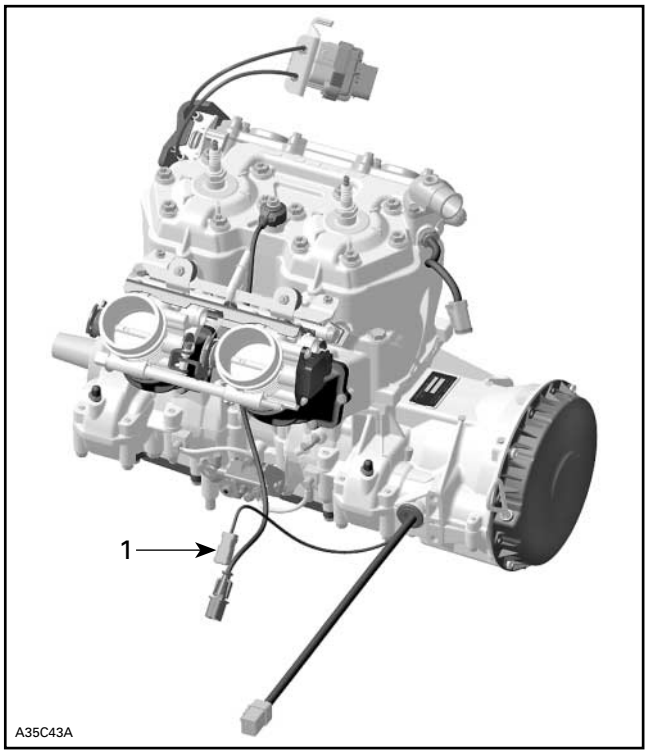
MODEL	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
Mach Z	4.8°	N.A.°
Summit	4.5°	5.0°

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 FAULT CODES in the DIAGNOSTIC PROCEDURES section 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.

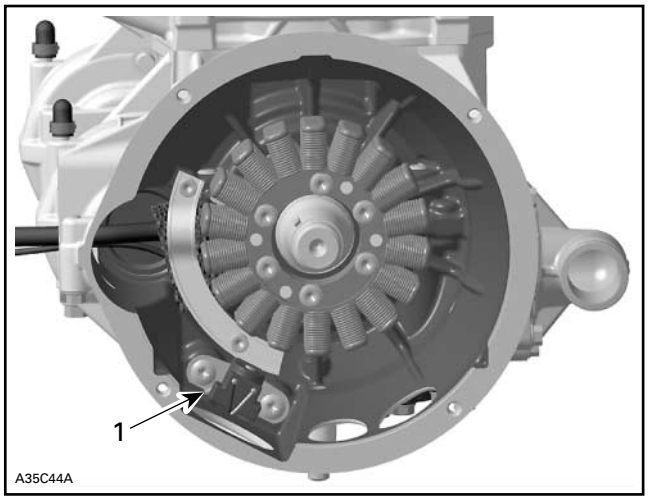
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Remove muffler.

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to MAGNETO SYSTEM.

Remove CPS.



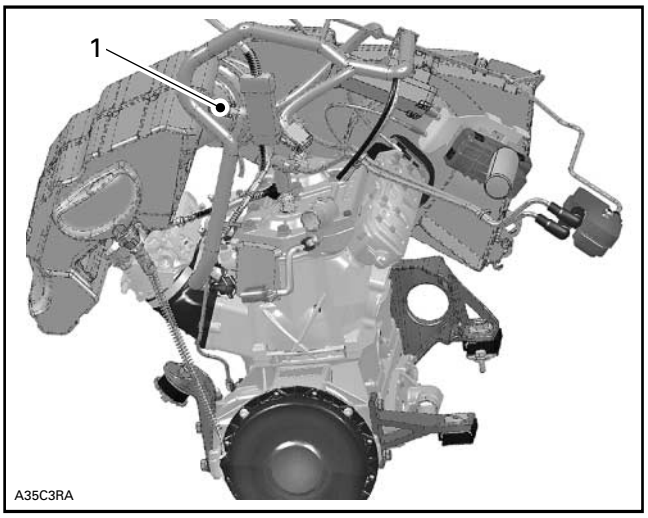
1. CPS inside crankcase

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 TEMPERATURE SENSOR TABLE 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

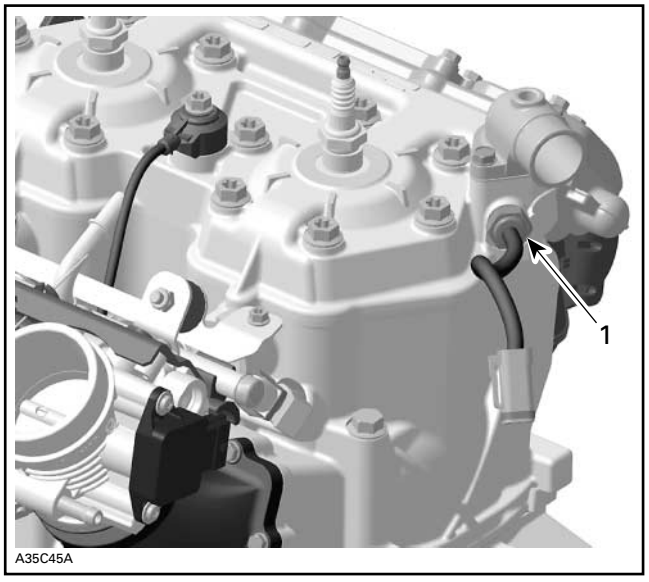
Unplug ATS connector.

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.

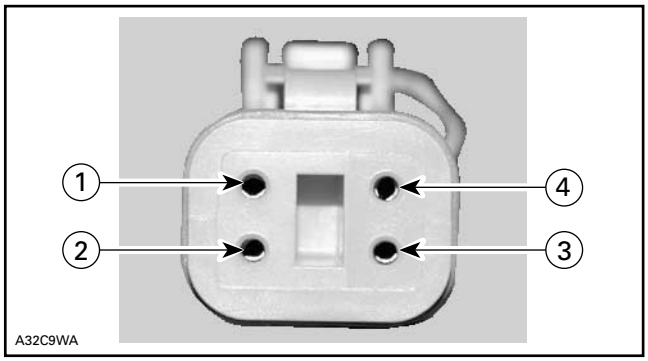
COOLANT TEMPERATURE SENSOR (CTS)



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 TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

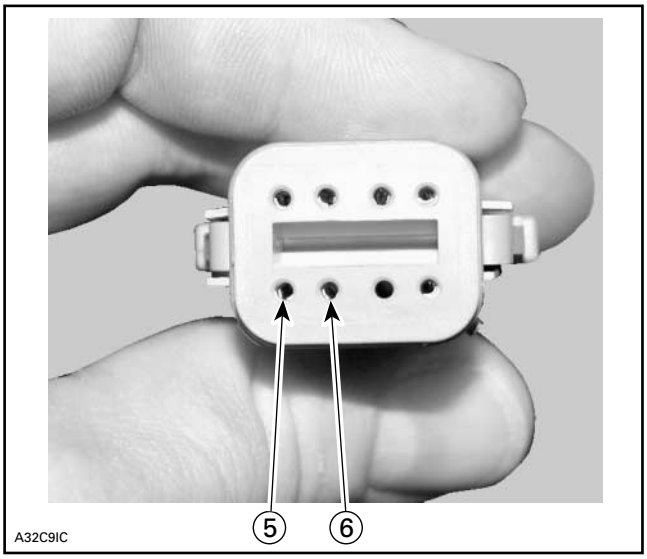
If out of specification, replace the sensor.

The resistance between terminal 3 and 4 is used for the ECM.

Refer to TEMPERATURE SENSOR TABLE 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 TEMPERATURE SENSOR TABLE 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 TEMPERATURE SENSOR TABLE 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.

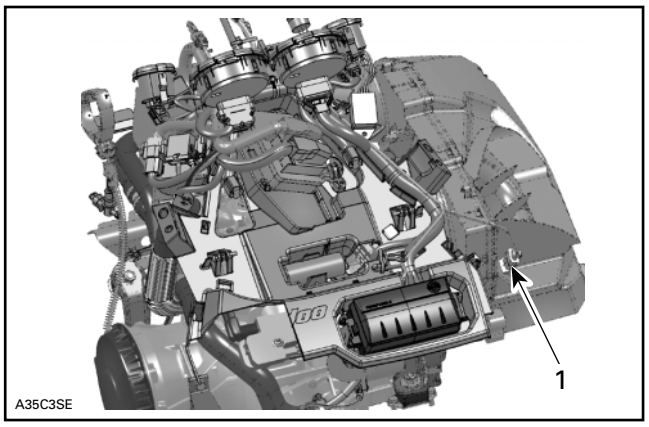
Disconnect CTS connector and remove CTS.

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 LIQUID 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.

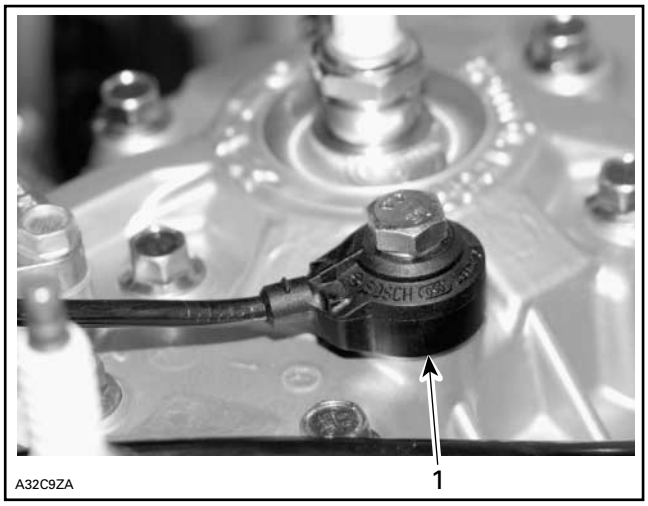
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

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.

Using the vehicle communication kit (VCK) with the 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.

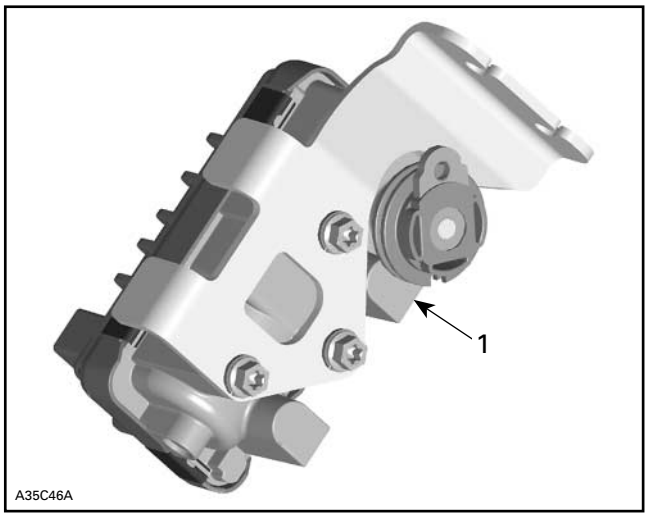
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

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.

E-RAVE ACTUATOR



1. E-RAVE actuator

IMPORTANT: Prior to testing the E-RAVE actuator, check for fault codes in B.U.D.S. using the vehicle communication kit (VCK).

NOTE:

If no fault code is displayed in B.U.D.S., the E-RAVE actuator can still be faulty. It could be a mechanical problem.

If actuator overheating occurs, fault code P0078 will appear. It could be caused by mechanical problems such as overtighten cables or damaged pulleys.

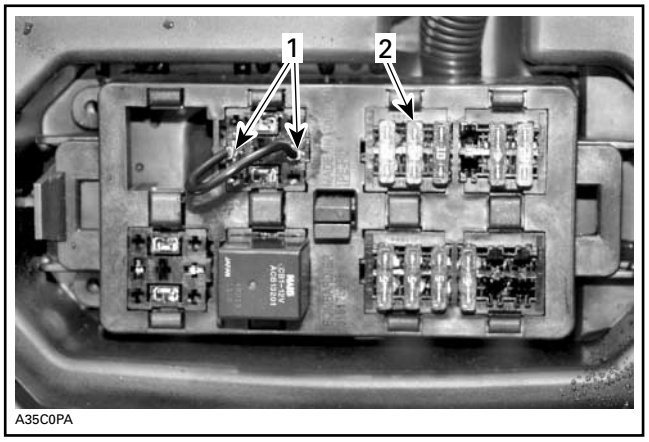
If a communication problem occurs between ECM and actuator, fault code P0600 will appear. It could also be caused by a not-powered actuator.

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.

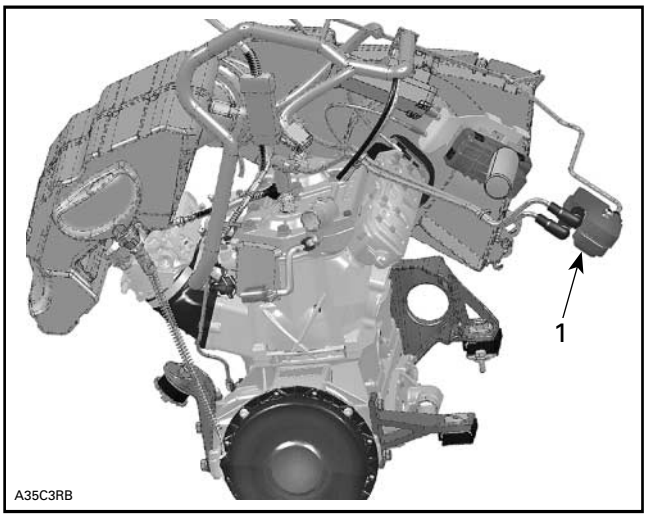
Check continuity of wires V V-3 and V V-5. If continuity is faulty, repair wiring/connector.

If continuity is good, try a new actuator.

Dynamic Test, Replacement and Cable Adjustment

Refer to RAVE system.

DOUBLE IGNITION COIL



1. 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.

Using the vehicle communication kit (VCK) with 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. Otherwise, perform the following checks.

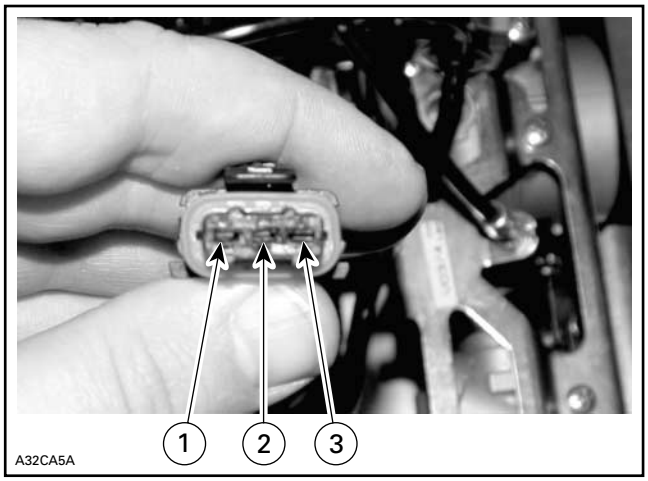
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

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, terminal 3 and terminal 1 respectively.

If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

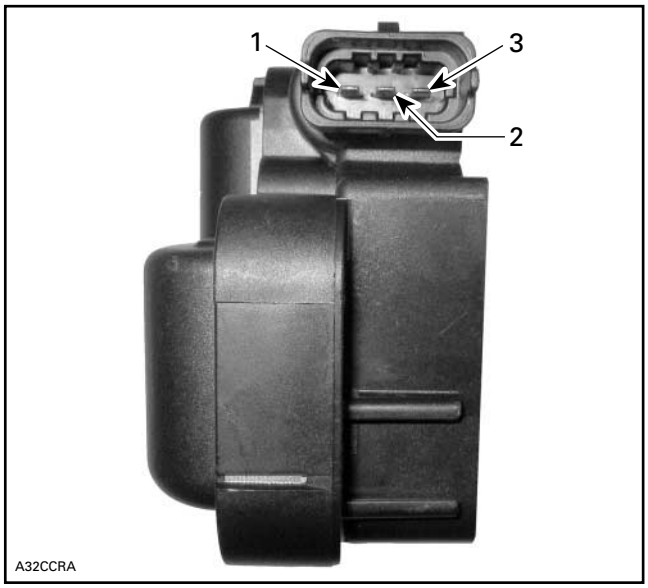
If wiring harness is good, test resistance of primary winding of ignition coil.

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).

If the resistance of one of both windings is not good, replace the ignition coil.

If the windings test good, try a new ECM.

⚠ 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.

BATTERY

Manual Start Models

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:

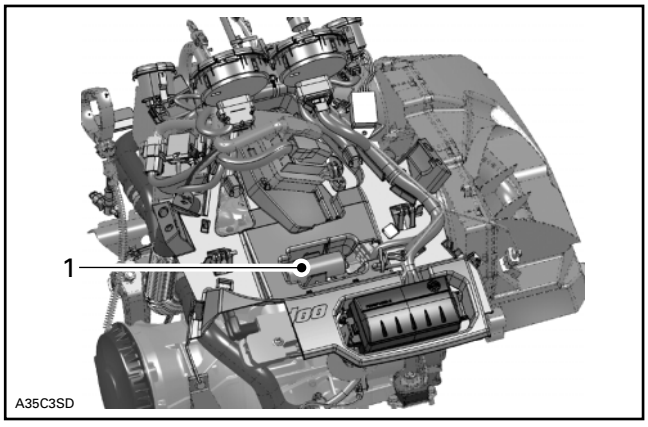
BATTERY TYPE	STANDARD CHARGE	QUICK CHARGE
YT4L-BS	0.3 Amps/hour for 5 to 10 hours	3.0 Amps/hour for 30 min.

Electric Start Models

Refer to CHARGING SYSTEM section for the charging procedure of the battery.

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 30 A 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 30 A 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 30 A fuse.

ENGINE START/RER SWITCH VERIFICATION

Refer to STARTING SYSTEM and Rotax Electronic Reverse (RER).

DESS POST VERIFICATION

If 2 short beeps are not heard when starting the engine, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect DESS post wires.

Tether Cord Cap Removed

Connect test probes to post BLACK/GREEN and BLACK/WHITE wires. Measure resistance, there should be NO continuity (open circuit).

Connect one test probe to the WHITE/GREY wire and the other test probe to the switch top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the BLACK/GREEN wire and the other test probe to the post ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

Connect test probes to switch BLACK/GREEN and BLACK/WHITE wires. Measure resistance, it must be close to 0 ohm.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
digital/inductive type tachometer	529 014 500	161
Vehicle Communication Kit (VCK)	529 035 981	159, 162

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	162

GENERAL

Ignition System Testing Sequence

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1) Fault codes.
2) Spark testing.
3) Ignition coil.
4) DESS post.
5) Engine cut-out switch.
6) Crankshaft Position Sensor (CPS).

Analysis of Readings

- Resistance Readings

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.

- 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 Vehicle Communication Kit (VCK) (P/N 529 035 981) and B.U.D.S. software, verify which fault codes occurred. Refer to ENGINE MANAGEMENT for complete list of codes.

Spark Testing

B.U.D.S. can be used to perform this test. Connect the VCK and go to the ACTIVATION folder.

A manual test can be performed too. Do the following.

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.

For more information on spark plug condition, refer to SPARK PLUG further in this section.

Ignition Coil

Disconnect ignition coil connector.

Compare readings with those appearing in the IGNITION COIL table.

IGNITION COIL			
TEST	Primary winding resistance	Secondary winding resistance spark plug wires and cap included	Secondary winding resistance spark plug wires removed
TEST PROBES	BROWN/BLACK and BROWN/ORANGE wires	Between both spark plug caps	Male terminals of coil
RESISTANCE	00.2 to 0.5	14.5 kΩ to 23.5 kΩ	9.6 kΩ to 14.4 kΩ
VOLTAGE	—	—	—
NOTE	Disconnect the ignition coil from the ECM	Do not attempt to remove spark plug caps from the wires.	With spark plug wires removed from high voltage coil.

DESS Post

DESS POST		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/WHITE and BLACK/GREEN wires	BLACK/WHITE and BLACK/GREEN wires
RESISTANCE	O.L.	00.0 to 00.5 Ω
VOLTAGE	—	—
NOTE	DESS key removed	DESS key installed

If readings do not correspond to the above mentioned indications, replace post.

Engine Cut-Out Switch

Check the condition of engine cut-out switch.

ENGINE CUT-OUT SWITCH		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in RUN position.	Engine cut-out switch must be in STOP position.

Crankshaft Position Sensor (CPS)

NOTE: Refer to ENGINE MANAGEMENT.

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 3500 RPM with a timing light.

NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the 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.


A35C2NA

TYPICAL

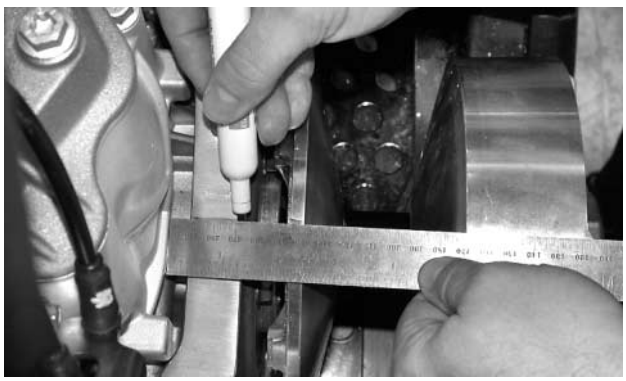
  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.

– 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.

ENGINE	MEASUREMENT
995 SDI	7.87 mm (0.310 in)

- With the TDC gauge indicating specified timing, scribe a mark on drive pulley inner half and on engine support.


A35C2OA

TIMING MARKS

Remove TDC gauge.

Checking Ignition Timing

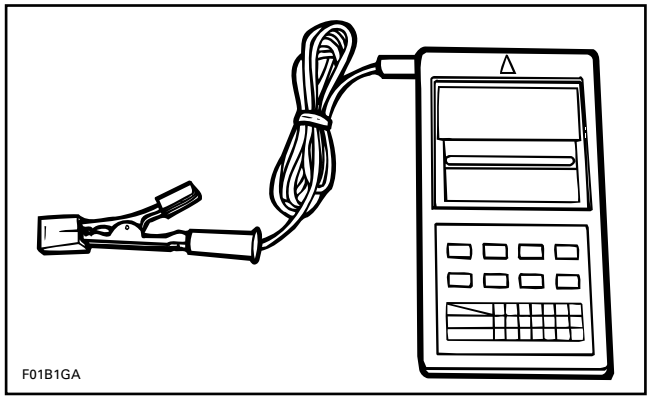
To check the ignition timing proceed as follows:

⚠ 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.


F01B1GA

TACHOMETER

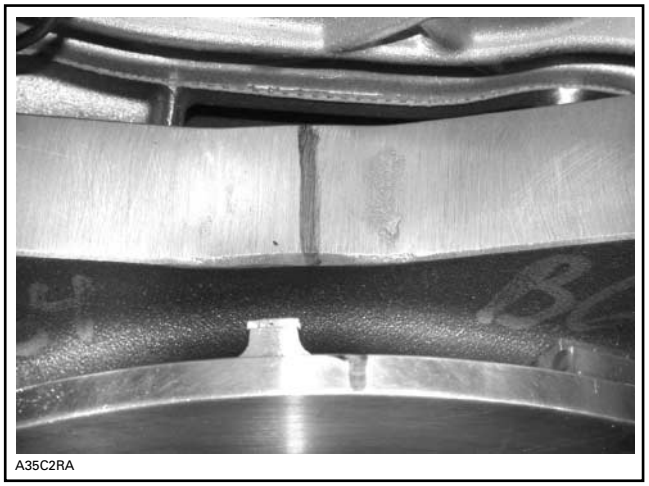
Start the engine and point timing light on timing mark.

The timing marks must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced.

ENGINE	TOLERANCE
995 SDI	± 0.5°


A35C2QA

TIMING RETARDED BY ABOUT 1°

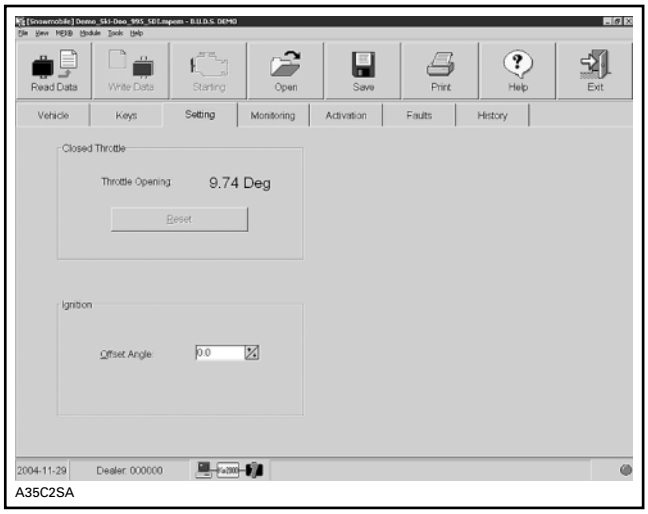

A35C2RA

TIMING ADVANCED BY ABOUT 1°

Changing Timing

VCK (Vehicle Communication Kit)

The Vehicle Communication Kit (VCK) (P/N 529 035 981) must be used, with B.U.D.S. software to change the ignition timing. Look under the proper **Setting** section of the B.U.D.S. software to change the ignition timing.



A35C2SA

Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

SPARK PLUG

Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

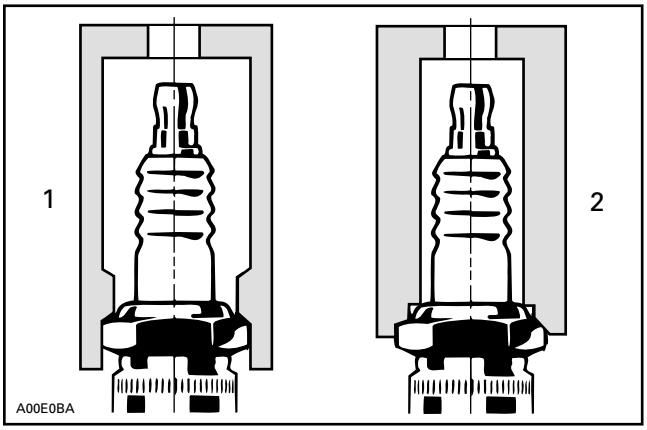
Whenever using compressed air, always wear protective eye wear.

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 BR9ECS 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.

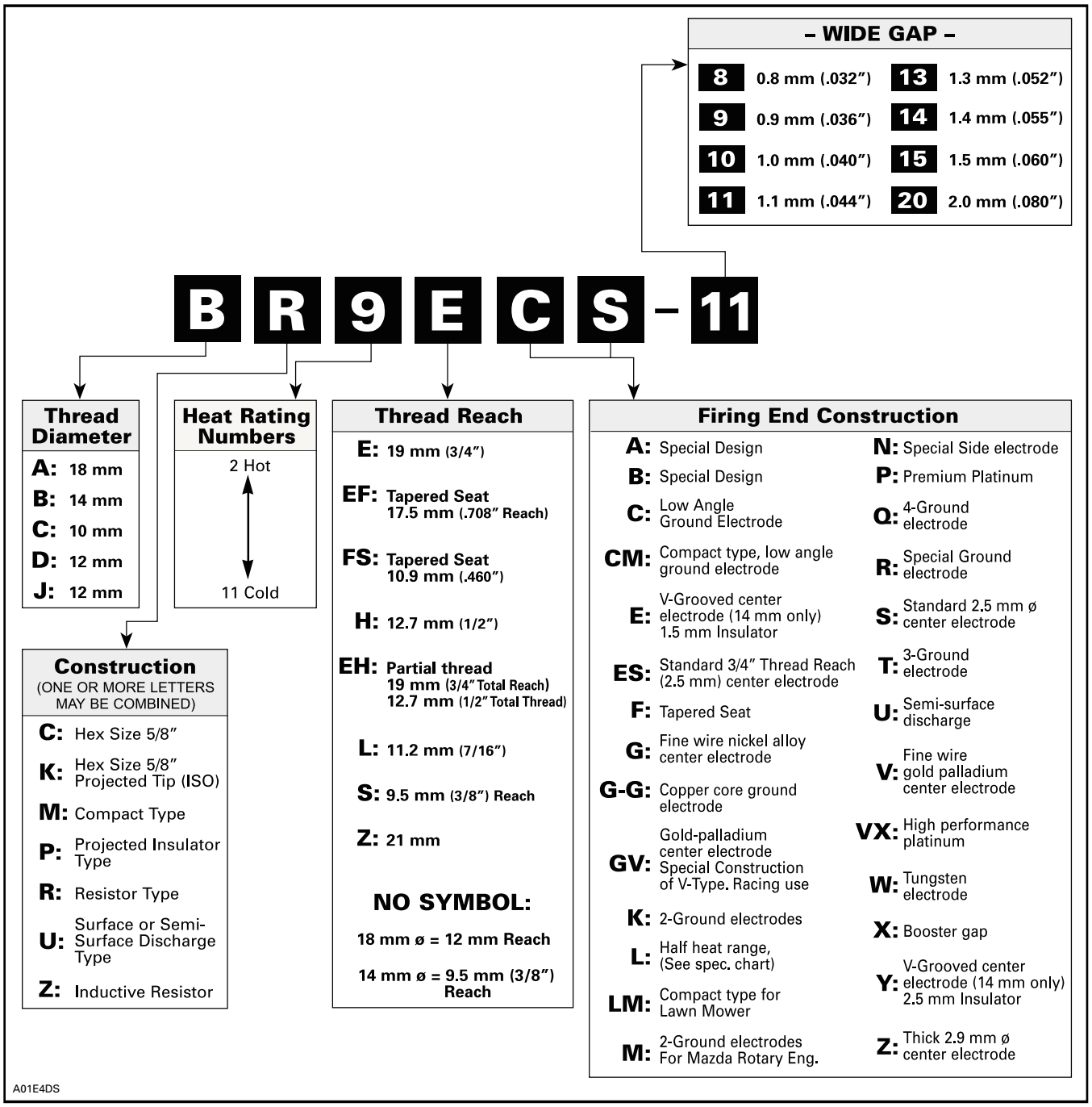


TYPICAL
1. Proper socket
2. Improper socket

Use the following table to torque the spark plugs.

ENGINE	SPARK PLUG	TORQUE N•m (lbf•ft)
995 SDI	NGK	27 (20)

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	169
multimeter FLUKE 111	529 035 868	165

SERVICE PRODUCTS

Description	Part Number	Page
silicone dielectric grease	293 550 004	167–168

GENERAL

Voltage measurements are always taken upon vehicle starting. Reading when the engine is running will be higher than indicated range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise reading could 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.

Place the selector switch of the multimeter FLUKE 111 (P/N 529 035 868) 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.

It is difficult to make a diagnostic in the case of intermittent 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.

CHARGING GENERATOR COIL (STATOR)

First measure the resistance.

To do this:

Disconnect connector.

Connect multimeter probes to YELLOW and/or GREEN wires, then place selector switch to Ω.

Compare reading with those appearing in the table further.

Now measure the voltage.

Connect the multimeter probes to appropriate wires, refer to table below.

Bring the selector switch of multimeter to V and the scale to 00.0 Vac.

Activate the manual starter and check values.

Repeat operation 3 times.

Compare reading with those appearing in the following table.

STATOR		
TEST	Output	Coil insulation
TEST PROBES	YELLOW, YELLOW and GREEN	YELLOW and ENGINE
RESISTANCE	00.0 to 00.5 3 times	O.L.
VOLTAGE	3.5 to 5.5 3 times	—
NOTE	Do the test between A and B, A and C and B and C using manual starter	Engine refers to the engine parts connected to the magneto housing.

VOLTAGE REGULATOR/ RECTIFIER

Test

To test the voltage regulator/rectifier use the following table.

VOLTAGE REGULATOR/RECTIFIER		
TEST	Charging voltage	Current to battery
TEST PROBES	RED/GREEN and negative battery terminal	RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	—	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

If the voltage regulator/rectifier is within the specification, the wiring harness between the voltage regulator/rectifier and battery is defective. If the voltage regulator/rectifier is out of specification and the stator tests good, the voltage regulator/rectifier is defective.

Removal

MODEL	LOCATION
All models of RT series	Under engine and behind muffler

All Models

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**).

BATTERY

NOTE: For manual start models with a small battery/capacitor arrangement, refer to ENGINE MANAGEMENT SECTION.

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	410 301 203

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.

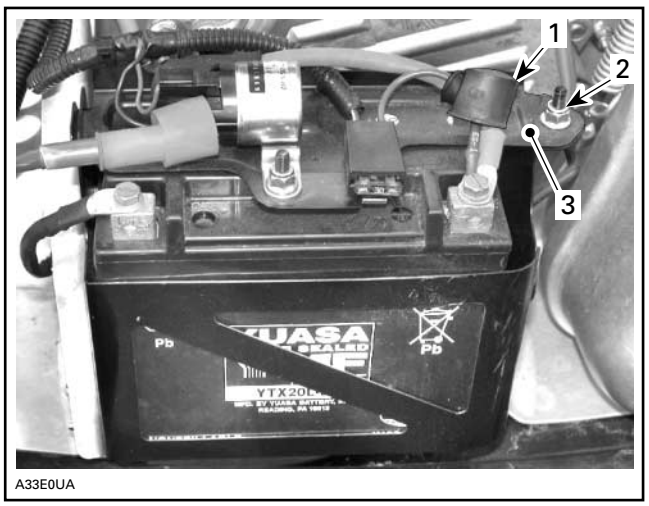
Disconnect BLACK (–) cable end from the terminal.

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.



TYPICAL
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 rubber 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

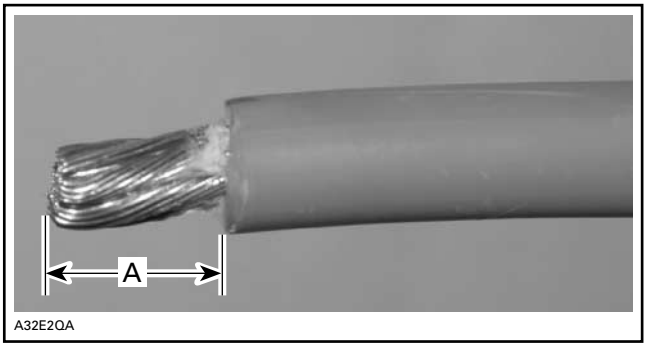
Never charge or boost battery while installed on vehicle.

Cover the RED (+) terminal with rubber boot.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

CABLE TERMINAL INSTALLATION

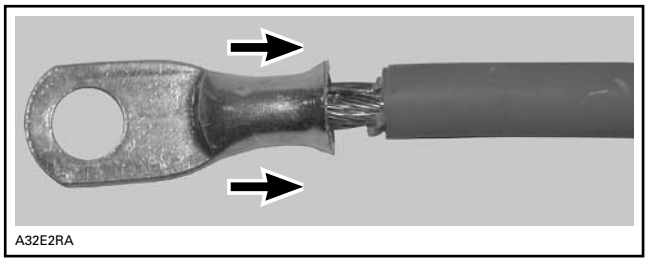
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

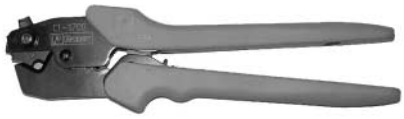
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.


A32E2RA

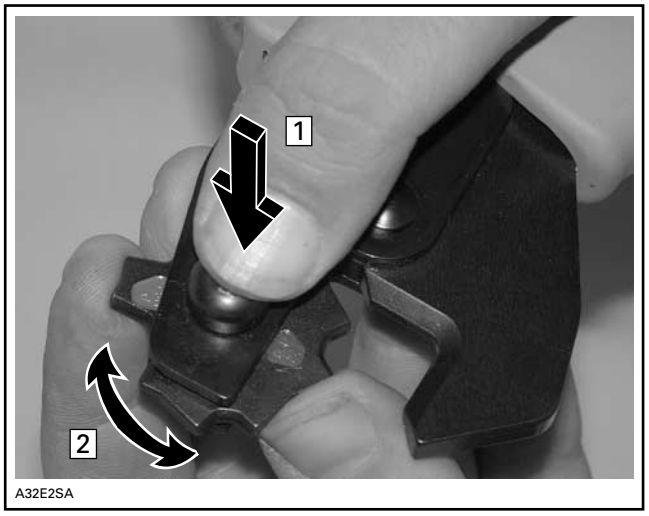
INSTALLATION OF TERMINAL

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.



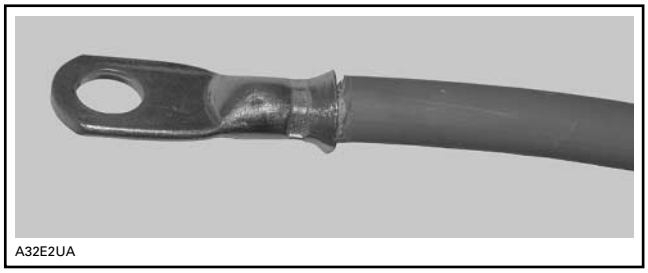
A32E2SA

POSITIONING THE CRIMP PLIERS
1. *Press*
2. *Rotate*

After positioning the crimp pliers, crimp the terminal already installed on wire.


A32E2TA

CRIMPING OF WIRE


A32E2UA

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	171

GENERAL

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 turn the engine.

In case of problems, first ensure the problem is not related to engine mechanical components. If not, test the starting system.

NOTE: Make sure problem is not related with engine. Pull rewind starter, engine should rotate normally. If not, problem is not related with 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.

NOTE: The flooded engine mode can be used to accomplish some tests, to avoid engine starting or injecting fuel in the engine. Refer to ENGINE MANAGEMENT for more details on this feature.

COMPONENT TESTING

Fuses

Make sure the charging fuse (30 A) on battery and the ECM fuse (5 A) on electrical harness are in good condition. If the fuses test good, continue with the next tests.

Battery

Check battery voltage. Make sure battery cables are cleaned and properly tightened.

Refer to CHARGING SYSTEM to check battery condition. If the test is good, continue with the next tests.

START/RER Switch

Check if the start/RER switch works normally.

Refer to the following:

NOTE: Start/RER switch operation can be confirmed also with BUDS software. Use the tab **Monitoring**. Refer to ENGINE MANAGEMENT for further informations.

START/RER SWITCH				
TEST	Continuity			
TEST PROBES	BLACK and RED wires		BLACK and WHITE wires	
RESISTANCE	0.3 Ω	O.L.	O.L.	0.3 Ω
VOLTAGE	—	—	—	—
NOTE	With button released	With button depressed	With button released	With button depressed

Starting Solenoid

NOTE: When testing the start switch with B.U.D.S., the starting solenoid signal from the ECM is also confirmed. Refer to ENGINE MANAGEMENT for further informations.

The starting solenoid can also be verified as follows.

Use multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between the wires, indicate in the following table, when starting the vehicle. The tether cord must be installed.

ENGINE TYPES	COLOR OF WIRES
995 SDI ENGINES	RED/GREY and ORANGE/BLACK

If the solenoid does not receive a signal and the start switch test good, make sure it is not a bad connection between the engine control module (ECM) and the starting solenoid. If not, the ECM can be suspected.

If the solenoid receives current, test it as follows.

– Disconnect battery and starter cables from solenoid.
– Inspect connections and clean as necessary.
– Solenoid condition can be checked with an ohmmeter. Install probes on large connectors of solenoid.
– Measure the resistance when current is applied to small connectors; if it is more than a few ohms, replace solenoid.

If solenoid tests good, check the electric starter.

Engine Control Module (ECM)

NOTE: When testing the start switch with B.U.D.S., the starting solenoid signal from the ECM is also confirmed. If the test is conclusive, the ECM is in good condition.

Check if there are any fault codes. Refer to ENGINE MANAGEMENT.

Engine Cut-Out Switch

Check the condition of engine cut-out switch as per following table.

ENGINE CUT-OUT SWITCH		
TEST	Running insulation	Continuity in STOP position
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in run position.	Engine cut-out switch must be in stop position.

Electrical Cables and Connections

Check all connections, harnesses and wires.

Tighten any loose connections.

Replace any chafed wires.

A voltage drop test can be performed in order to find a poor connection, defective wire or component, causing parasite resistance in the system.

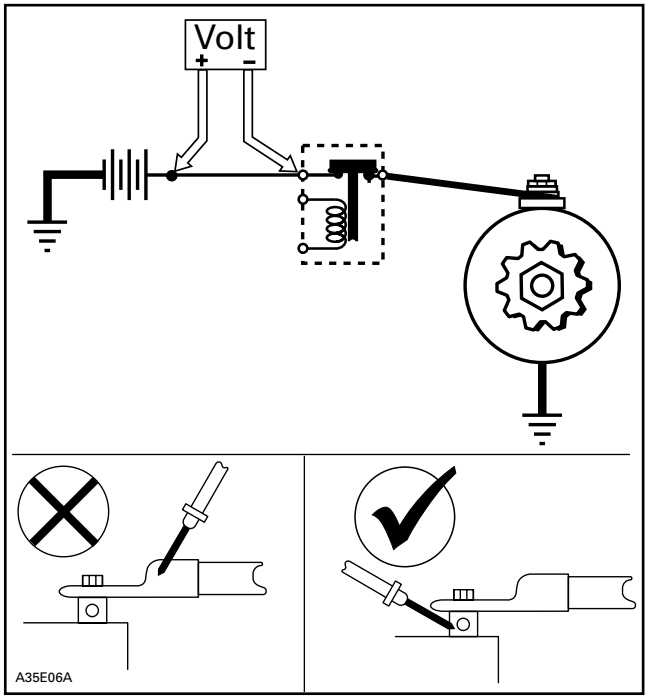
To perform a voltage drop test, proceed as follows:

CAUTION: Do not active starter more than 15 seconds. Wait 2 minutes between each test.

NOTE: Place probes to terminals not to the connectors. More that one component can be defective. Repair any defective component before performing the next test.

TEST 1

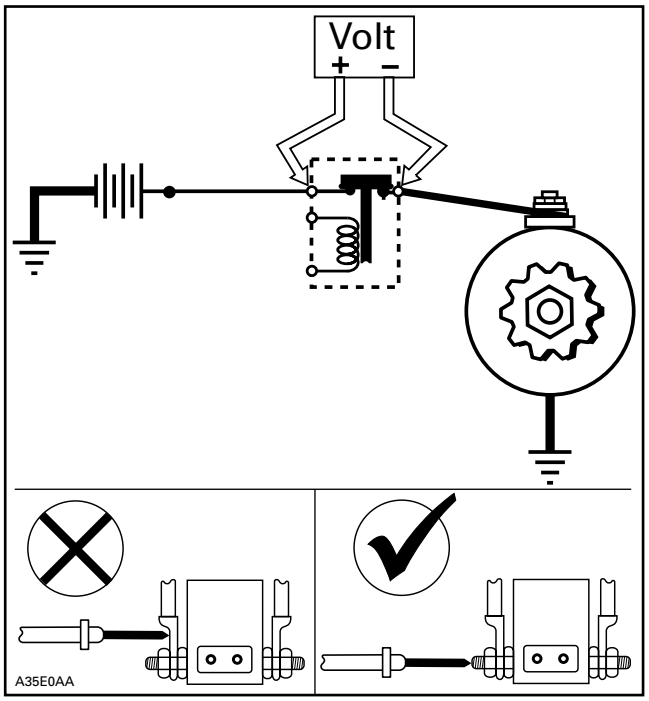
– Place the positive probe of multimeter on positive battery terminal and the negative probe on the high-current input of starter solenoid.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and wire condition.

TEST 2

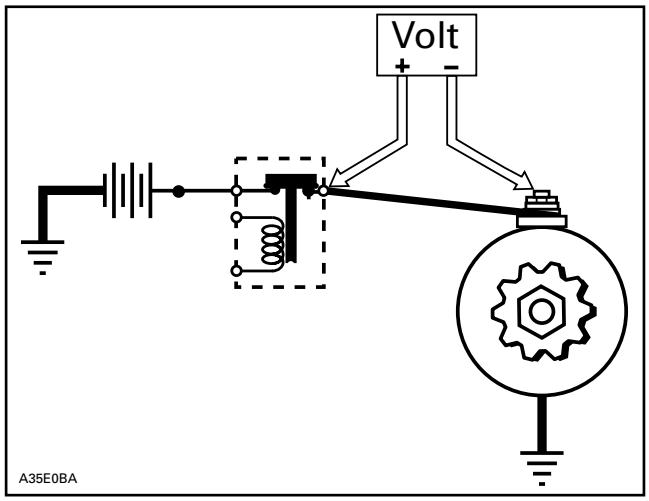
– Check solenoid by placing the test probes to the solenoid terminals.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, the solenoid is defective or there is a bad connection.

TEST 3

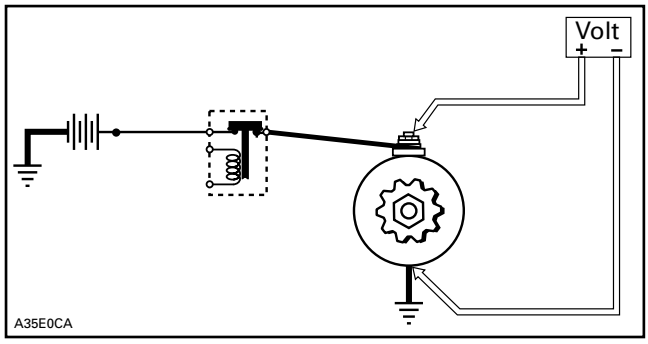
– Place the positive probe of multimeter to the output terminal of solenoid and the negative probe to the starter positive terminal.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and wire condition.

TEST 4

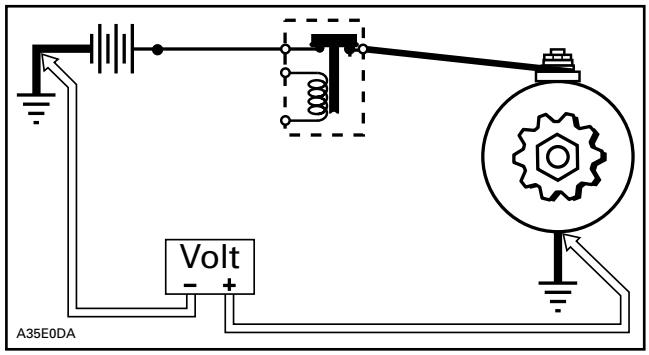
– Measure voltage to starter. Place the positive probe to the starter positive terminal and the negative probe to the starter housing.



– Crank engine and record the result.
– The voltage reading should not drop below 9 volts. If the result is under 9 volts, the starter is defective or there is a bad connection.

TEST 5

– Place the positive probe to the starter housing and the negative probe to negative battery terminal.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and battery/engine ground wire conditions.

Electric Starter

Remove the tuned pipe and disconnect spark plug cables.

Using booster cables, carefully supply current from the battery directly to the starter. Connect the BLACK cable first to the ground. Connect the other booster cable from the battery to the starter positive terminal.

If the starter turns, ensure wiring harness and connectors between battery and starter are in good condition. See procedure above.

If the starter does not turn, replace it.

STARTER REMOVAL

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

⚠ WARNING

Always disconnect BLACK (-) cable first.

Remove tuned pipe.

Disconnect RED cable from starter.

Disconnect ground cable from starter.

Unbolt and remove starter from engine.

STARTER INSTALLATION

Use new teflon washers on the 3 bolts retaining starter to engine.

Torque the bolts to 28 N•m (20 lbf•ft).

Connect the RED wire to the large terminal of the starter.

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**).

Install battery cables.

⚠ WARNING

Always connect RED (+) cable first.

ROTAX ELECTRONIC REVERSE (RER)

TROUBLESHOOTING

RER Does Not Response When Depressing START/RER Button

– Check for faults using the vehicle communication kit (VCK) and B.U.D.S. software.
– Check if engine START/RER button works normally, refer to ENGINE MANAGEMENT.

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 reed valves on intake side. 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.

When it does not work at all, check wiring and START/RER switch as explained above.

ACCESSORIES AND LIGHTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	178, 182–184
supply cable	529 035 997	177, 183
supply harness	529 035 869	177–178, 183
VCK (Vehicle Communication Kit)	529 035 981	177

GENERAL

⚠ 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.

Lighting and Accessories System Testing

Connect the VCK (Vehicle Communication Kit) (P/N 529 035 981).

529 035 981

In BUDS, click on the relay 2 (R2) button to supply lighting system with 12 volts.

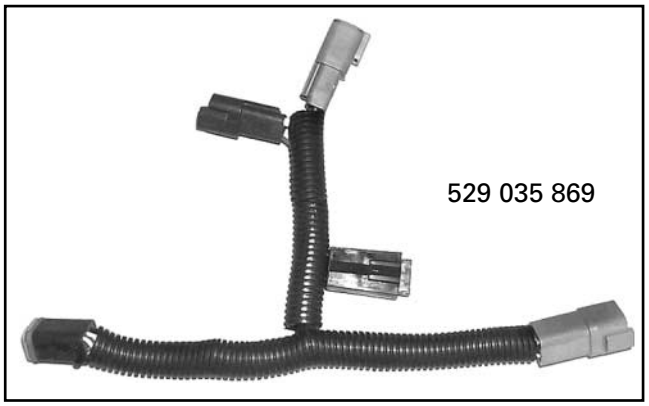
To supply 12 volts to the accessories, click on the relay 3 (R3) button.

Once this test is done, disconnect the VCK.

Connect the supply cable (P/N 529 035 997) to the supply harness (P/N 529 035 869).

CAUTION: Respect polarity by connecting 12V to RED wire and ground to BLACK wire.

529 035 997



Connect the supply harness (P/N 529 035 869) to diagnostic connector, located on right side of the vehicle. Now the headlight and accessories systems are supplied with 12 volts. Refer to WIRING DIAGRAM section to troubleshoot lighting system.

CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Once lighting system testing is done, disconnect supply cable from vehicle and then 12-Volt supply from the supply cable.

12-VOLT POWER OUTLET (cigarette-lighter type)

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.

Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between RED/YELLOW and BLACK wires.

The obtained value should be between 12 and 14.5 Vdc.

– No voltage:
  - Check accessories fuse (20 A), 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 near the ignition coil.

Open the front hood, remove the windshield then remove screws retaining the accessories panel.

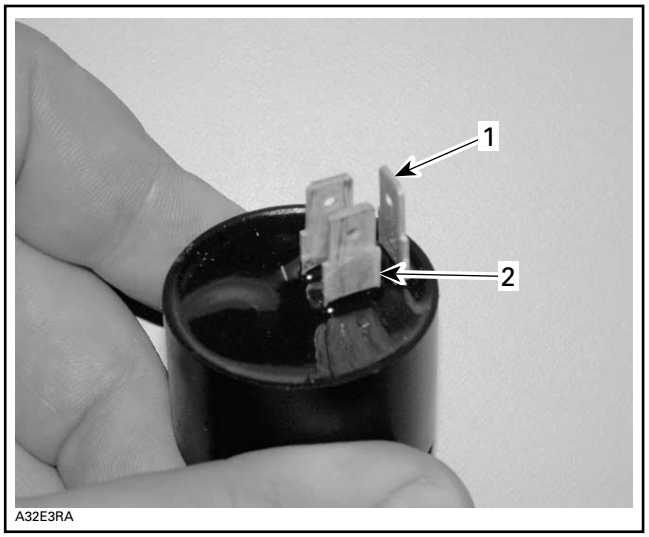
Unplug connector from beeper.

Unscrew retaining ring then remove beeper.

Test

NOTE: Before testing the beeper, make sure the connectors are installed on proper beeper tabs.

ENGINE	TAB LOCATION
995 SDI engines	RED/GREY on positive tab BEIGE/BLACK on negative tab

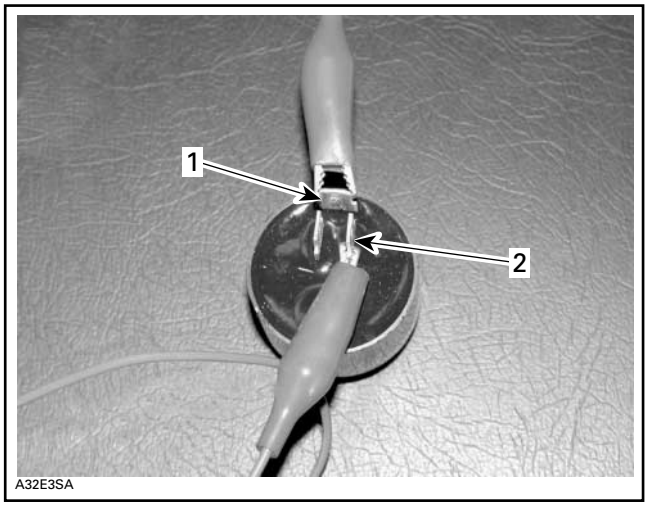


1. RED/GREY wire on positive tab
2. BEIGE/BLACK wire on negative tab

Using jumper wires, connect battery positive post to beeper positive tab.

Connect battery negative post to beeper negative tab. See next photo.

CAUTION: To avoid beeper damage, ensure that polarity is respected.



TYPICAL — 12-VOLT BATTERY PLUGGED TO BEEPER
1. Beeper positive tab
2. Beeper negative tab

A continuous sound should be heard. If not, replace the beeper with a new one.

If the beeper is good, check connectors, fuse and wiring harness.

Installation

To install beeper, reverse the removal procedure. Check connectors position.

ENGINE TEMPERATURE GAUGE

Test

Check fuse, connectors and harness.

Check the condition of relay 2 by using the BUDS software.

Check temperature sensor.

Replace the 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

Check fuse, connectors and harness.

Check relay 2 by using BUDS software.

Check fuel sensor on fuel tank.

Replace electric 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.

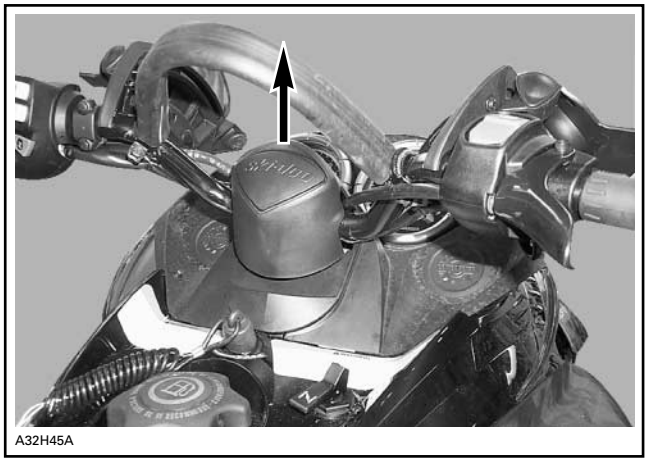
HEADLAMP

Bulb Replacement

If any headlight bulb is burnt, proceed as follows.

Remove windshield.

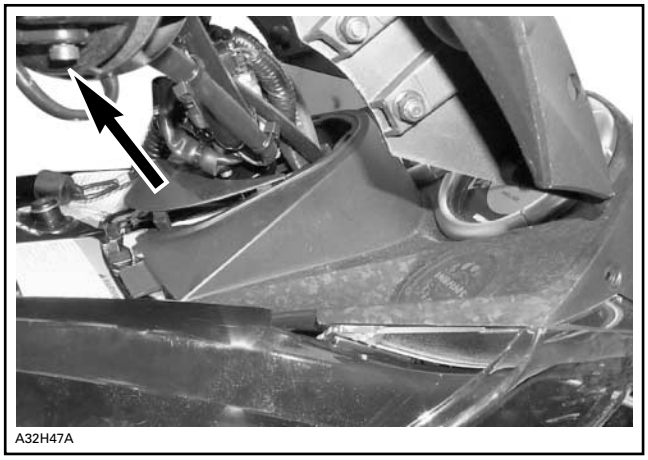
Pull out steering support cap.


A32H45A

TYPICAL

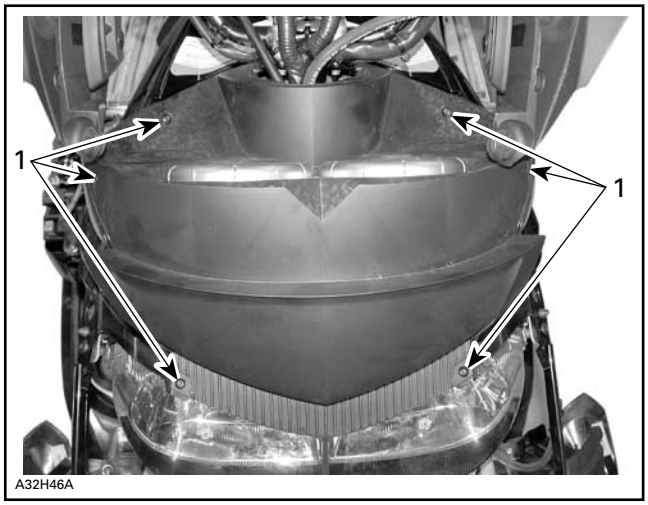
Lift hood.

Pull up front console end cap.


A32H47A

TYPICAL

Remove retaining screws and slightly lift accessories panel.



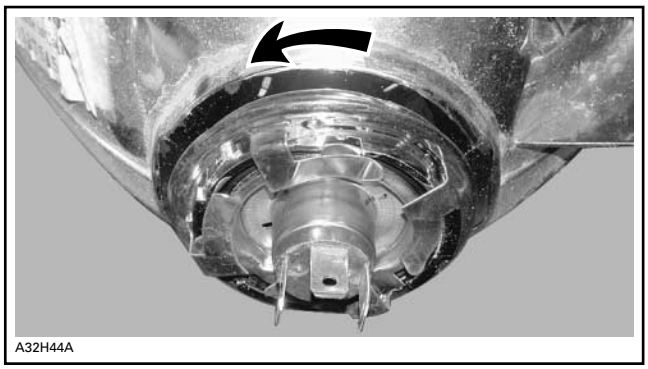
A32H46A

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 connector, wiring harness or HI-LOW beam switch.

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

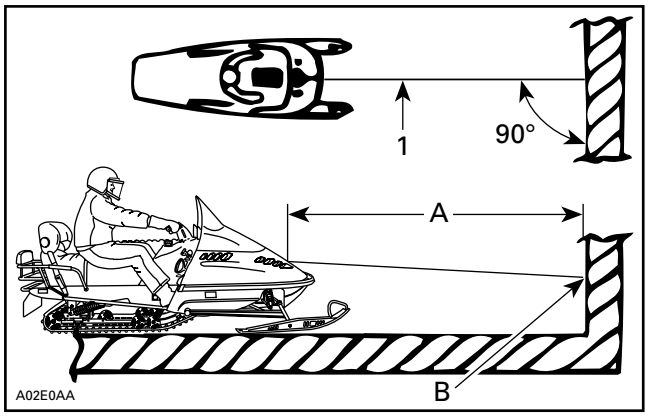
Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

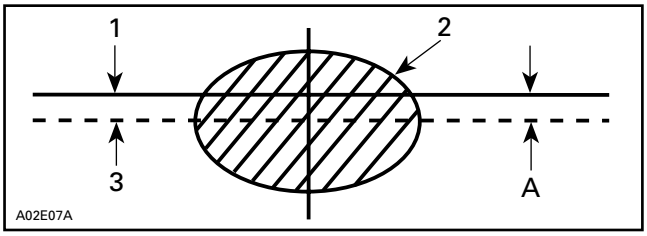
Rider or equivalent weight must be on the vehicle.

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)

HEATING ELEMENTS

NOTE: All measurements must be performed at 21°C (70°F).

Throttle Lever Heating Element

Resistance Measurement

THROTTLE LEVER HEATING ELEMENT		
TEST	High Intensity	Low Intensity
WIRE COLOR	BROWN and YELLOW/BLACK	BROWN/YELLOW and YELLOW/BLACK
RESISTANCE	1.73 to 4.22 Ω	5.73 to 18.54 Ω
NOTE	—	—

Handlebar Grip Heating Element

Resistance Measurement

HANDLEBAR GRIP HEATING ELEMENT		
TEST	High Intensity	Low Intensity
WIRE COLOR	ORANGE/VIOLET and BLACK	ORANGE and BLACK
RESISTANCE	17 to 23.5 Ω	8.5 to 11.8 Ω
NOTE	When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.	

If the heating elements are good, check connectors and wiring harness.

RELAY

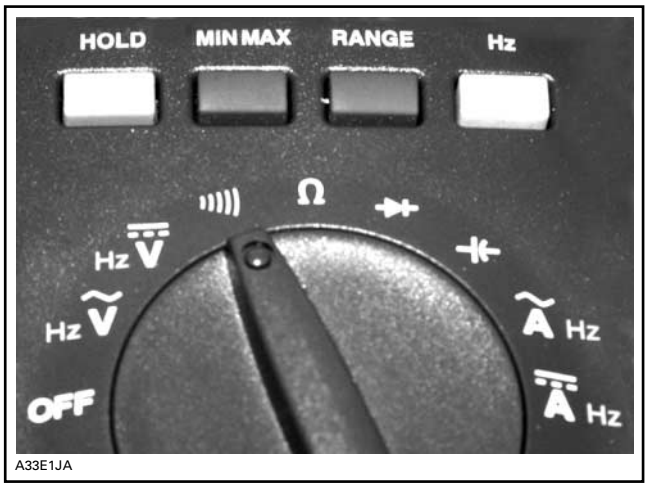
Voltage Test

RELAY		
TEST	Coil	Contact
WIRE COLOR	WHITE/GREEN and BLACK	BLACK/YELLOW and BLACK
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

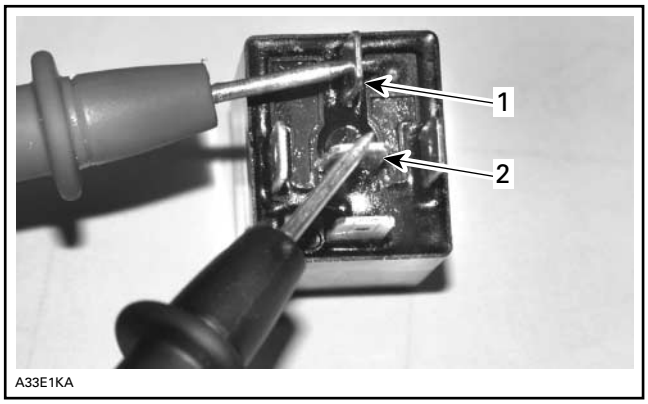
Remove the relay from vehicle.

Using the multimeter FLUKE 111 (P/N 529 035 868), select the beeper position.



A33E1JA

Position the RED probe on the terminal 30 and the BLACK probe on the terminal 87a.

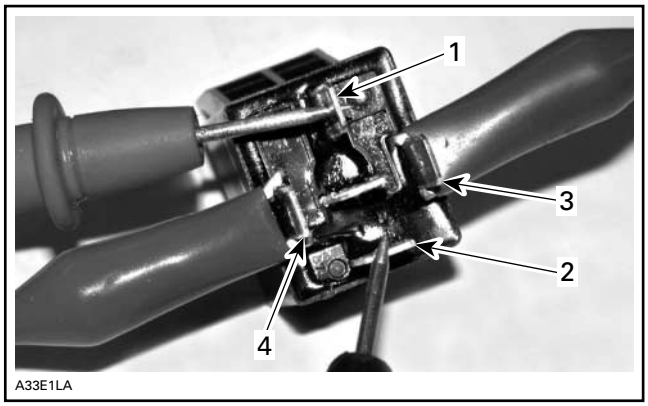


A33E1KA

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.

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.

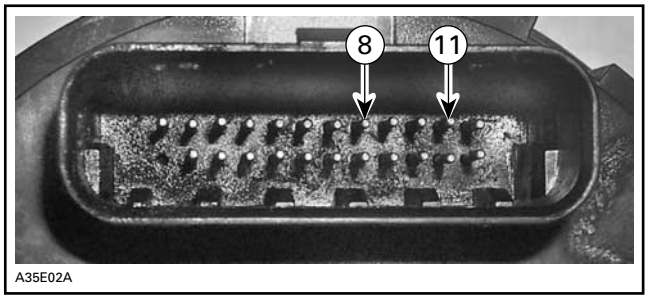
Unplug connector.

Test

No Lights and the Needle Does Not Move

Remove the speedometer. Apply 12 volts between pin 8 and pin 11. Place the positive probe on pin 8 and the negative on pin 11.

NOTE: Respect positive and negative positions if not the speedometer could be damaged.



A35E02A

If the speedometer stays off, change it.

If the speedometer is lighted, check connector and wiring harness. Repair defective parts.

The Speedometer Is Lighted But the Needle Does Not Move

Check the speed sensor and the wiring harness.

If the speed sensor and the wiring harness are good, change the speedometer.

Installation

The installation is the reverse of the removal procedure.

SPEED SENSOR

Test

Install the supply harness (P/N 529 035 869) with the supply cable (P/N 529 035 997).

NOTE: Remove the headlight system fuse to save the battery during the test.

Static Test

Unplug the speed sensor connector.

A33E1MA

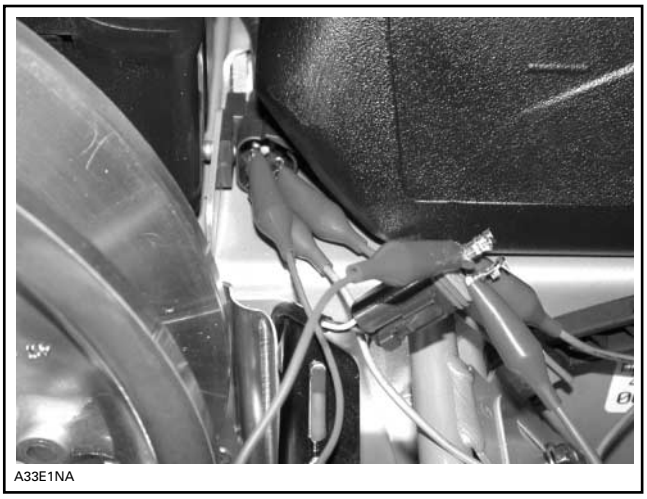
Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between BLACK/BLUE and RED/GREY wires. The obtained value should be the battery voltage.

Measure the voltage between BLACK/BLUE and GREEN/WHITE wires. The obtained value should be ±1 volt under battery voltage.

Dynamic Test

Install 3 pins in each speed sensor connector.

Install wire jumpers between pins.



A33E1NA

Lift the rear of the vehicle.

Connect multimeter probe on GREEN/WHITE and BLACK/BLUE wires.

Turn the track slowly. The voltage should be 12 volts then drop to O.L.

If the obtained value is out of specifications, change it.

TACHOMETER

Test

No Light But the Needle Moves

The tachometer is supplied through the speedometer. Check the voltage between pins 9 and 10 of tachometer connector.

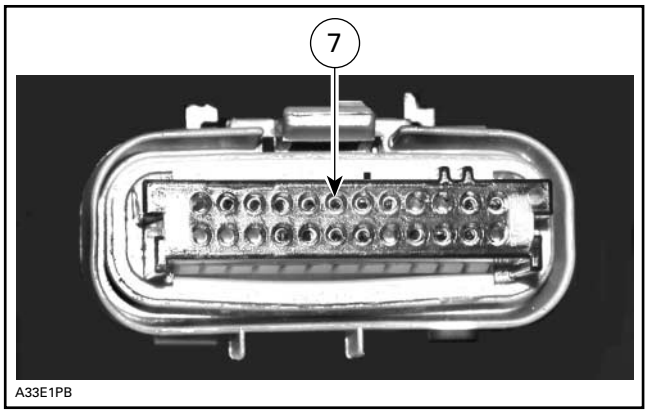
The obtained value should be the battery voltage. If not, check connections and wiring harness.

If the voltage is good, replace the tachometer.

The Needle Does Not Move

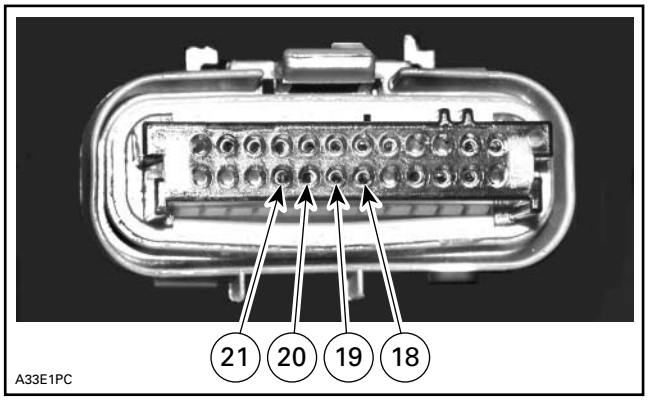
No lights, see speedometer

With lights, check RPM signal on pin 7 of speedometer connector.



Crazy Needle

Check wire connections on pin 18, 19, 20 and 21 of tachometer connector.



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.

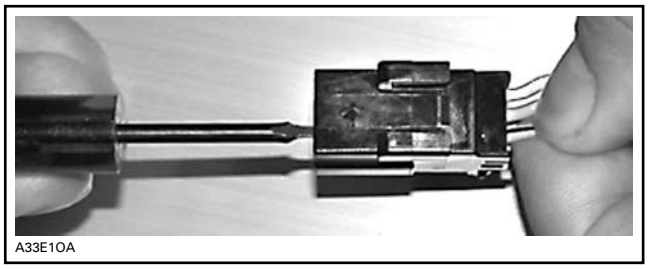
Removal

Remove the radiator cover by removing the retaining screws.

Remove trunk behind seat.

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.

Summit Highmark and Summit Highmark X

Unscrew the screws retaining the rack to the side of frame.

Unscrew the other screws that attach the rack near the radiator.

All Models

Unscrew taillight lens and pull the wire.

NOTE: Attach a cord at the end of wire to reinstall the new wire easily.

Installation

The installation is the reverse of the removal procedure.

VISOR OUTLET

Removal

Remove the console.

Unplug the visor connector.

Unscrew visor outlet.

Test

Unplug the visor connector.

Using the multimeter FLUKE 111 (P/N 529 035 868), check voltage between RED/YELLOW and BLACK wires. The obtained value should be ± 12 Vdc.

Before changing the visor outlet, try another accessory, if the accessory does not work, change visor outlet.

Installation

The installation is the reverse of the removal procedure.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	187

APPLICATION CHART

MODEL	PART NUMBER	MINIMUM WIDTH (wear limit) mm (in)
995 SDI engines	417 300 189	35.9 (1.413)

INSPECTION

Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt.

Check drive belt width. Replace the drive belt if width is under minimum recommended width (see table above).

CHECKING NEUTRAL FUNCTION

⚠ WARNING

Always check neutral function when servicing.

Apply parking brake. Vehicle must be on the ground and on a plane level surface. No one should be in front of vehicle.

Attach vehicle tether cord to your clothing. Stand aside of vehicle, then start engine.

⚠ WARNING

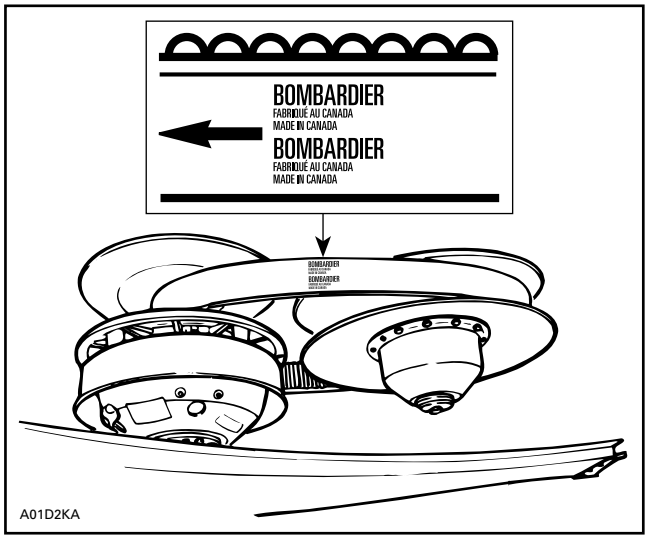
Do not sit on vehicle.

Release parking brake. Vehicle must not creep when engine is idling. Otherwise, make sure that:

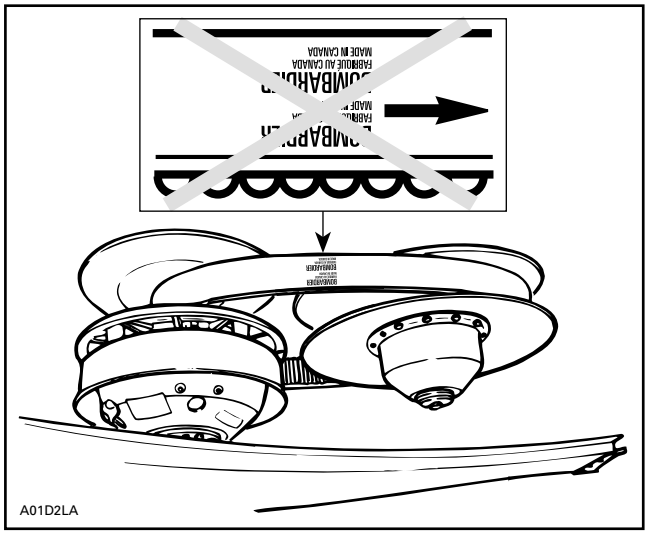
- idle speed is as specified
- proper belt is installed
- pulley center-to-center is as specified
- belt deflection is as specified.

ROTATION DIRECTION

The maximum drive belt life span is obtained when the drive belt is installed as shown. This will ensure that correct direction of rotation is respected.



CORRECT



INCORRECT

NOTE: For used drive belt, mark and reinstall in the same position.

DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT

Measurement

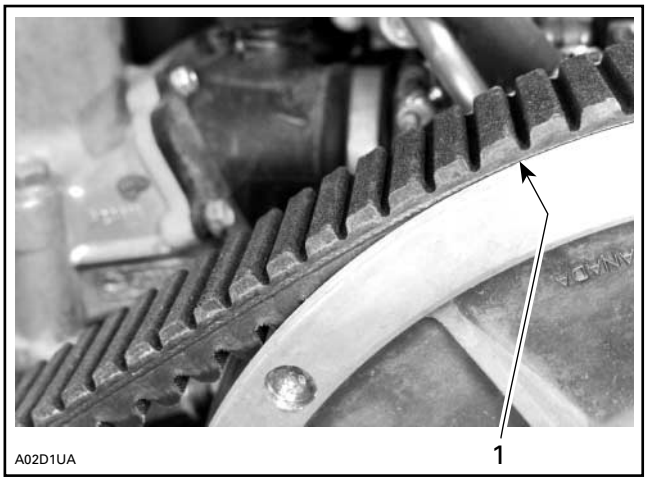
NOTE: The drive belt height measurement must be performed each time a new drive belt is installed. To obtain an accurate drive belt height measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Adjust pulley alignment. Refer to PULLEY ALIGNMENT.

To obtain maximum vehicle performance, the belt height must be adjusted according to specifications shown in the accompanying chart.

MODEL	BELT HEIGHT
All models	Top edge of drive belt cord should be flush with driven pulley edge.

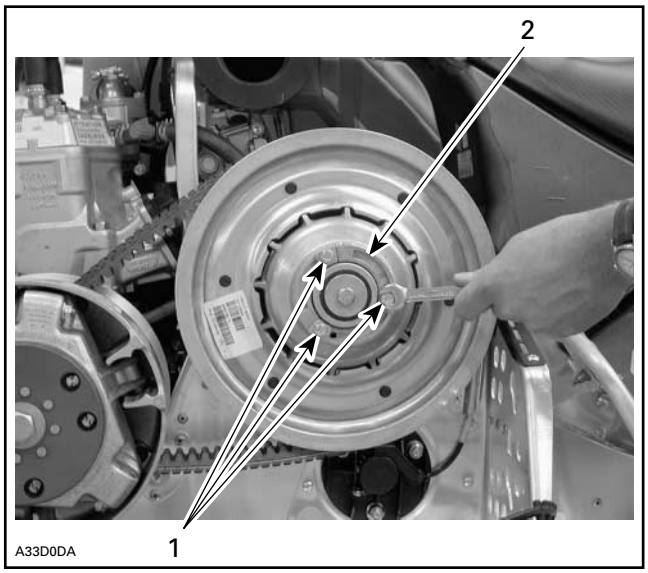


TYPICAL
1. Flush

Adjustment

Before adjusting the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Align pulleys according to specification, refer to PULLEY ALIGNMENT.

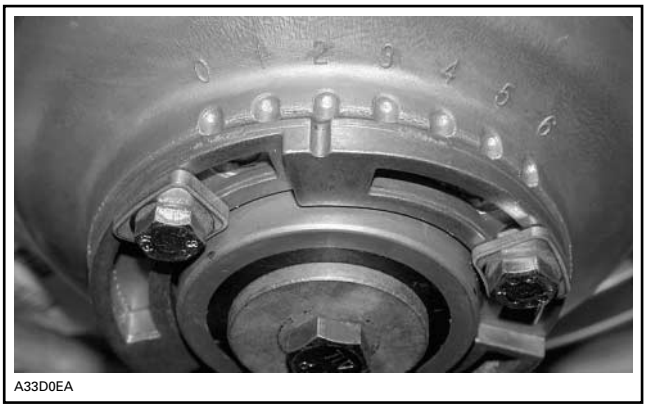


TYPICAL
1. Screws
2. Adjustment ring

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 ring clockwise and tighten the adjustment screws.



DRIVEN PULLEY NOTCHES

Turn the adjustment ring up to 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.

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 MEASUREMENT (reference only)

NOTE: The drive belt deflection measurement must be performed each time a new drive belt is installed. To obtain an accurate drive belt deflection measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt deflection, ensure vehicle has the proper belt (refer to the APPLICATION CHART).

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt tension must be adjusted according to specifications shown in the accompanying chart.

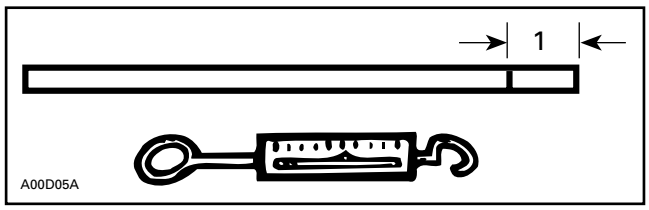
MODEL	DEFLECTION † mm (in)	FORCE kg (lb)
All models	32 ± 5 (1.260 ± .197)	11.5 (25)

† FOR REFERENCE ONLY

To Check Tension

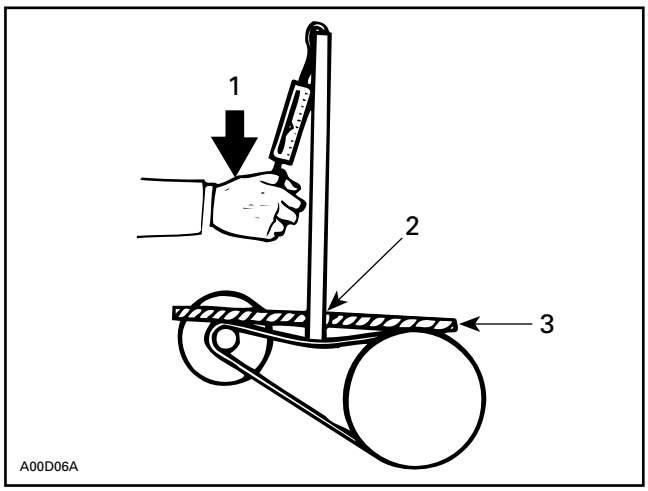
Position a reference rule on drive belt.

Wooden Stick and Spring Scale Method



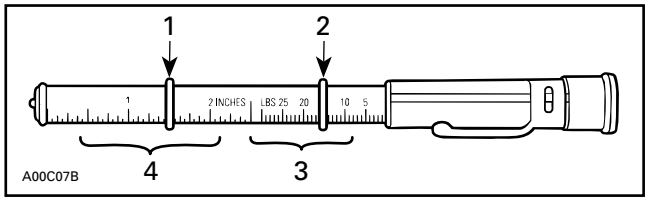
1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.



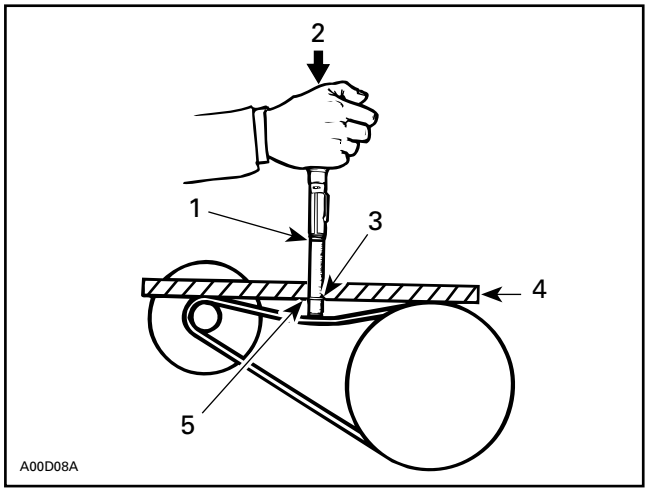
1. Force
2. Read deflection here
3. Reference rule

Or use the belt tension tester (P/N 414 348 200).



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 rule 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 rule
5. Deflection

DRIVE PULLEY

SERVICE TOOLS

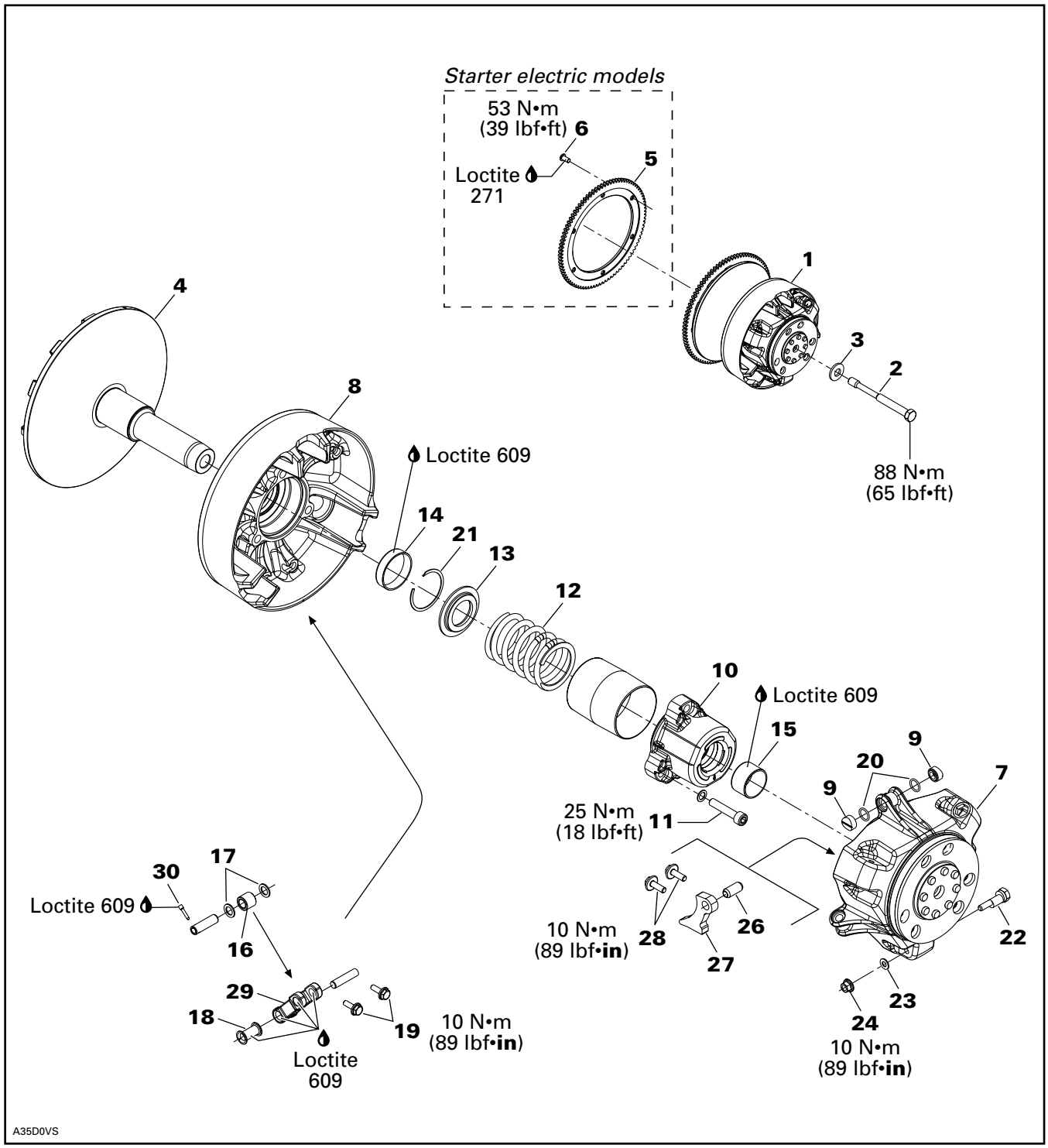
Description	Part Number	Page
bushing remover/installer	529 031 200	194
drive pulley holder	529 035 674	191, 198
drive pulley puller	529 022 400	191
slider shoe fork	529 005 500	192, 197
sliding half bushing remover/installer	529 035 931	194–195
spring compressor	529 035 524	192, 194–195, 197

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	195
Loctite 609	413 703 100	195–197
pulley flange cleaner	413 711 809	193, 195

TRA V

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.



GENERAL

⚠ 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.

NOTE: TRA drive pulley stands for Total Range Adjustable drive pulley.

⚠ 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

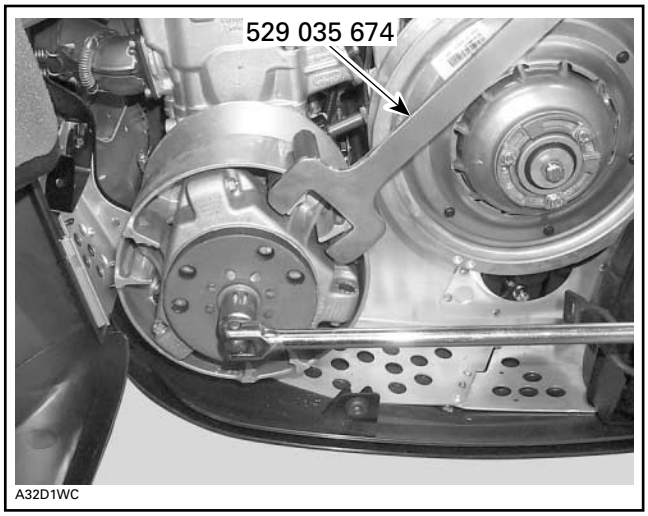
Each time the drive pulley is removed from the engine, check the tightening of ring gear screws. Torque them if necessary.

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.

REMOVAL

Remove drive belt.

Secure drive pulley **no. 1** with the drive pulley holder (P/N 529 035 674). Install it over a sliding half tower.



TYPICAL — INSERT THE TOOL IN SLIDING FLANGE TOWER

Remove the drive pulley bolt **no. 2** and its conical spring washer **no. 3**.

To remove drive pulley **no. 1** and/or fixed half **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

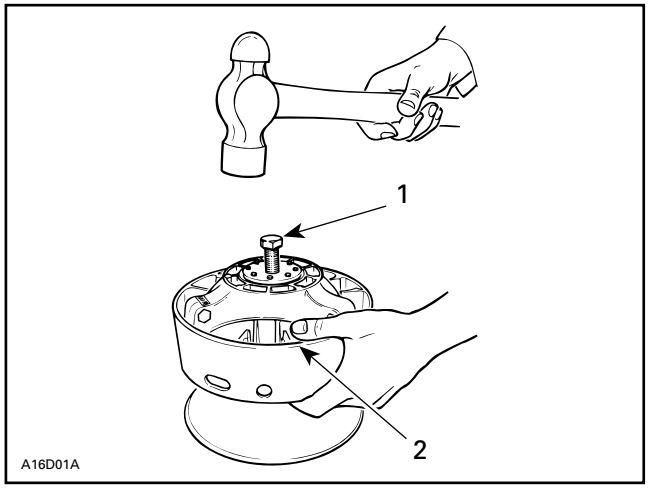
To remove the ring gear **no. 5**, use a heat gun to break the threadlocker on ring gear screws **no. 6** before disassembly.

CAUTION: If another tool than a heat gun is used, do not exceed 150°C (300°F).

Fixed Half

CAUTION: NEVER tap on governor cup no. 7.

To separate fixed half **no. 4** from sliding half **no. 8**, heat the stop plate with a heat gun then screw puller into fixed half shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding half while knocking on puller head to disengage fixed half.



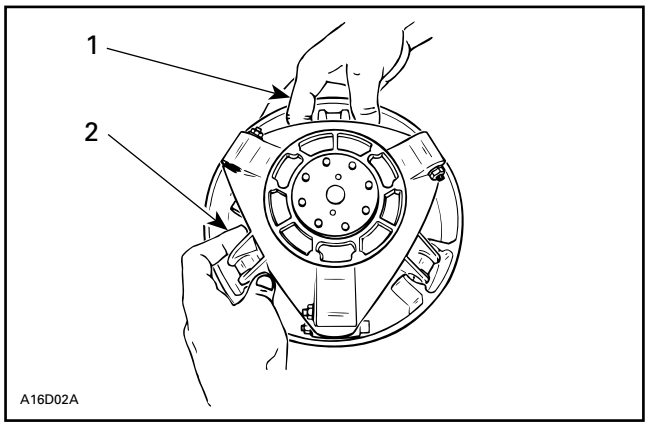
TYPICAL
1. Puller
2. Holding sliding half

NOTE: No components marking is required before disassembling this drive pulley since it has factory mark and arrows as indexing reference.

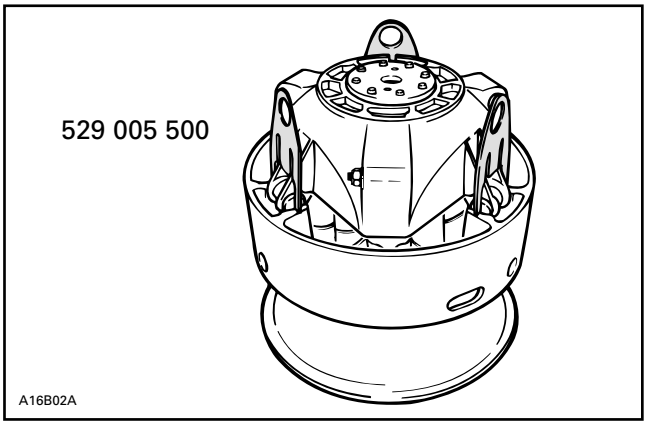
Slider Shoe and Governor Cup

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

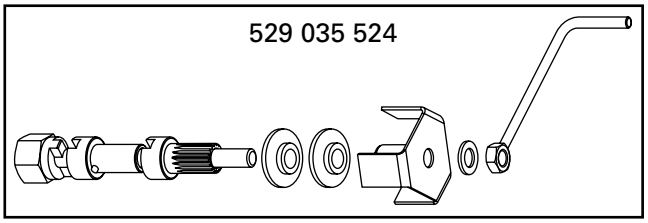
When all slider shoes are hold with the forks, remove the governor cup.

Spring Cover

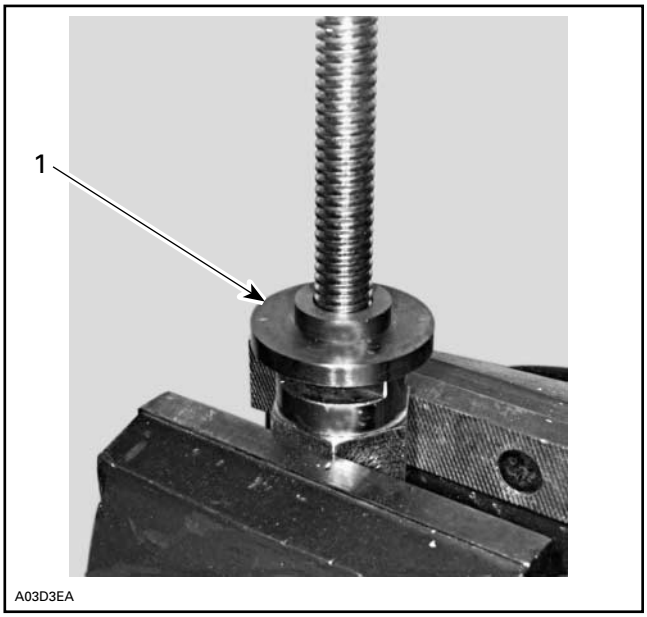
To remove the spring cover **no. 10**, always use the spring compressor (P/N 529 035 524). The spring cover is pushed by clutch spring pressure.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

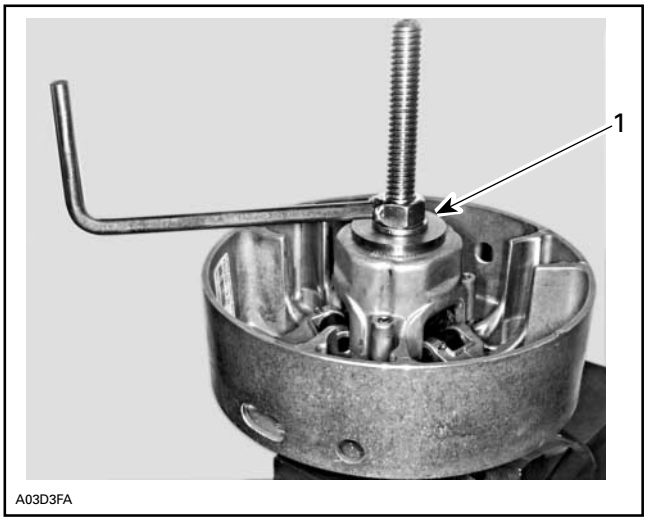


Install support guide of spring compressor in vice.



1. Support guide

Install sliding half **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 Halves

Parts must be at room temperature before cleaning.

Clean pulley halves 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 half 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 half 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.

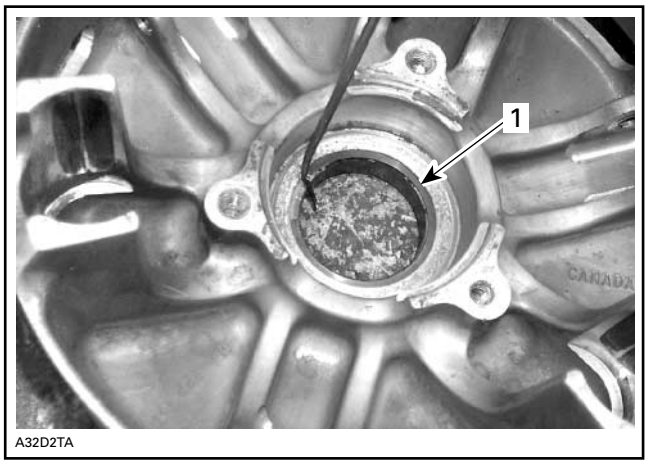
Sliding Half and Spring Cover Bushings

Visually inspect coating of bushings **no. 14** and **no. 15**. Replace if worn.

Sliding Half Bushing Replacement

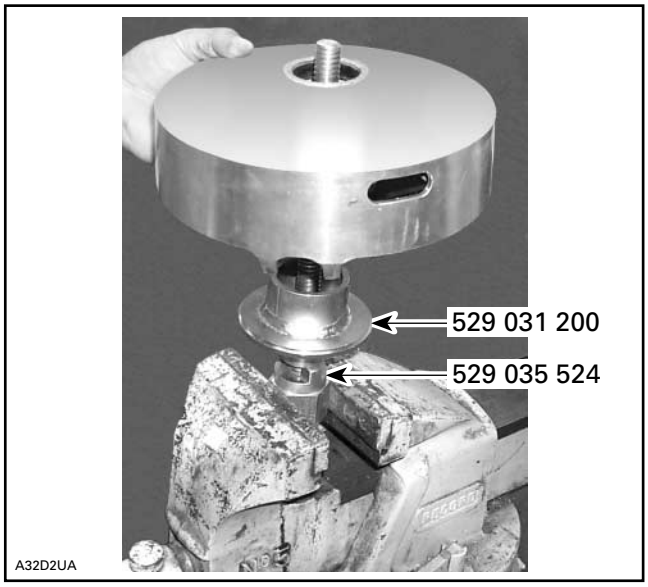
NOTE: In case of worn out bushing, it is advisable to replace whole sliding half assembly as replacing just the bushing may reduce the drive pulley performance.

Remove circlip **no. 21** from the sliding half.



TYPICAL
1. Circlip

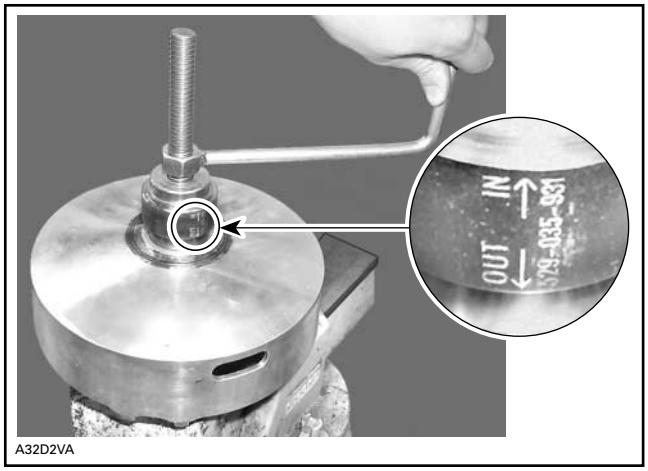
Secure the spring compressor (P/N 529 035 524) in a vice. Mount the bushing remover/installer (P/N 529 031 200) and the sliding half assembly on it.



TYPICAL

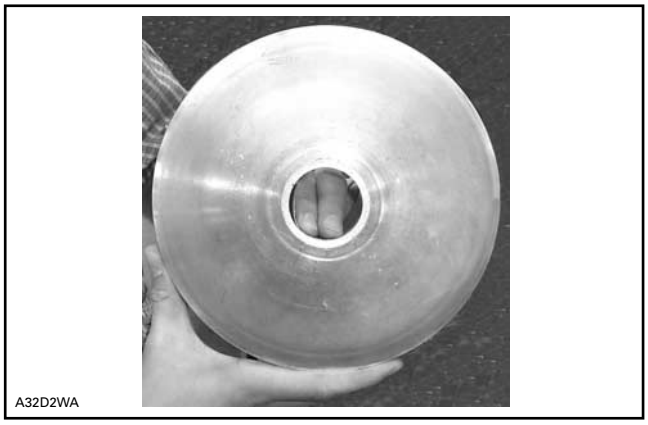
Use the sliding half bushing remover/installer (P/N 529 035 931) to press out old bushing.

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 half bushing mounting surface.


A32D2WA

Clean sliding half bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

To install a new bushing, secure the spring compressor (P/N 529 035 524) in a vice and mount the sliding half .

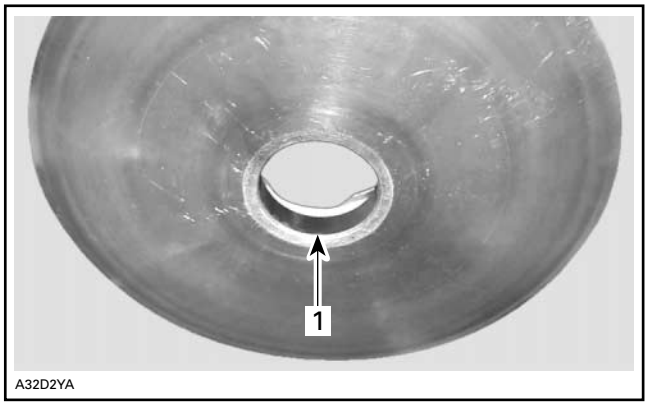
Apply Loctite 609 (P/N 413 703 100) on the outside of bushing face then insert the bushing from inner side of sliding half.

Mount the sliding half bushing remover/installer (P/N 529 035 931) with side marked "IN" to press in a new bushing.


A32D2XA

TYPICAL

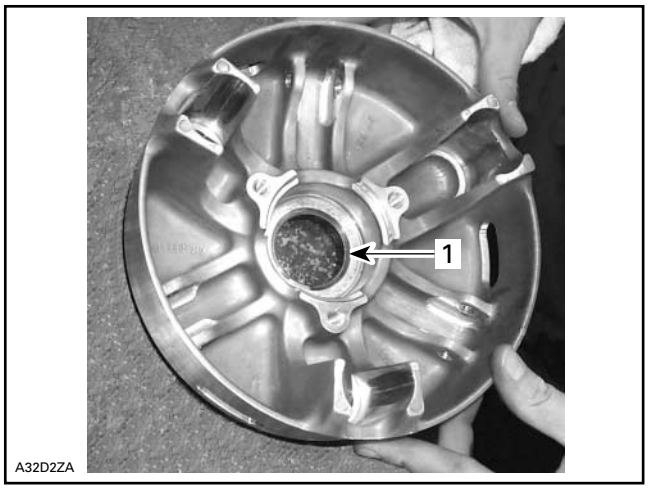
NOTE: Make sure that the bushing is well seated on the sliding half.



A32D2YA

1. Bushing

Install the circlip.



A32D2ZA

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 half **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 half holes.

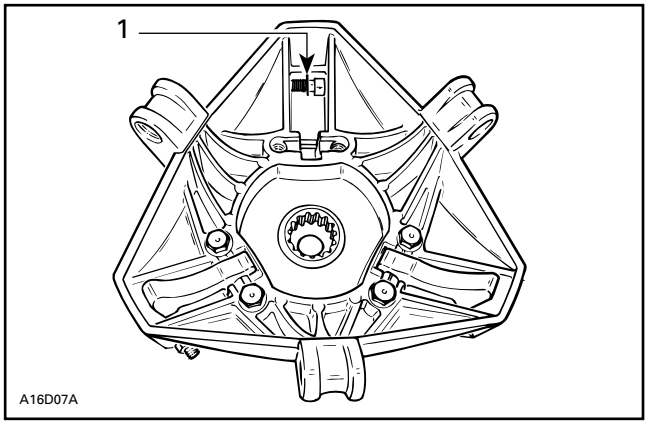
Torque ring gear screws.

CAUTION: Do not use other screws than recommended ones in the parts catalog. Never use bolts coming from another type of pulley.

RING GEAR ON TRA V	
ENGINE	TORQUE
All 995 SDI	53 N•m (39 lbf•ft)

Calibration Screw, Washer and Locking Nut

When installing calibration screw **no. 22**, make sure to install washer **no. 23** as shown.



TYPICAL
1. Washer

The calibration screws should be installed at the following position.

CALIBRATION SCREW POSITION		
MODEL	ENGINE	POSITION
Mach Z	995 SDI	6
Summit (Canada and U.S.A.)	995 SDI	4
Summit (Europe)	995 SDI	3

Torque locking nut **no. 24** to 10 N•m (89 lbf•**in**).

Pin

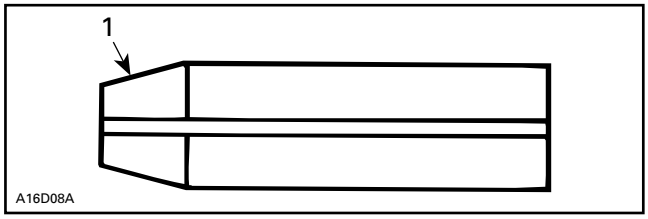
Always use the same type of pin **no. 25** as originally installed when servicing. Different types have different weights for calibration purpose. Refer to TECHNICAL DATA.

Use a heat gun for pin removal.

Apply Loctite 609 (P/N 413 703 100) between pin and lever when assembling.

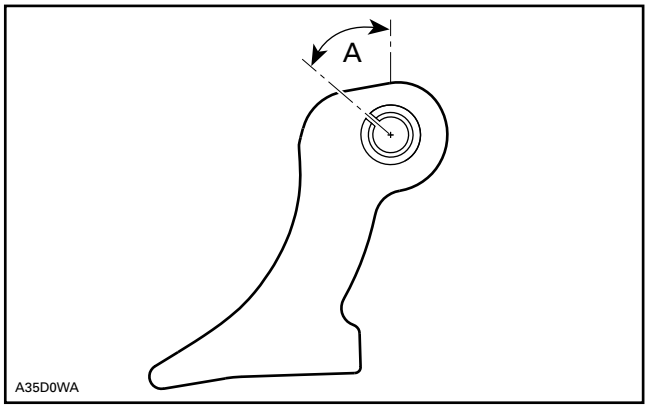
Dowel Tube and Ramp

Insert dowel tube **no. 26** from chamfered side. Make sure ramp **no. 27** is centered on dowel tube.

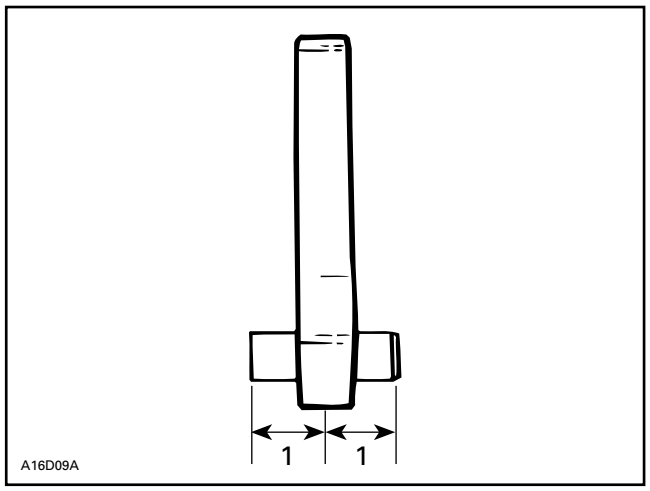


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA V	45 ± 3°



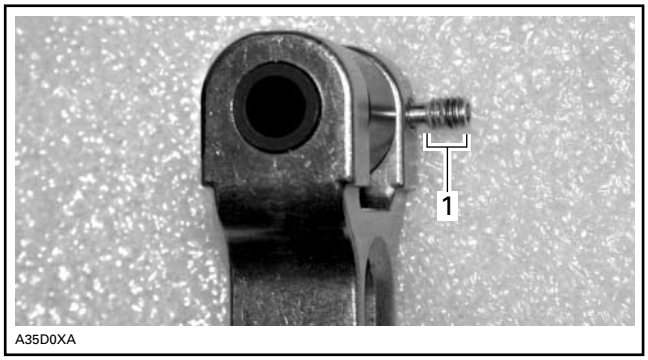
1. Equal distance

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.

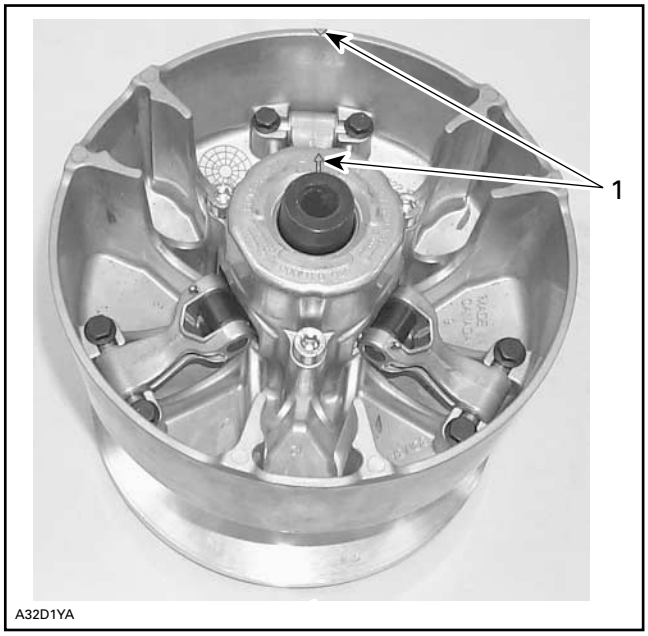
CAUTION: Lever assembly and rollers must move easily after installation.

Fixed Half, Sliding Half, Spring and Spring Cover

To install spring cover, use spring compressor (P/N 529 035 524).

Assemble fixed and sliding halves. Note that fixed halves have different taper angle. Match taper angle with crankshaft.

Lift sliding half against spring cover and align spring cover arrow with sliding half mark.

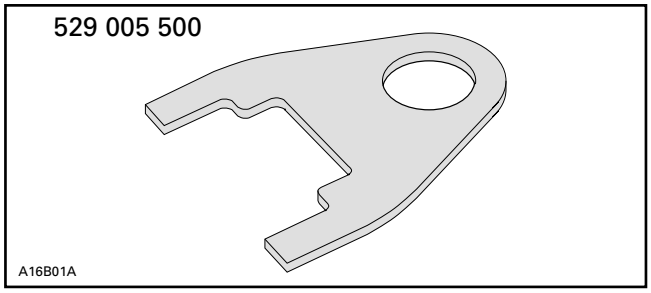


TYPICAL
1. Align

Tighten screws **no. 11** to proper torque as mentioned in exploded view.

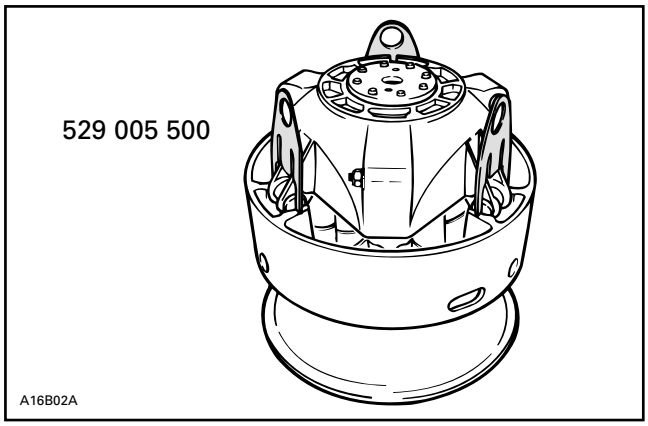
Sliding Half, Slider Shoe and Governor Cup

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.

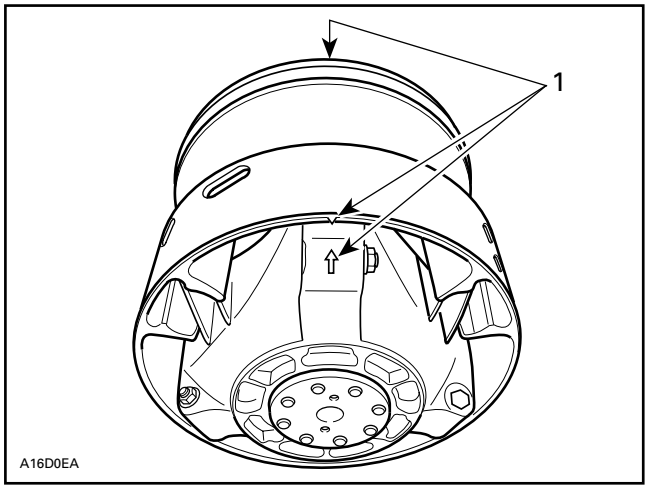
Install a slider shoe fork into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.



TYPICAL

Make sure to align governor cup arrow with sliding half and fixed half mark.

NOTE: If fixed half has no mark, align governor cup mark with **segment no. 1 of inner half**. Segments are identified on engine side.



TYPICAL
1. Align

Carefully slide governor cup into sliding half. Align mark of governor cup with mark of fixed half.

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).

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.

DRIVE PULLEY 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.

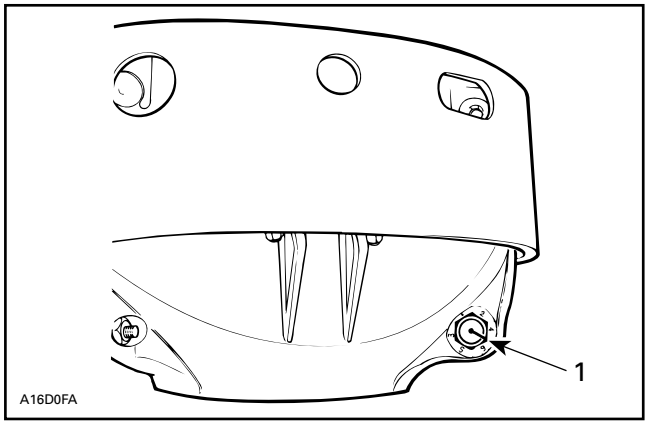
Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in TECHNICAL DATA.

NOTE: Use precision digital tachometer for engine RPM adjustment.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

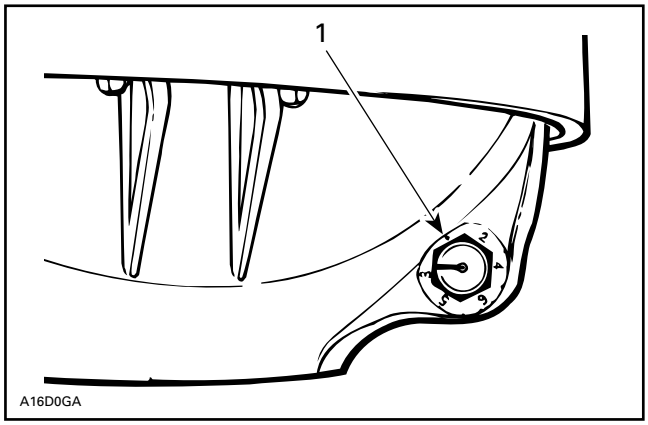
Calibration screw has a notch on top of its head.



TYPICAL
1. Notch

Governor cup has 6 positions numbered 1 to 6.

See the CALIBRATION SCREW POSITION table, above in this section, for original setting.



TYPICAL
1. Position 1 (not numbered)

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:

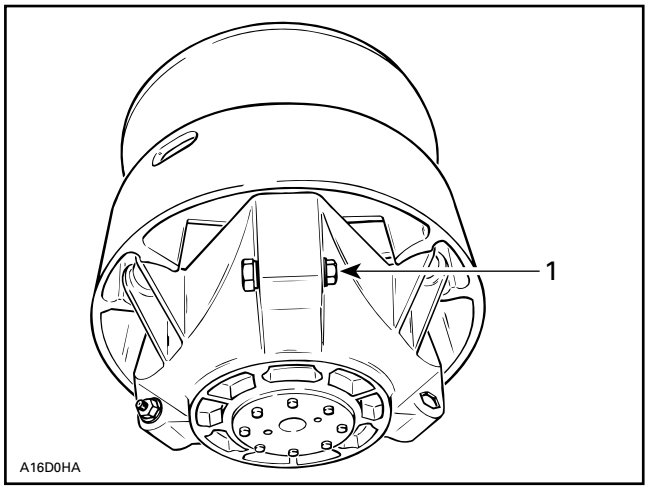
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

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

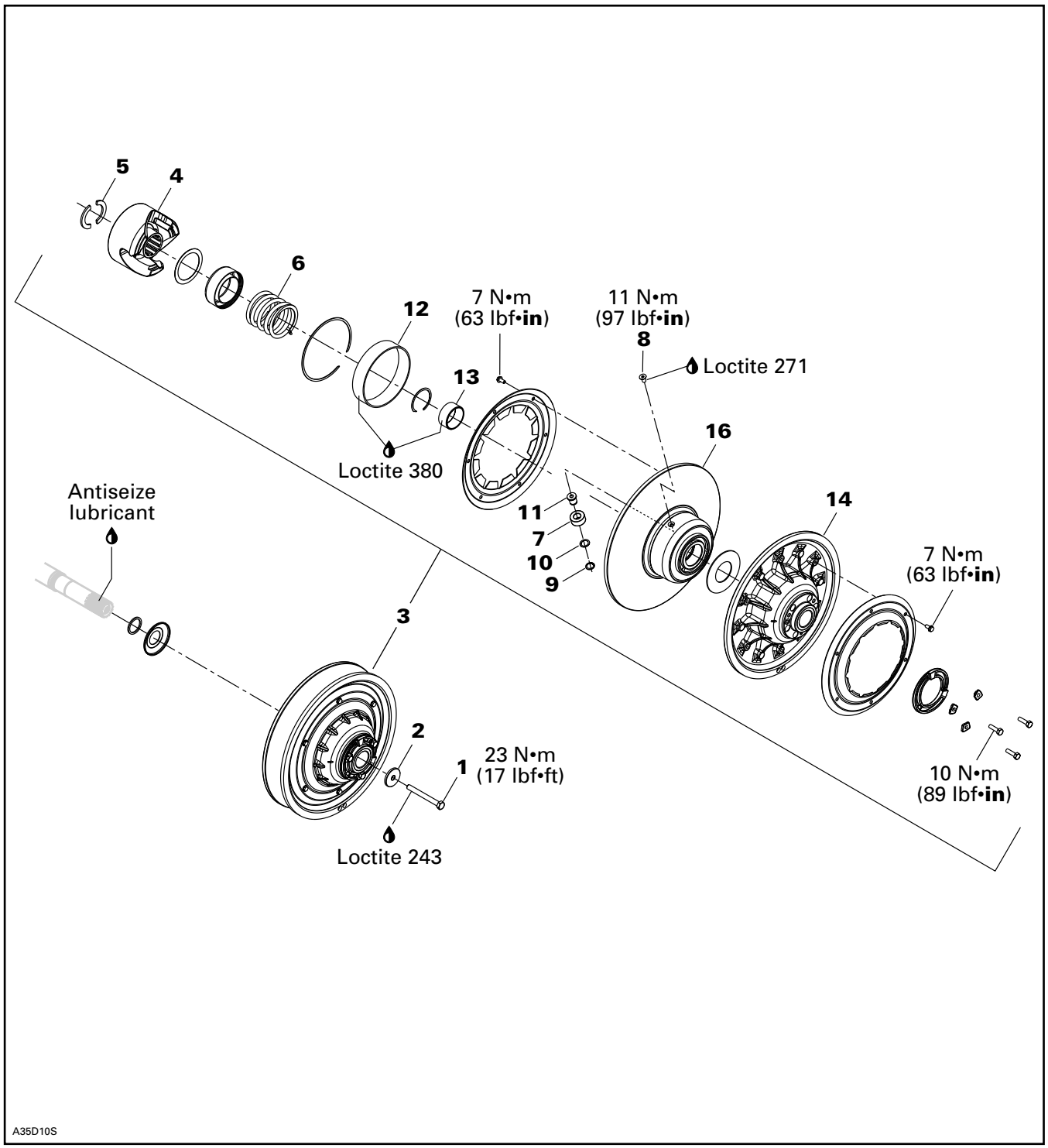
Description	Part Number	Page
bushing extractor/installer	529 031 300	206
clutch spring compressor	529 035 524	209
clutch spring compressor	529 036 012	203, 206
crankshaft protector	420 876 552	206
large bushing extractor	529 031 100	205
large bushing extractor	529 035 575	206
spring scale hook	529 006 500	211

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	205
Loctite 271 (red)	293 800 005	205
Loctite 380 (Black MAX)	413 408 300	206
Loctite antiseize lubricant	293 800 070	205, 210
pulley flange cleaner	413 711 809	204, 206, 209

HPV ROLLER

Mach Z Models



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.

REMOVAL

Driven Pulley

Remove belt guard and drive belt.

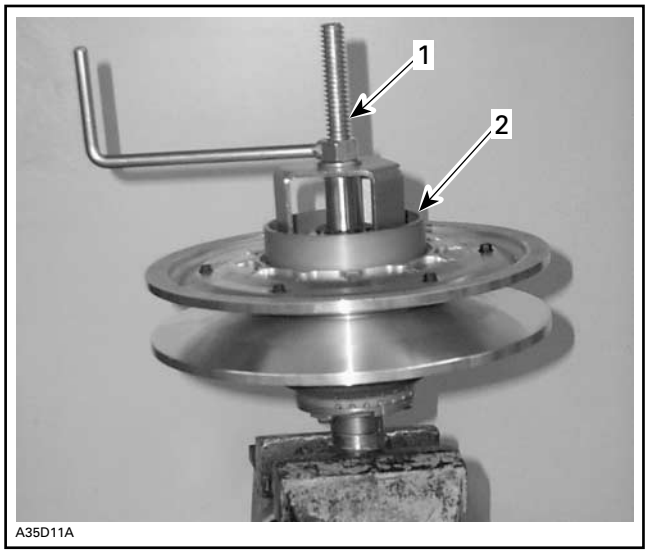
Remove driven pulley bolt **no. 1** and shouldered washer **no. 2** then pull the driven pulley **no. 3** from the countershaft.

Countershaft and Countershaft Bearing

To remove and install countershaft and its bearing refer to CHAINCASE.

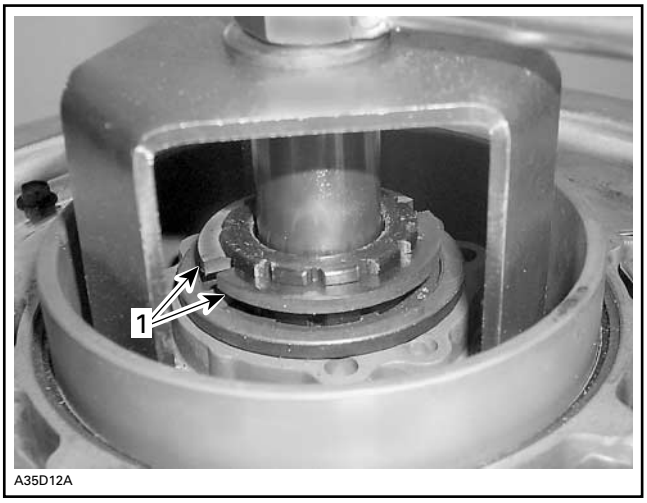
DISASSEMBLY

Using the clutch spring compressor (P/N 529 036 012), push the cam **no. 4**.



1. Clutch spring compressor
2. Cam

Remove the half keys **no. 5**.



1. Half keys

⚠ WARNING

Driven pulley cam is spring loaded, use only the above mentioned tool. Do not use other clutch spring compressor.

Unscrew clutch spring compressor then remove cam and spring **no. 6** and separate the 2 pulley halves.

Remove the circlip **no. 9** and the washer **no. 10** then remove the roller **no. 7** from the roller axle **no. 11**.

Remove the rollers axles in sliding half **no. 16** by unscrewing the roller axle screws **no. 8**. Heat screws to break the threadlocker.

CLEANING

Pulley Halves

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean pulley halves.

If necessary, use a fine steel wool and a dry cloth to remove a stubborn deposit.

Bushings and Cam

During break-in period (about 10 hours of use), teflon from bushing **no. 12** and **no. 13** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

INSPECTION

NOTE: Inner flanges, threads, countershaft and all surfaces which have contacts with other moving parts must be free of dust, scratches or rust.

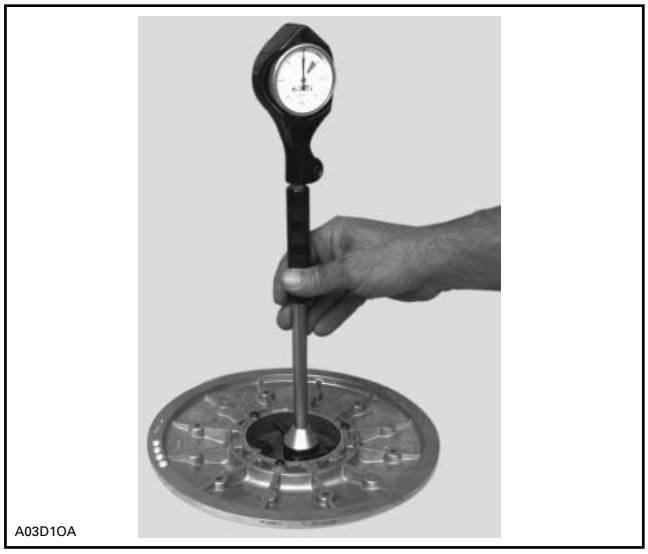
Pulley Halves

Check pulley halves for marks or scratches.

Check splines in fixed half 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.



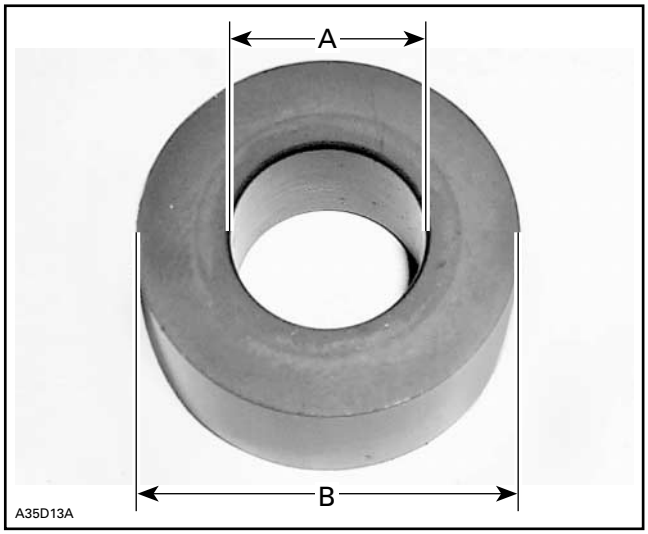
BUSHING	SERVICE LIMIT
Small bushing	38.30 mm (1.508 in)
Large bushing	108.2 mm (4.260 in)

Replace the bushing if the measurement is out of specification. Refer to BUSHING REPLACEMENT at the end of this section.

Rollers

Check the rollers **no. 7** for flat spots, cracks or other visible damages.

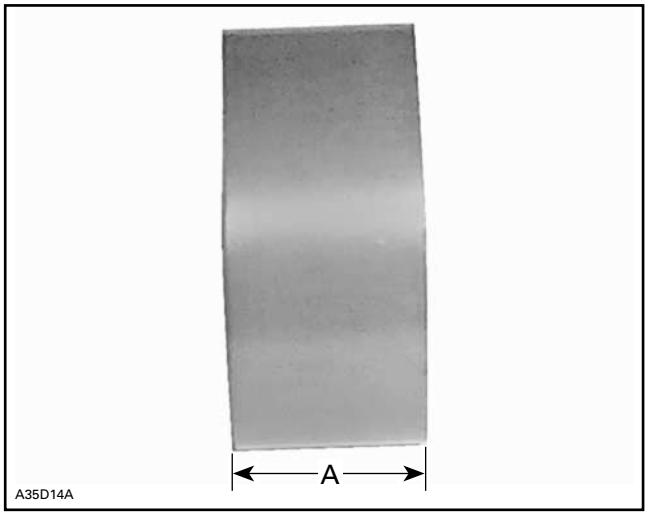
Measure inner and outer diameter of rollers.



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.

ASSEMBLY

The assembly is the reverse of the disassembly procedure. However, pay attention to the following details.

Clean threads of roller axles **no. 11** before installing their screws **no. 8**. Apply Loctite 271 (red) (P/N 293 800 005) on screw threads. Torque screws to 11 N•m (97 lbf•**in**).

Make sure to install the proper cam. The cam angle is indicated on the cam. Refer to TECHNICAL DATA to know which cam must be used.

During cam installation, make sure to align the cam slides with the rollers.

INSTALLATION

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

Apply Loctite 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.

BUSHING REPLACEMENT

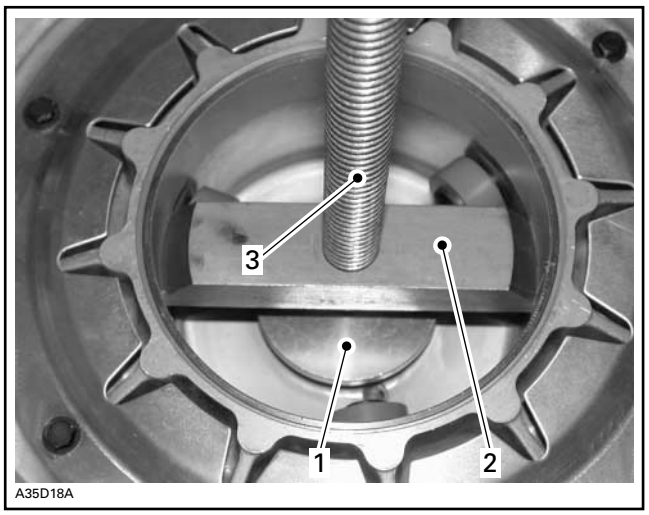
Large Bushing

Remove circlip.

Install the support plate included in the large bushing extractor (P/N 529 031 100) inside sliding half.


A35D17A

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.



A35D18A

TYPICAL
1. *Support plate*
2. *Large bushing extractor*
3. *Threaded rod of spring compressor*

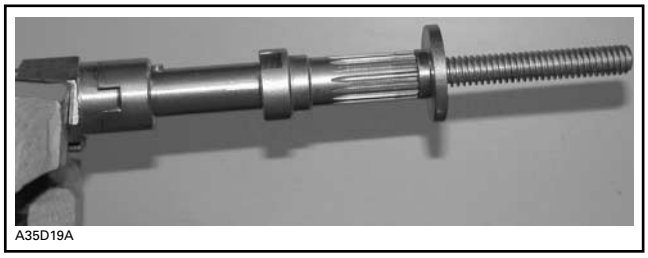
Mount the clutch spring compressor head in a vise.

Using a heat gun, heat bushing to break the adhesive product.

Turn pulley half 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 half 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 half by hand to insert the new bushing.

NOTE: Change the position of extractor often to push the bushing straight.

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).

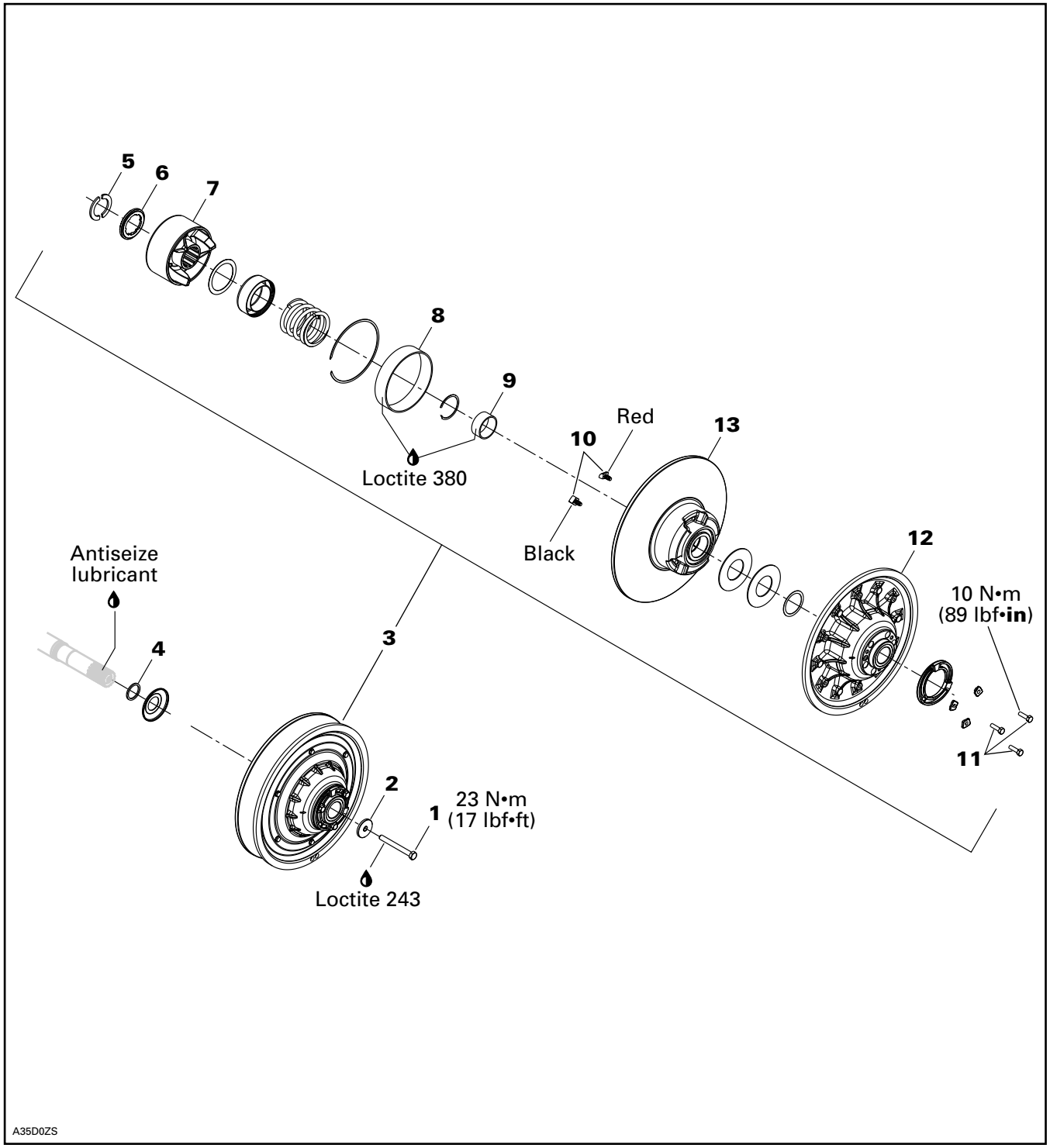
Using press, bushing extractor/installer (P/N 529 031 300) and the crankshaft protector (P/N 420 876 552), insert small bushing in its location.


A35D1BA

Install circlip.

HPV VSA

Summit Highmark and Summit Highmark X Models



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.

REMOVAL

Remove guard and drive belt from vehicle.

Remove driven pulley bolt **no. 1** and shouldered washer **no. 2** then pull the driven pulley **no. 3** from the countershaft.

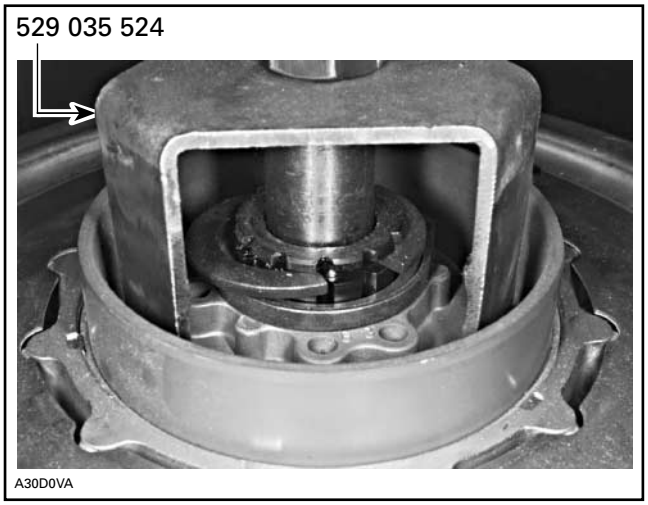
Note shouldered washer position for reinstallation. Take care not to lose spacer **no. 4**.

Countershaft

Should countershaft removal be required, refer to CHAINCASE.

DISASSEMBLY

Use clutch spring compressor (P/N 529 035 524).



TYPICAL

Remove half keys **no. 5** and washer **no. 6** to disassemble the cam **no. 7** and the 2 pulley halves.

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

CLEANING

Large Bushing and Small Bushing

During break-in period (about 10 hours of use), teflon from bushing **no. 8** and **no. 9** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

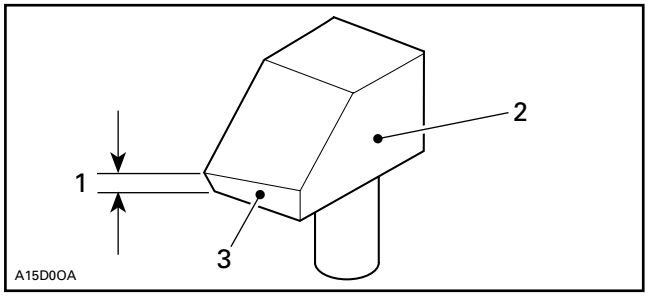
Pulley Half Cleaning

Use pulley flange cleaner (P/N 413 711 809) to clean pulley halves.

INSPECTION

Slider Shoe

Check cam slider shoes **no. 10** for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

Bushings

Measure the inner diameter of small and large bushings **no. 8** and **no. 9**.

BUSHING	SERVICE LIMIT
Small bushing	38.30 mm (1.508 in)
Large bushing	108.2 mm (4.260 in)

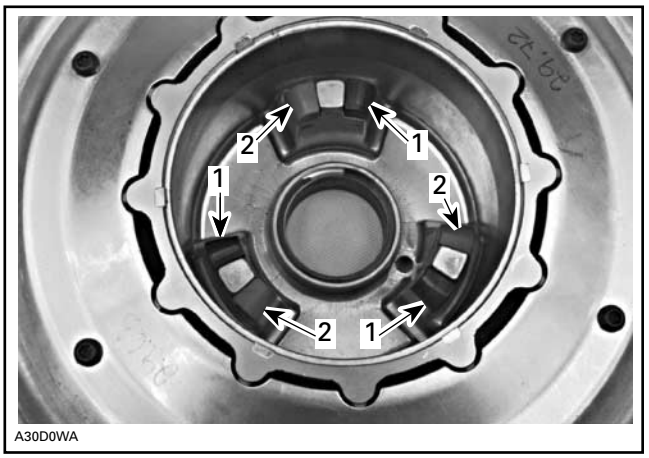
Replace the bushing if the measurement is out of specification. Refer to BUSHING REPLACEMENT at the end of this section.

ASSEMBLY

Cam Slider Shoe

When replacing slider shoes **no. 10**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



1. BLACK slider shoe
2. RED slider shoe

Screws

Screws **no. 11** are machined at their end. With the adjustment ring steel to position 0 (zero), screw ends are flush with inner side of fixed pulley half **no. 12** when tighten.

CAUTION: If any of these screws is not flush with inner side of sliding pulley no. 13, bushings will worn unequally.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 7** interior with Loctite antiseize lubricant (P/N 293 800 070).

INSTALLATION

Apply Loctite antiseize lubricant (P/N 293 800 070) on countershaft splines.

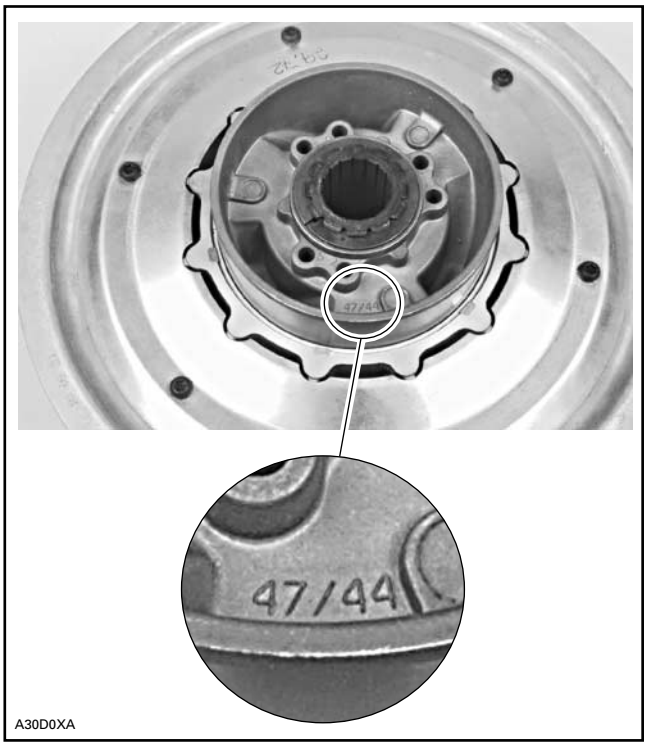
Reinstall the driven pulley on the countershaft by reversing the removal procedure.

ADJUSTMENT

Cam

Make sure to install proper cam **no. 7**. Refer to TECHNICAL DATA.

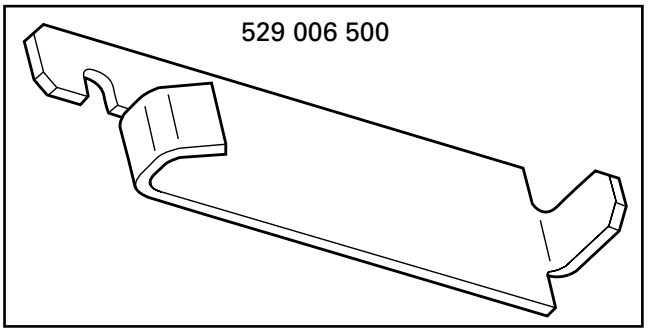
Cam angle is identified on cam.



NOTE: For high altitude regions, a service bulletin will give information about calibration according to altitude.

Spring

To check spring preload adjustment, use the spring scale hook (P/N 529 006 500) and a spring scale.



Remove drive belt.

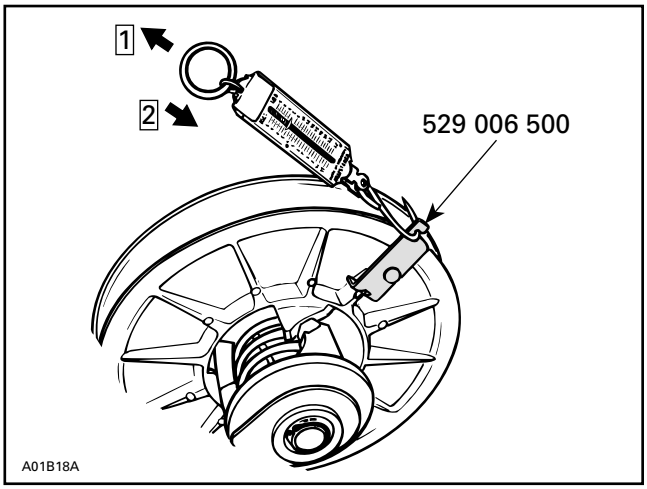
Install the hook on the sliding half **no. 12**. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take first measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold spring scale at this position. Slowly release tension from spring scale and take second measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

$$\frac{\text{First measurement (when opening)} + \text{Second measurement (when closing)}}{2} = \text{Spring preload}$$

EXAMPLE:

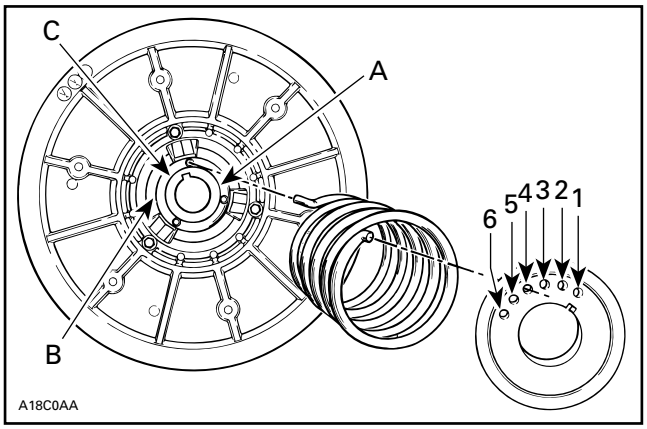
$$\frac{3.8\ \text{kg}\ (8.4\ \text{lb})\ \text{(when opening)} + 3.4\ \text{kg}\ (7.5\ \text{lb})\ \text{(when closing)}}{2} = 3.6\ \text{kg}\ (8\ \text{lb})\ \text{actual spring preload}$$



TYPICAL
1. Pull for the first measurement
2. Release slowly for the second measurement

To adjust spring preload, relocated spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: If the spring preload can not be adjusted, try to relocate the other end of spring in sliding pulley (holes A, B or C).



LETTERS AND NUMBERS SHOWN IN ILLUSTRATION ARE ACTUAL LETTERS AND NUMBERS EMBOSSED ON PARTS

NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Height

Refer to PULLEY ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

PULLEY ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
alignment bar	529 035 831	214
driven pulley opening tool	529 017 200	213

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.

All Pulley Alignment Specifications Refer to:

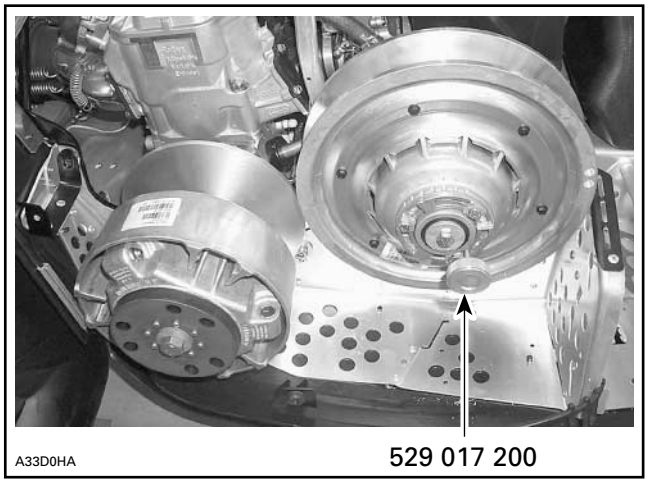
X = Distance between straight bar and drive pulley fixed half edge, measured between pulleys.

Y = Distance between straight bar and drive pulley fixed half edge, measured at the end of straight bar.

MEASURING PROCEDURE

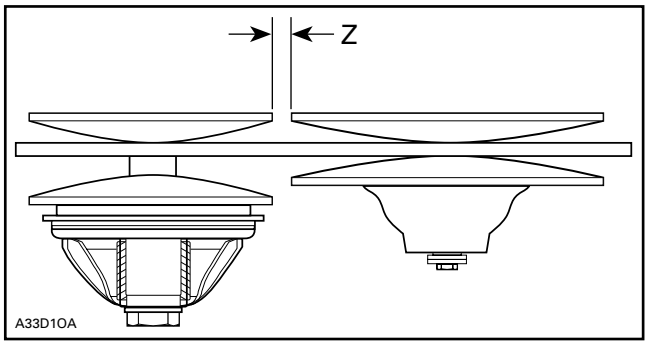
Remove guard, drive belt and air silencer.

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

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.



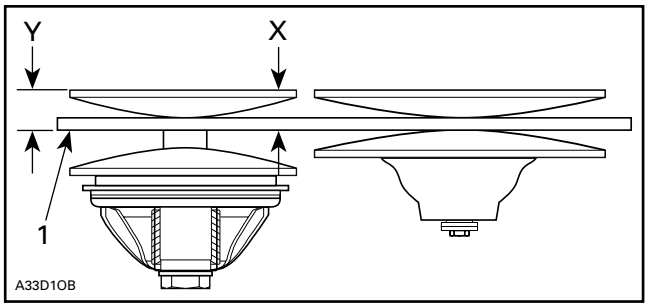
TYPICAL
Z = Distance between both pulleys

PULLEY DISTANCE	
MODEL	DISTANCE
HPV roller	27.5 mm (1.083 in)

Insert the alignment bar (P/N 529 035 831) into the opened driven pulley.

TYPICAL — ALIGNMENT BAR IN PULLEYS

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).



TYPICAL
1. Straight bar

The distance Y **must** exceed distance X to compensate for the twist due to the engine torque.

DRIVE PULLEYS ALIGNMENT		
MODEL	OFFSET mm (in)	
	X	Y-X
	± 0.50 (.020)	
HPV roller	37.0 (1.456)	1.23 (0.048)

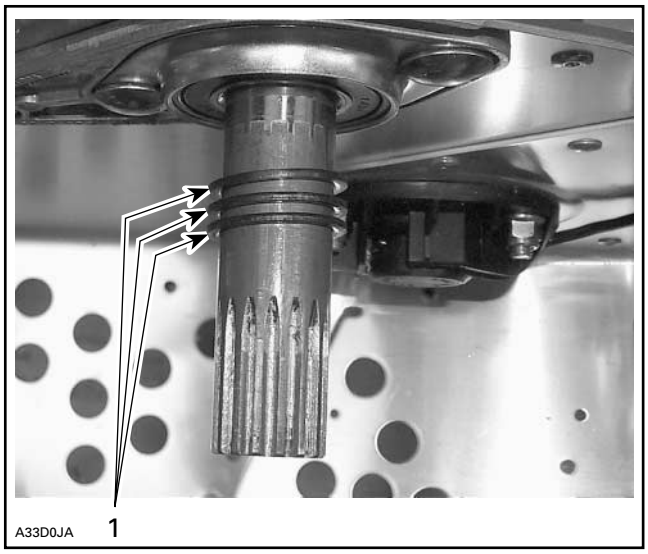
If an alignment is necessary, see ALIGNMENT PROCEDURE below.

If the alignment is good, hand torque the torque rod so it slightly contacts engine crankcase. Do not over tighten, it will disalign pulleys.

When the alignment is done, refer to DRIVE BELT to adjust the drive belt deflection.

ALIGNMENT PROCEDURE

Remove driven pulley and add or remove spacer(s) as required to obtain the specified alignment.



TYPICAL
1. Spacers

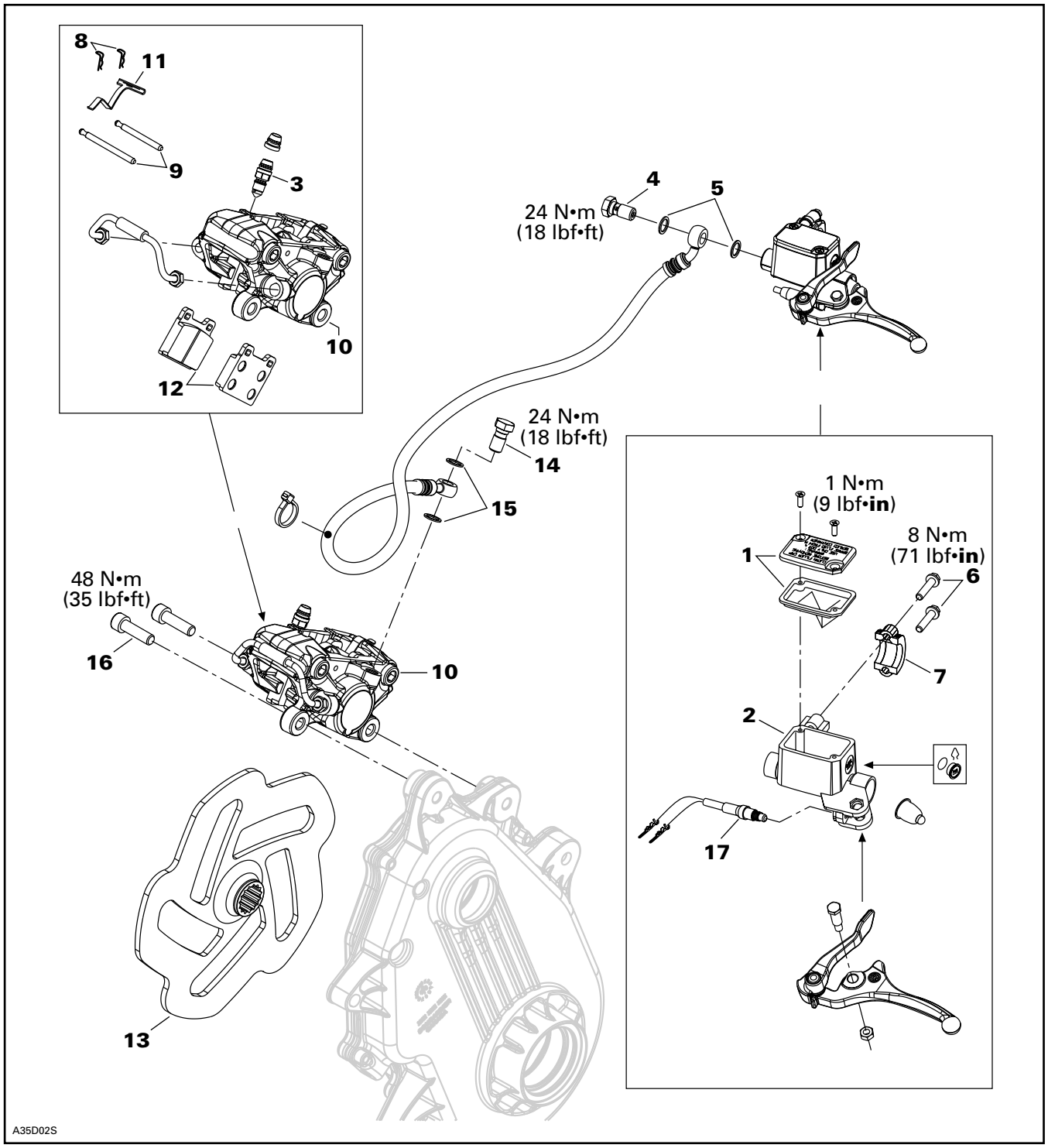
Use the following table to choose the proper shim(s).

SHIM CHART	
SHIM NUMBER	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, refer to DRIVE BELT to adjust the drive belt deflection.

BRAKE

SERVICE PRODUCTS



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.

COUNTERSHAFT BEARING

Refer to CHAINCASE for complete procedure.

COUNTERSHAFT

Refer to CHAINCASE for complete procedure.

BRAKE FLUID

The brake fluid must be changed in accordance with the maintenance chart.

Use recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062).

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

DRAINING

Remove reservoir cover **no. 1** on master cylinder **no. 2**.

Install a clear hose on caliper bleed valve **no. 3**. Route this hose to a container.

Loosen bleed valve and pump brake lever until no more fluid flows out of bleed valve.

Close bleed valve and remove bleed hose.

BLEEDING

Bleed brake system as follows:

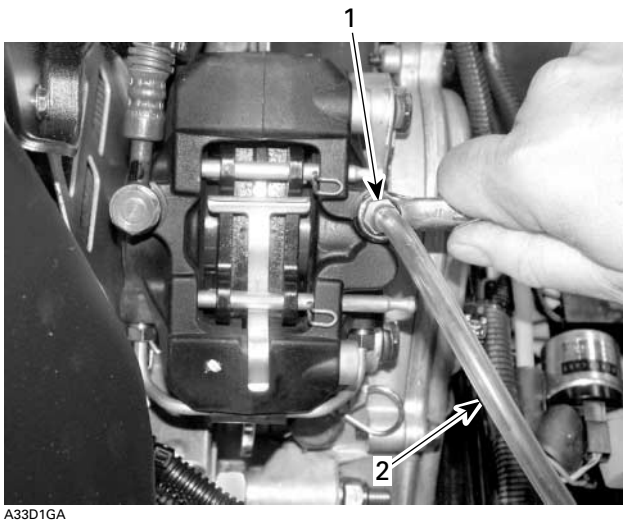
Keep sufficient recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062) in reservoir at all times.

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

Install a clear hose on bleed valve **no. 3**. Route this hose to a container. Open bleed valve.

Pump brake lever until no air escapes from hose.

Close bleed valve.



TYPICAL
1. *Open bleed valve*
2. *Clear hose to catch used brake fluid*

⚠ WARNING

Avoid getting oil on brake pads.

MASTER CYLINDER

Removal

Drain brake fluid until master cylinder **no. 2** is empty.

Remove the Banjo bolt **no. 4** and discard the sealing rings **no. 5**.

Unscrew master cylinder screws **no. 6** from the master cylinder holder **no. 7** then remove master cylinder from handlebar.

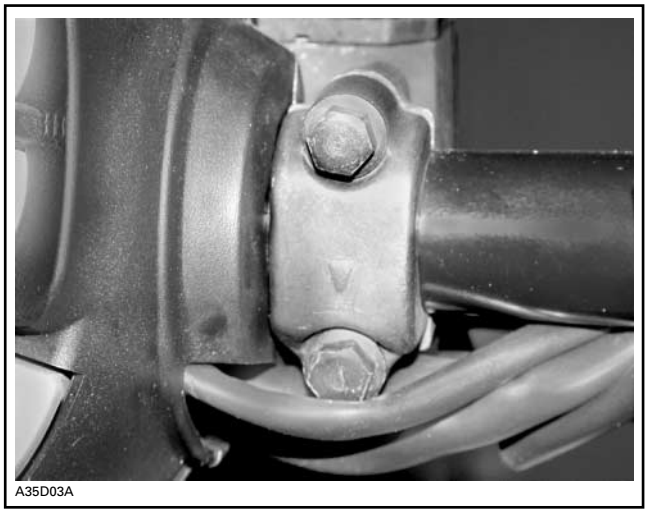
Inspection

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.

Install the master cylinder holder **no. 7** with the arrow pointing downwards.

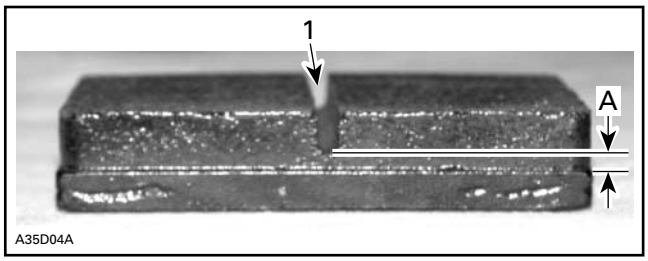

A35D03A

Torque the lower screw first to 8 N•m (71 lbf•**in**) then the upper screw to the same torque.

BRAKE PADS

Inspection

Look the slot on pad lining. Replace brake pads when the slot is disappeared. If the slot disappears, the lining is less than 1 mm (1/32 in).

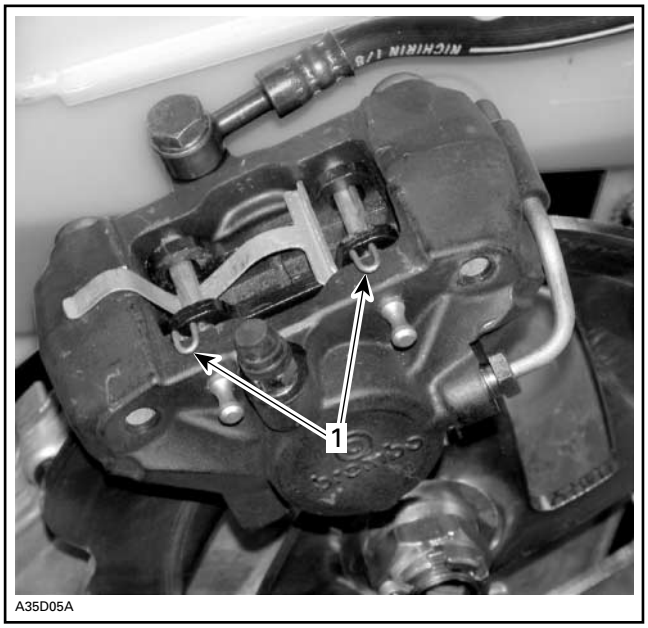


A35D04A

1. Slot on pad lining
A. Brake pad minimum thickness 1 mm (1/32 in)

Removal

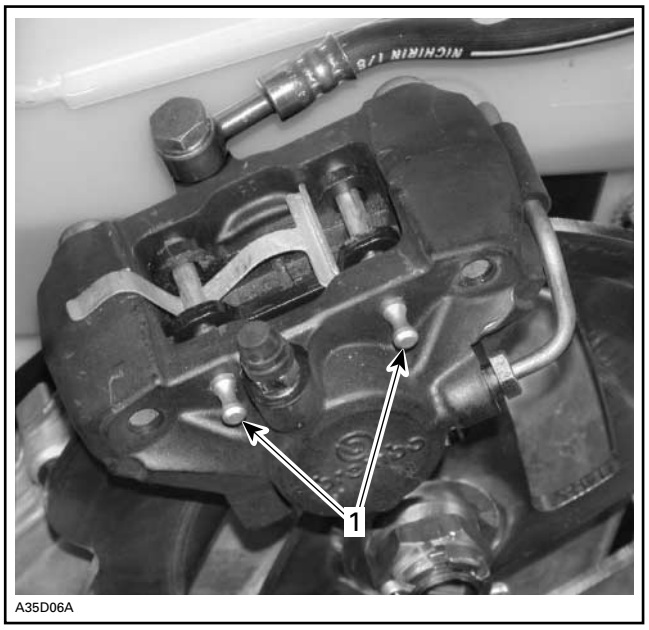
Remove clips **no. 8** that retain pad pins **no. 9**.



A35D05A

1. Clips

Pull pad pins out of caliper **no. 10**.



1. Pad pins

Remove pad spring **no. 11**.

1. Pad spring

Remove brake pads **no. 12** from caliper.

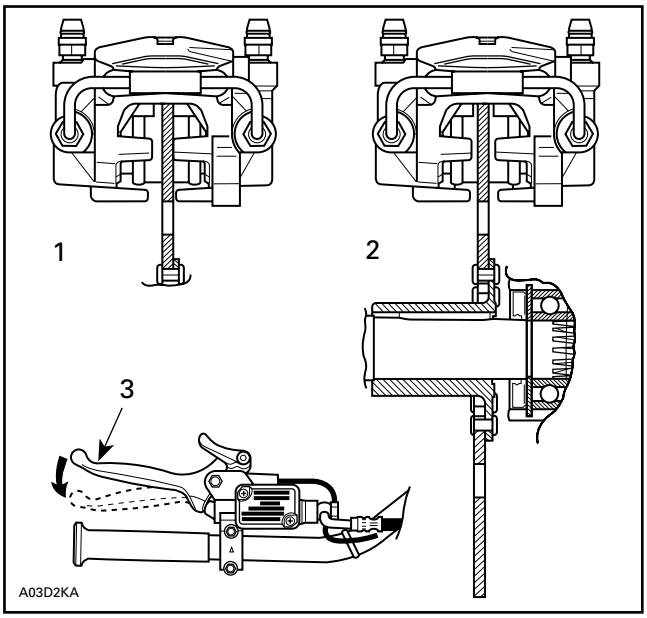
Installation

Clean pistons then push them inward before installing new brake pads.

Install brake pads and all other removed parts.

The brake disc **no. 13** 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.

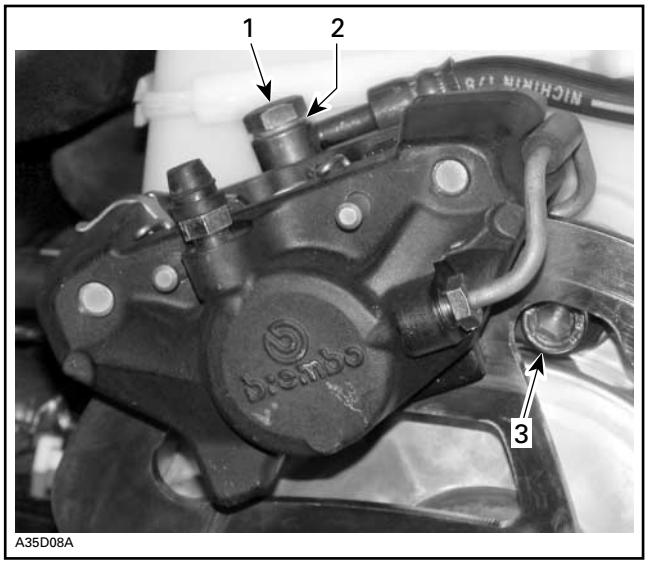
CALIPER

Removal

Drain brake system.

Unscrew Banjo bolt **no. 14** and discard sealing rings **no. 15**.

Align brake disc slots with caliper bolts **no. 16** then unscrew them.



1. Banjo bolt
2. Sealing ring
3. Caliper bolt

Remove caliper.

Inspection

Check caliper for cracks or leakages. Replace if necessary.

Installation

The installation is the reverse of the removal procedure.

NOTE: Bleed brake system before using the vehicle.

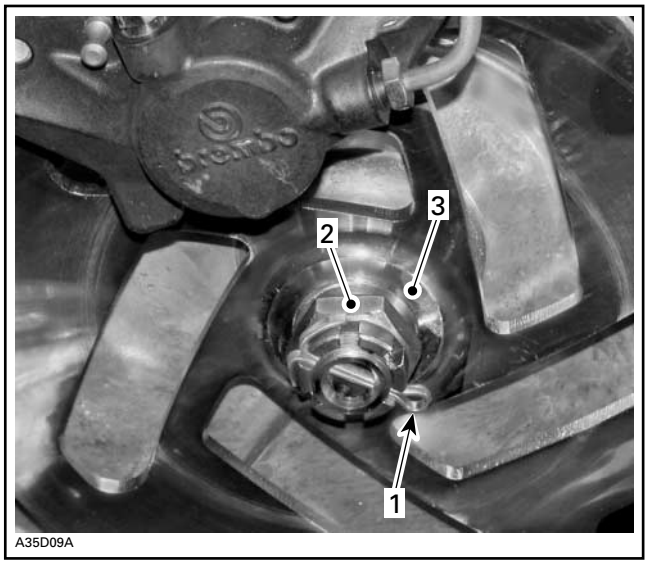
BRAKE DISC

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

Unscrew caliper bolts **no. 16** 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 **no. 13**.

Inspection

Before removing disc brake, measure its thickness. The minimum thickness should be 4.5 mm (.177 in).

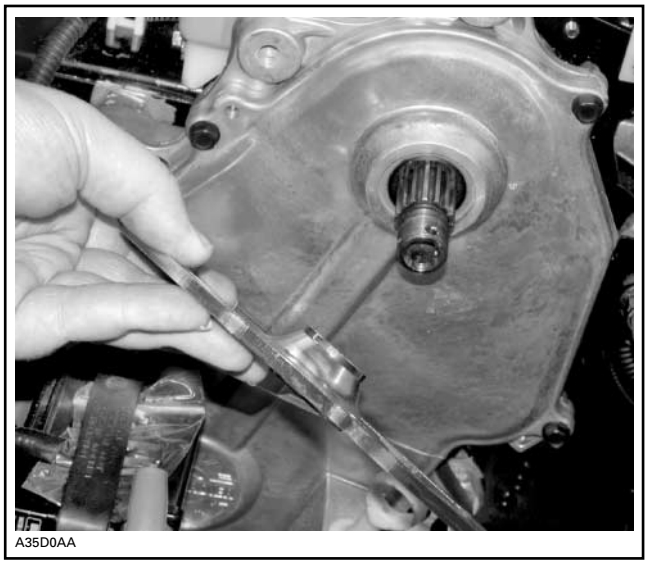
If the brake disc is out of specification, replace it by a new one.

CAUTION: The brake disc should never be machined.

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.

BRAKE LIGHT SWITCH

Removal

The brake light switch **no. 17** 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 with the clamp screw. If there is resistance to the advance of the clamp screw, use a proper wrench.

NOTE: In case of switch body breaking during the unscrewing activity, act mechanical restoring the threads on master cylinder seat and then go on with the installation procedure.

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 release during the mounting operations, set the master cylinder in a sloping position (with lever on the top) and hold the master cylinder lever for 3/4 times.

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.

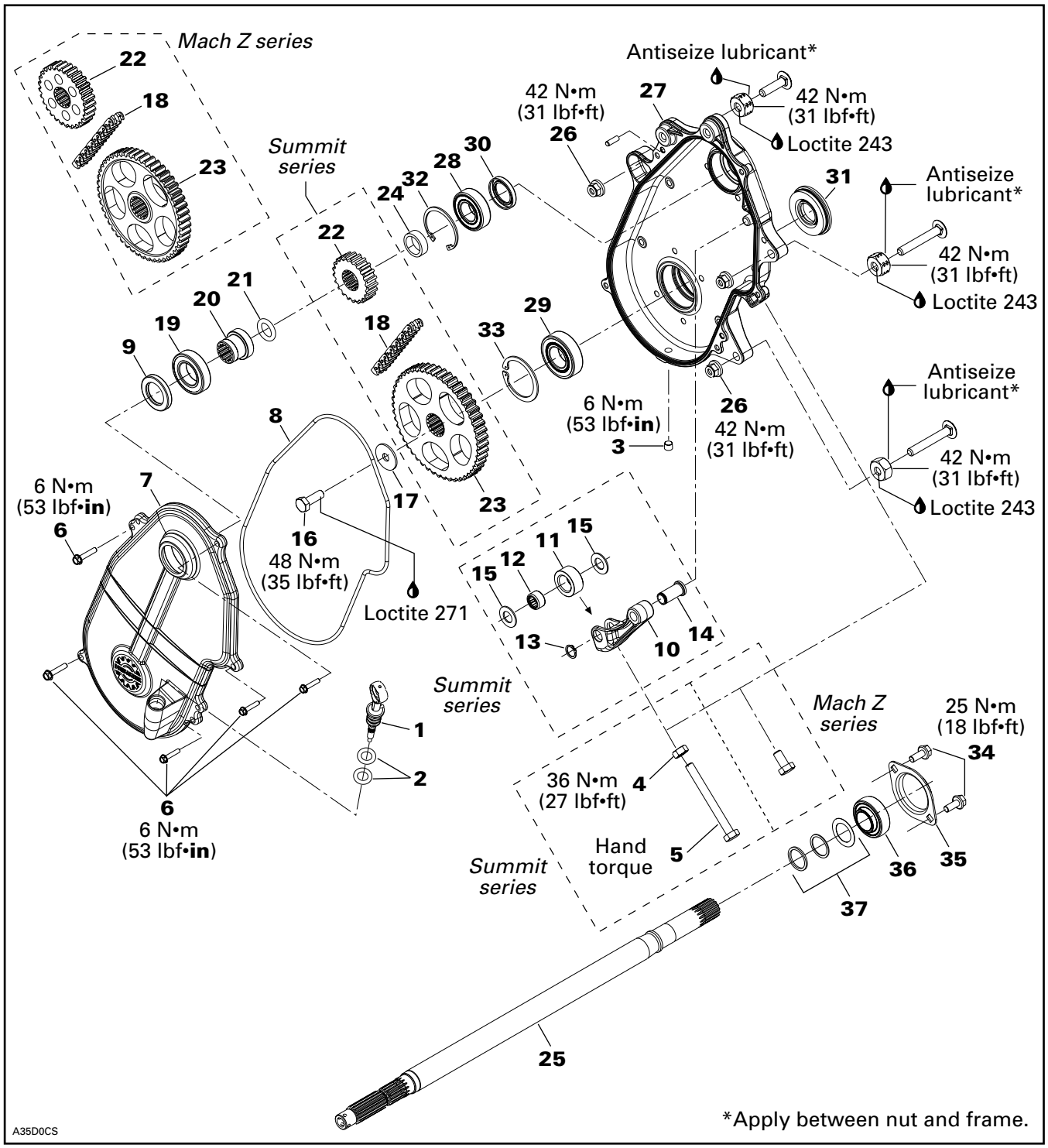
CHAINCASE

SERVICE TOOLS

Description	Part Number	Page
countershaft bearing remover/installer	529 036 010	230–231
countershaft measurement tool	529 036 009	230

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	228
XP-S chaincase oil	413 801 900	225
XP-S synthetic chaincase oil	413 803 300	225



GENERAL

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

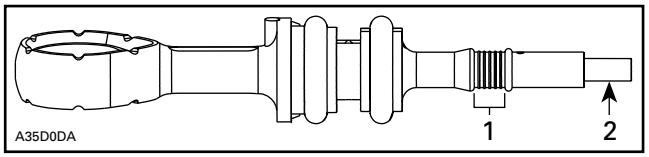
Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ 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.

CHAINCASE OIL LEVEL

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. Level between marks
2. 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 XP-S chaincase oil (P/N 413 801 900) or 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 O-rings **no. 2**. If the O-rings are brittle, hard or otherwise damaged, replace them.

OIL CHANGE

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**.

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 chaincase oil (P/N 413 801 900) or the 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

Summit Series

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**.

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.

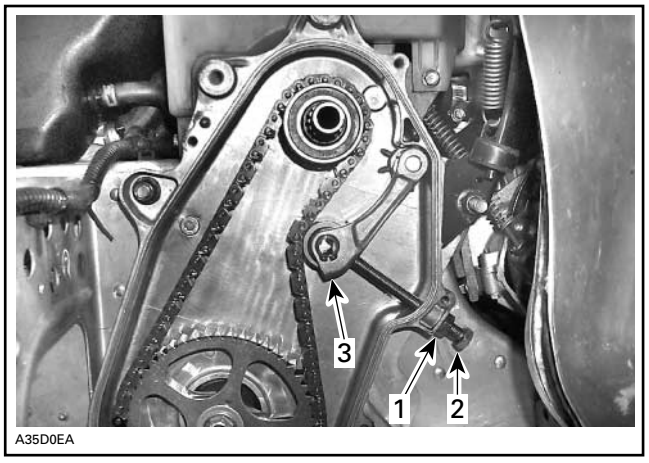
TENSIONER

Summit Series Only

Removal

Drain chaincase and remove chaincase cover.

Unscrew the lock nut **no. 4** then release drive chain tension by unscrewing the tensioner bolt **no. 5**.



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 the 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

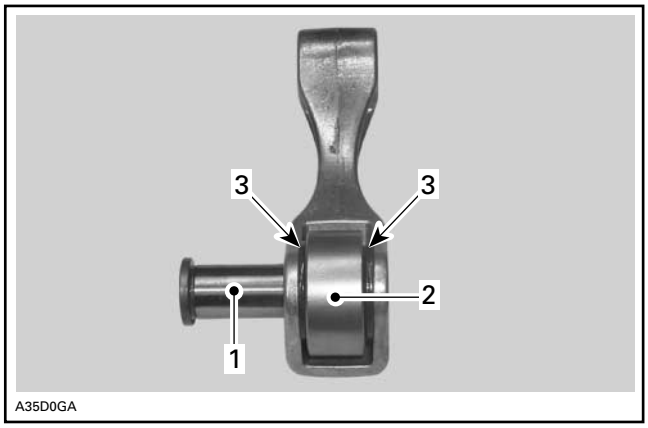
Summit Series Only

Removal

First, remove the tensioner lever **no. 10** then remove the circlip **no. 13**.


A35D0FA

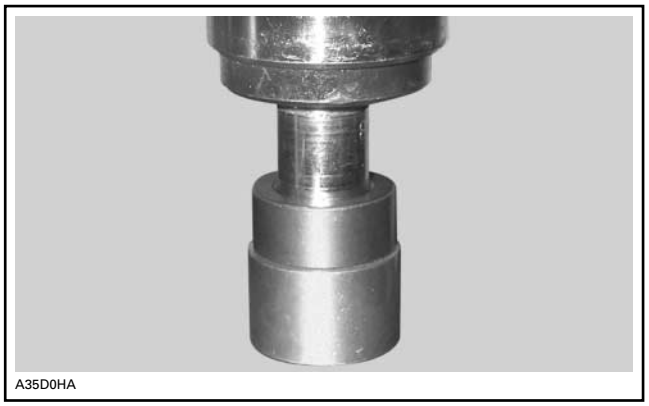
Remove tensioner axle **no. 14**, roller **no. 11** and washers **no. 15**.



A35D0GA

1. Tensioner axle
2. Roller
3. Washers

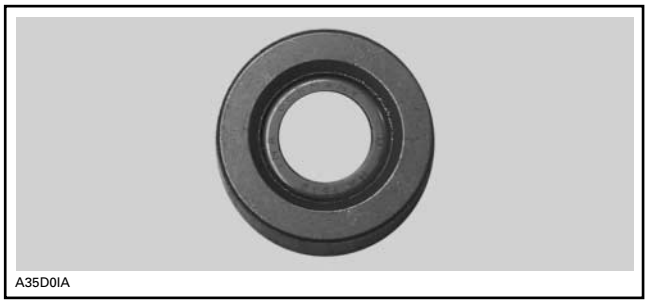
Using a press machine and suitable tappet, push needle bearing **no. 12** out of roller.


A35D0HA

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 and this circlip must be visible when the tensioner is installed.


A35D0IA

ENGRAVED SIDE OF NEEDLE BEARING

DRIVE CHAIN AND SPROCKETS

Removal

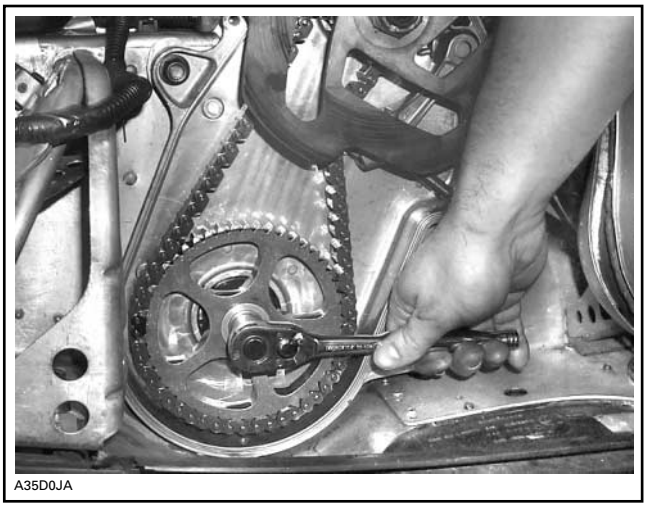
Remove chaincase cover.

Temporarily, install the brake disc and its nut, do not torque nut.

Install the caliper. Torque bolts.

Apply parking brake.

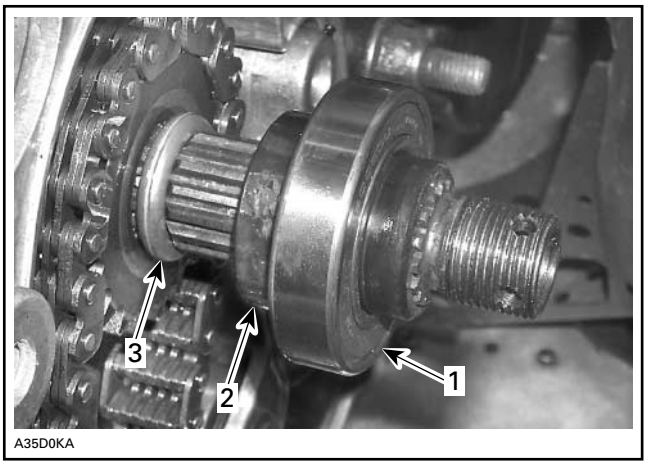
Remove the lower sprocket bolt **no. 16** and its washer **no. 17**.


A35D0JA

Release parking brake and remove caliper and brake disc.

On **Summit series**, 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**.



A35D0KA

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 **Summit series**, 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**.


A35D0LA

Unscrew nuts **no. 26** that attach the chaincase housing **no. 27** to the vehicle.

Remove chaincase housing 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.

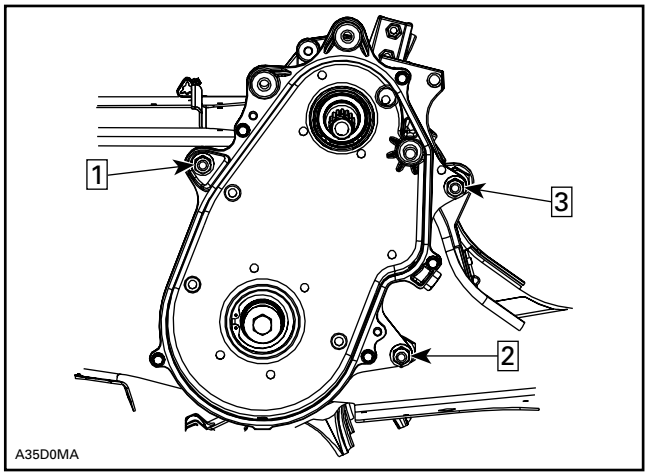
Check condition of oil seals **no. 30** and **no. 31**.

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).



A35D0MA

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.

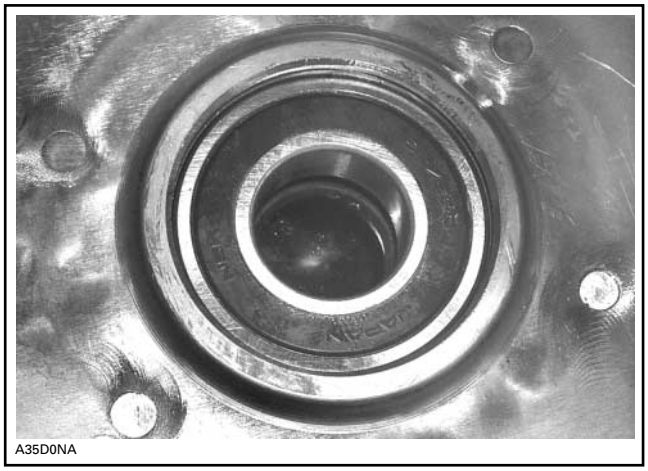
Remove the circlip **no. 33**. Turn the housing and remove the oil seal **no. 31**.

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

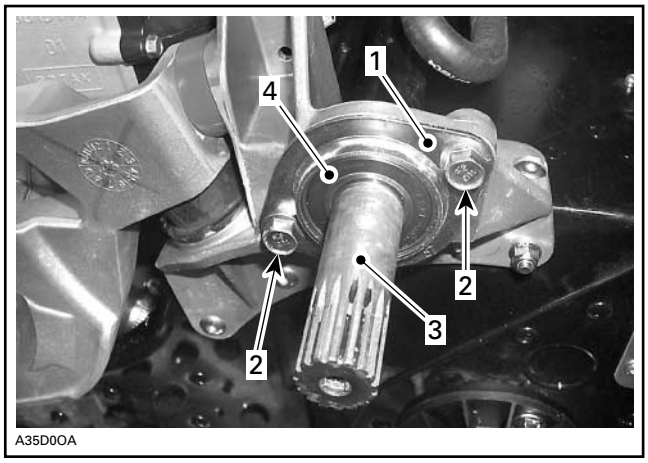
COUNTERSHAFT

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**.

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. Refer to COUNTERSHAFT BEARING.

COUNTERSHAFT BEARING

Inspection

No play must be felt between countershaft bearing **no. 36** and countershaft **no. 25**.

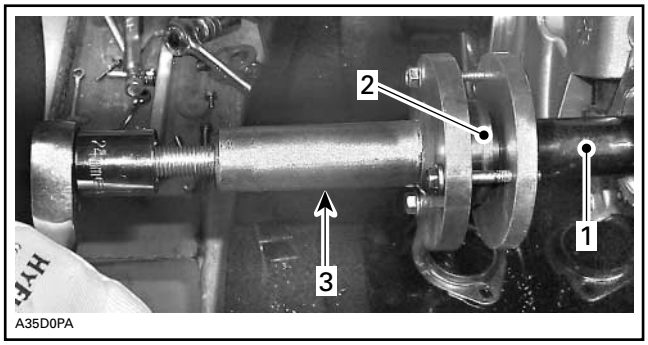
Check if the bearing turns smoothly and freely.

Replace bearing if any damage is detected.

Removal

Remove the countershaft.

Install the countershaft bearing remover/installer (P/N 529 036 010) on the end of countershaft to remove the bearing.



A35D0PA

1. Countershaft
2. Countershaft bearing
3. Countershaft bearing remover/installer

Remove bearing and its shim(s) **no. 37**.

Discard the bearing.

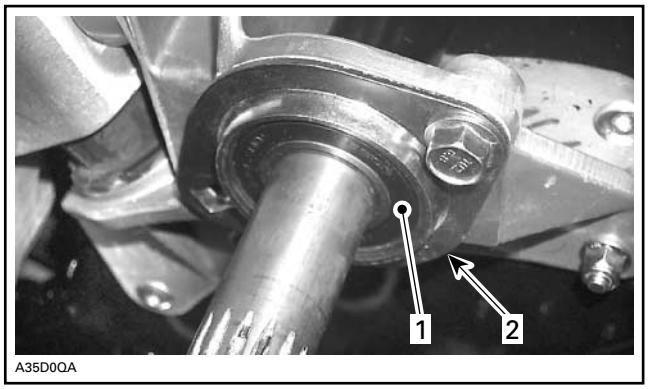
CAUTION: Never use a countershaft bearing a second time, each time when it is removed it must be replaced by a new one.

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**.

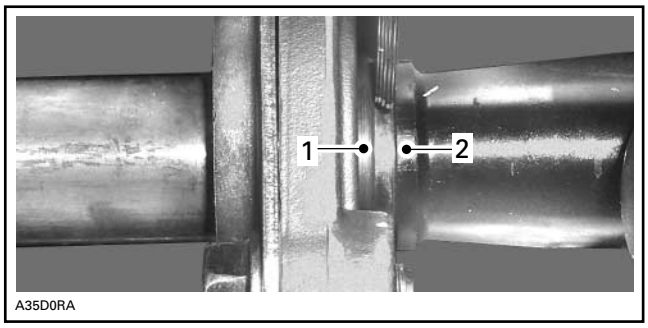


A35D0QA

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.



A35D0RA

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).

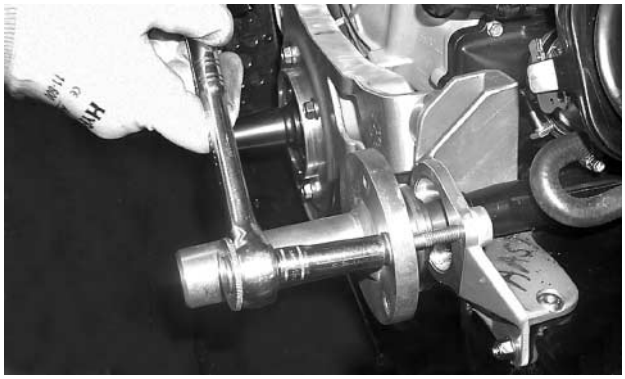
SHIM CHART	
SHIM NUMBER	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

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 529 036 010) and push bearing in its location.



A35D0SA

Install all other removed parts in the reverse order of their removal.

DRIVE AXLE

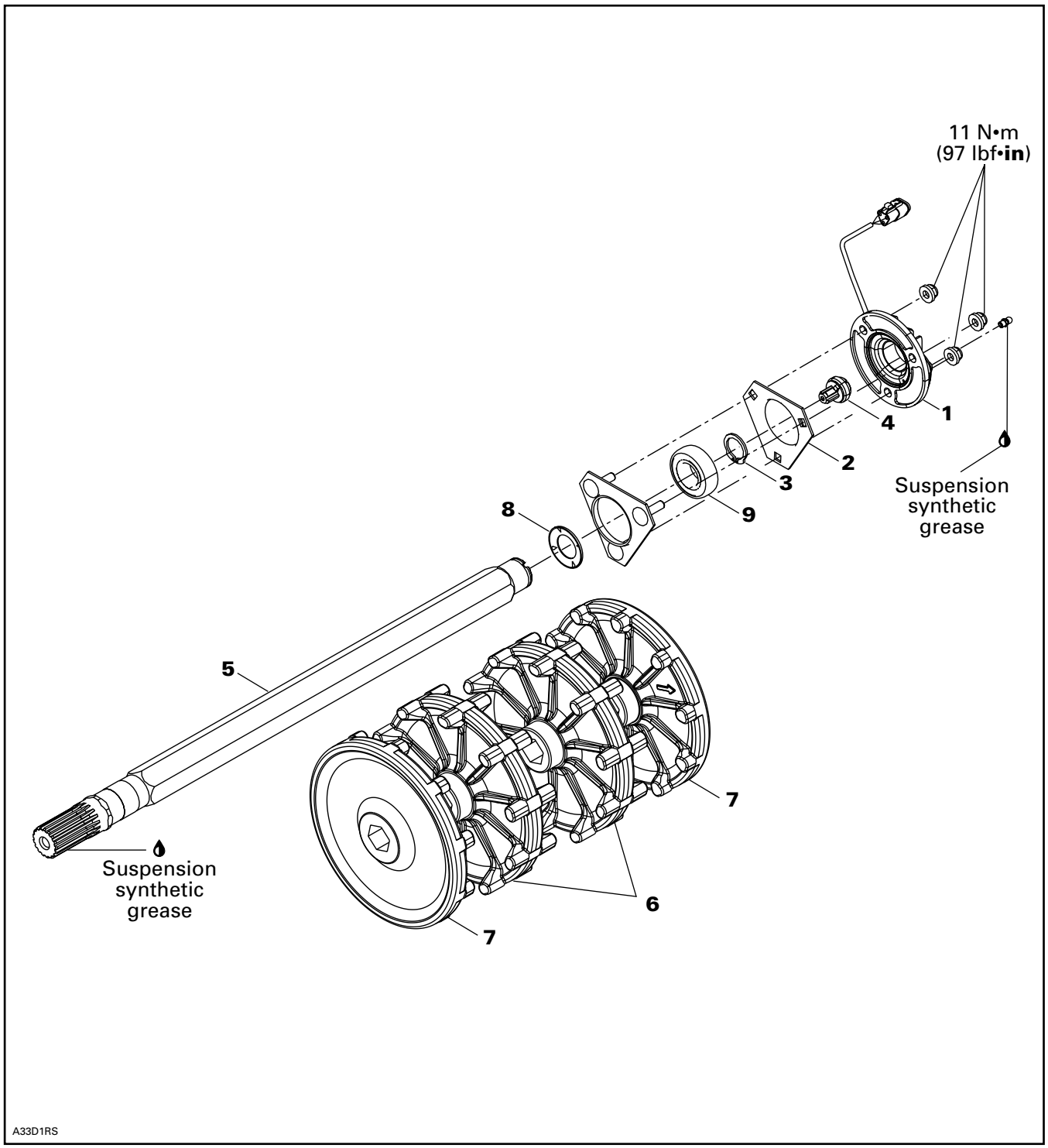
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	238

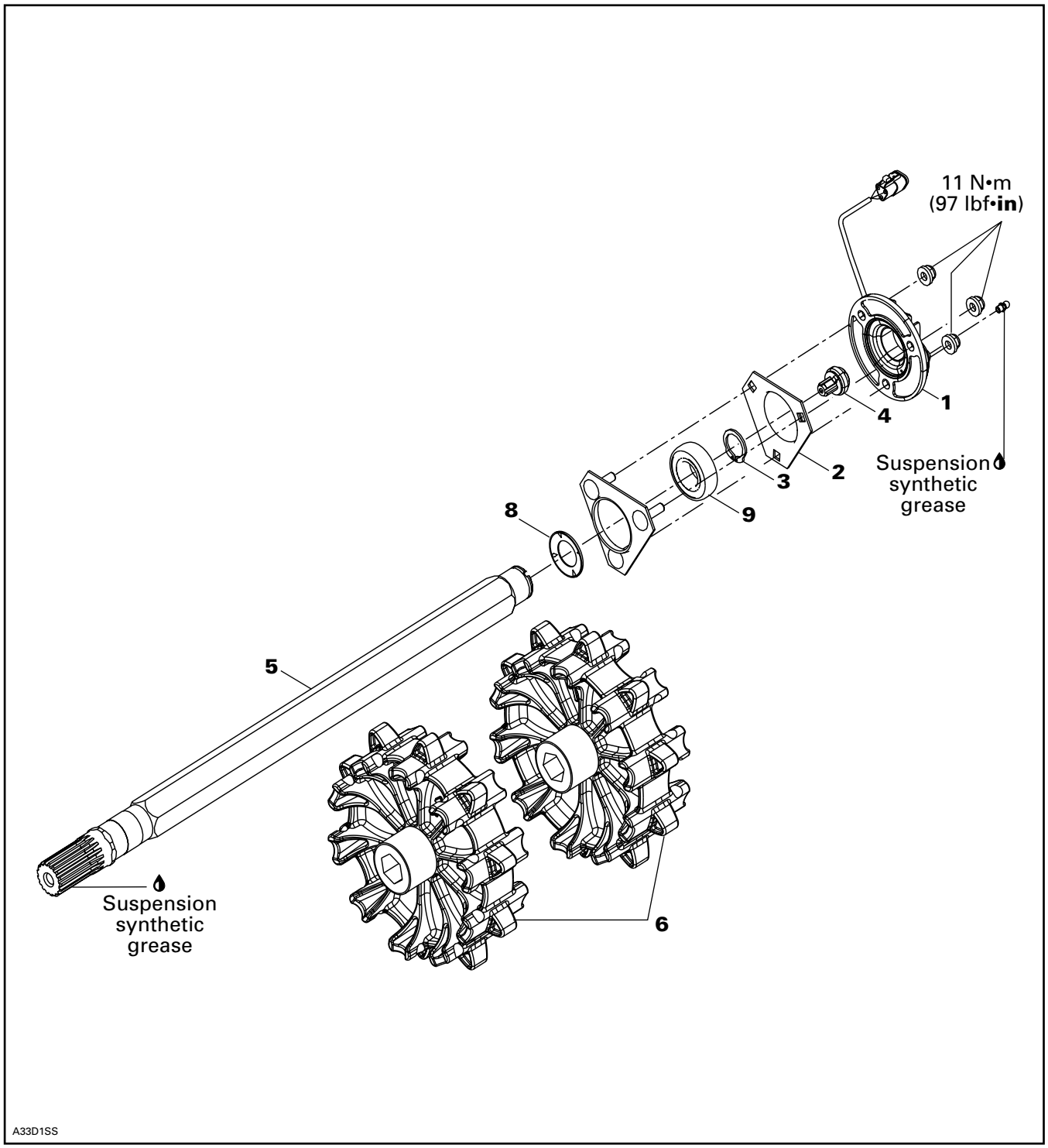
SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	219 700 417	238

MACH Z Models



Summit Highmark and Summit Highmark X Models



REMOVAL

Remove battery, battery rack and toe-hold to gain access.

Drain oil from chaincase. Remove chaincase cover. On **Summit series**, release drive chain tension.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to proper subsection.

Remove driven pulley. Refer to DRIVEN PULLEY.

Remove speedometer sensor **no. 1**, outer flange **no. 2** and circlip **no. 3** from left side.

TYPICAL
1. Circlip

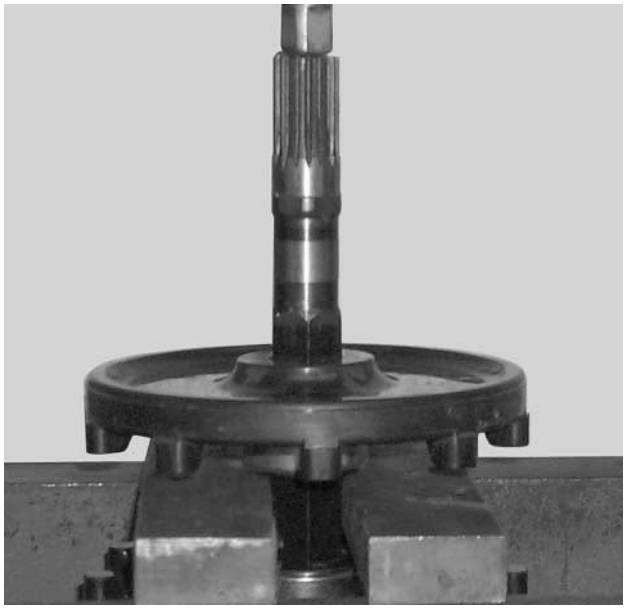
Unscrew then pull speedometer magnetic adapter **no. 4** from drive axle **no. 5**.

Remove chain and sprockets then circlip from right side.

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.

Sprocket and Half-Sprocket

To remove press fit sprockets **no. 6** and **no. 7**, use a press and a suitable support as illustrated.



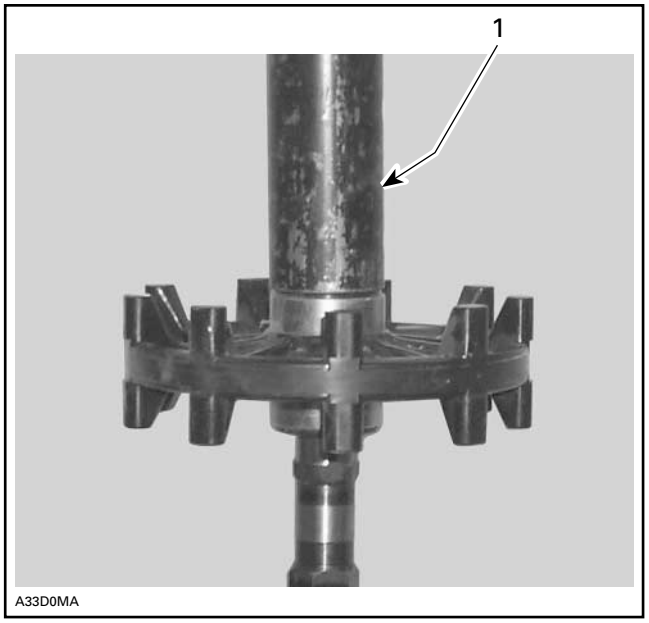
TYPICAL — SUPPORT SPROCKET NEAR HUB

ASSEMBLY

CAUTION: The same sprocket must not be pressed twice on the axle. When sprocket has been removed from drive axle, use a new sprocket at the installation.

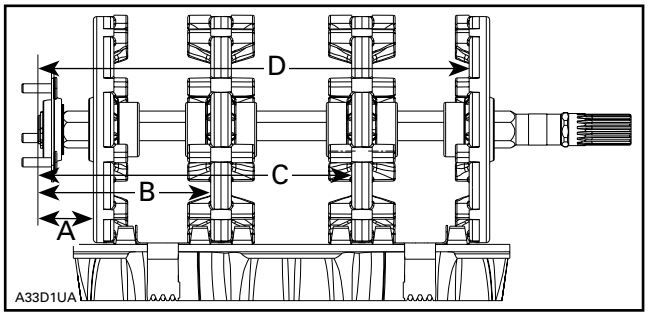
Drive Axle and Sprocket

To assemble press fit sprockets **no. 6** and **no. 7**, use a press and a suitable pipe as illustrated. Sprockets must be assembled according to the following dimensions measured from drive axle end.



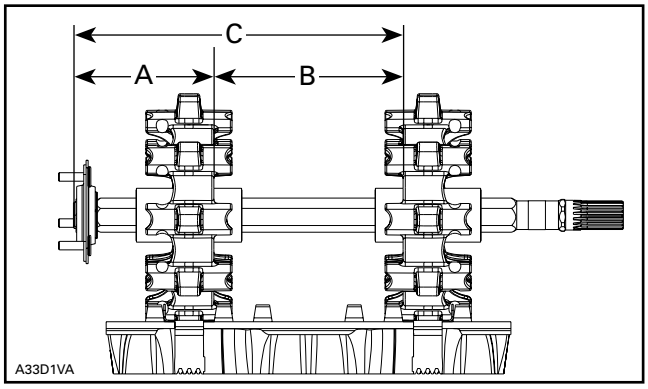
TYPICAL
1. Pipe

MACH Z Models



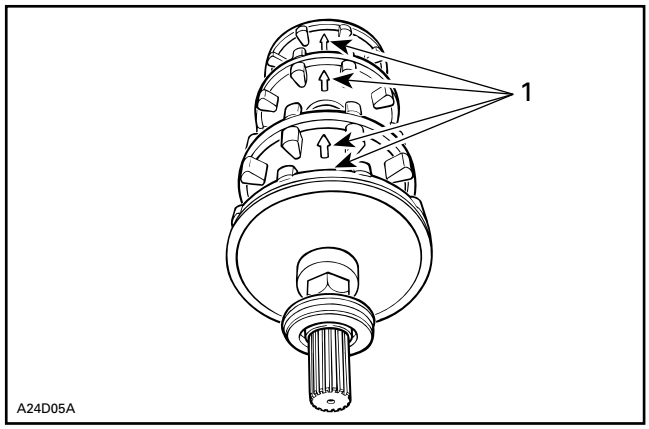
MEASURE FROM END OF DRIVE SHAFT
A. 48.3 mm (1.902 in)
B. 150.8 mm (5.937 in)
C. 273.8 mm (10.780 in)
D. 376.3 mm (14.815 in)

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)

Ensure to align indexing marks of each sprocket when assembling.



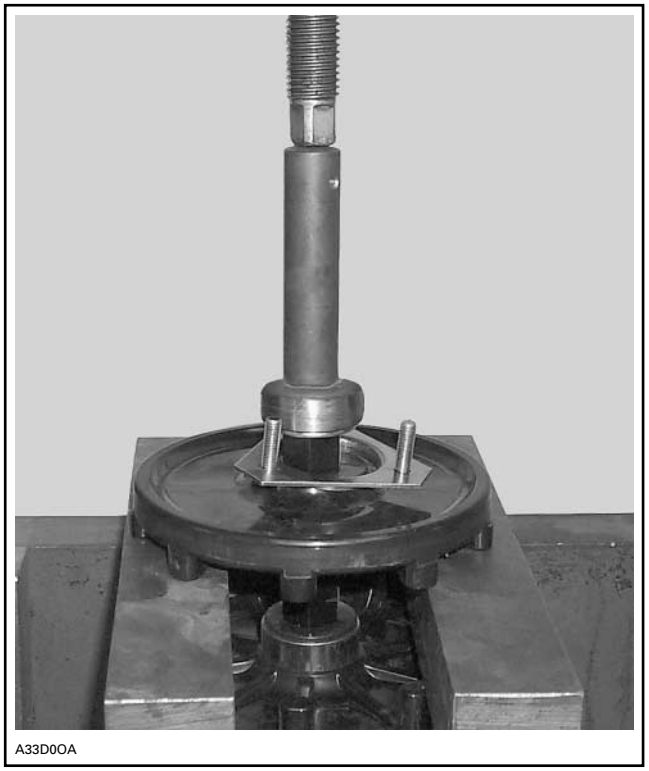
TYPICAL
1. Indexing marks aligned

Bearing Protector

At assembly, flat side of bearing protector **no. 8** must be against bearing **no. 9**.

Bearing

Always push bearing **no. 9** by inner race.


A33D0OA

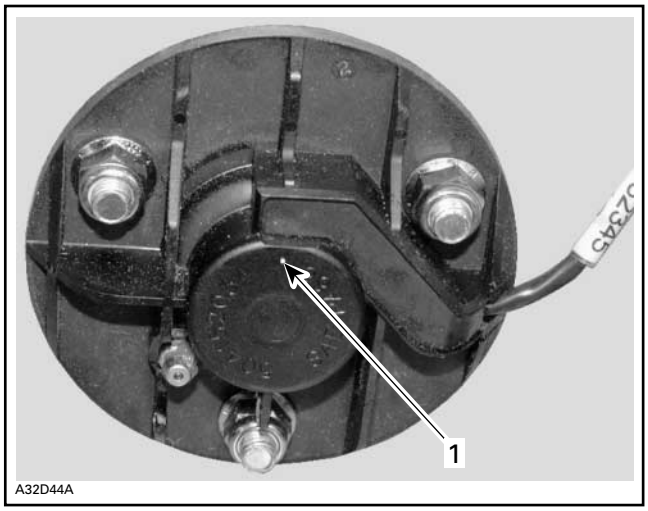
The bearing **no. 9** must have its shield facing the sprocket.

The drive axle bearing in chaincase must have its shield facing right side (cover).

Index speedometer magnetic adapter **no. 4** in drive axle and push until it is completely inserted in its hole.

LUBRICATION

Lubricate end housing bearing with synthetic grease (P/N 219 700 417). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.



A32D44A

TYPICAL
1. Lubricate until grease flows out here

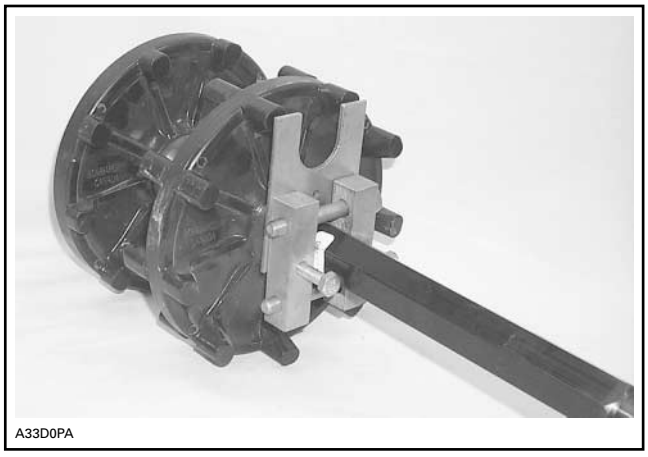
ADJUSTMENT

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).


A33D0PA

TYPICAL

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	240
cleat remover	529 028 700	239, 241
narrow-cleat installer	529 028 800	239, 241

TRACK TYPE APPLICATION

Refer to TECHNICAL DATA.

GENERAL

This section gives guidelines for track removal. Some components require more detailed disassembly procedures. In these particular cases, refer to the pertaining section in this manual.

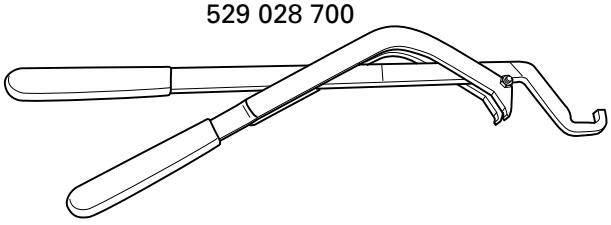
INSPECTION

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, using cleat remover (P/N 529 028 700). Use narrow-cleat installer (P/N 529 028 800).

529 028 700



529 028 800

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

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

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.

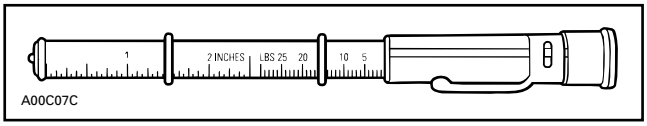
Tension

NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

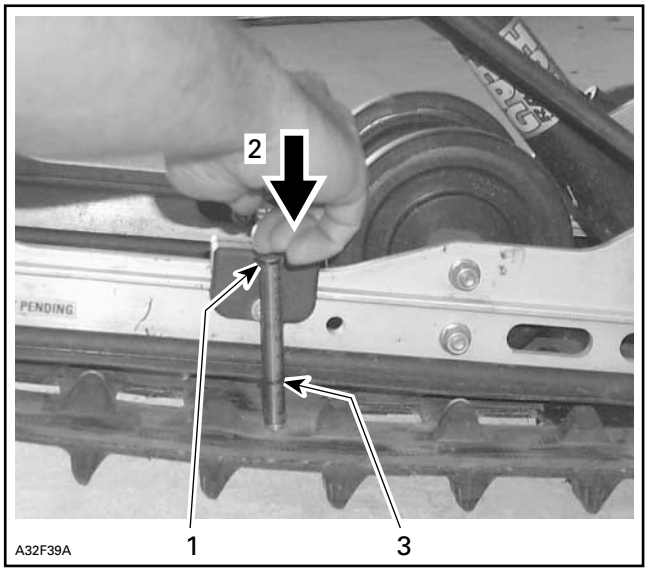
Lift snowmobile by a rope, chain or lift strap hooked to rear bumper.

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 SPECIFICATIONS. If the track tension is too loose, track will have a tendency to thump.

NOTE: The belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

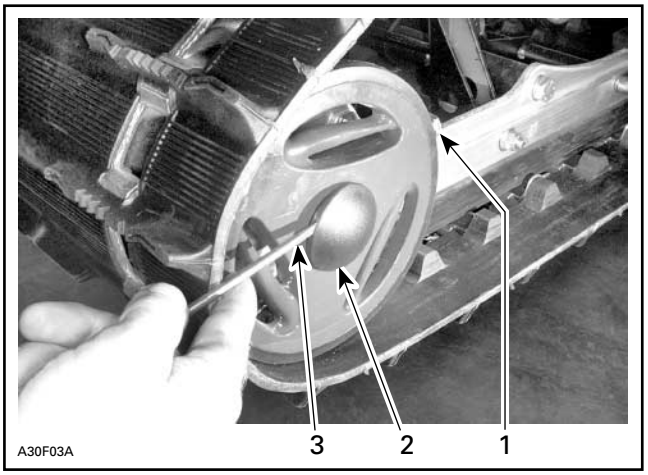


1. *Top tool O-ring positioned at 7.3 kg (16 lb)*
2. *Push on top portion of tool until it contacts the top O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To Adjust Tension:

– 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*

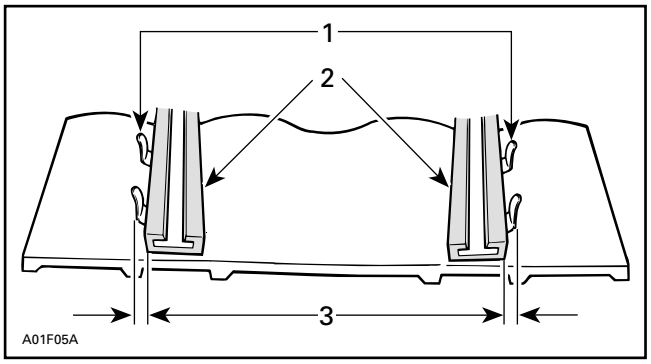
Alignment

⚠ 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.

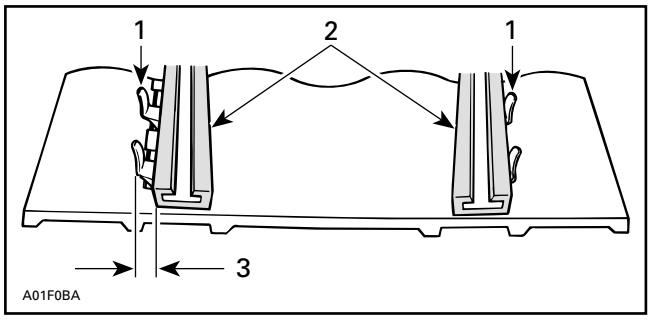
Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (1 to 2 minutes).

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.

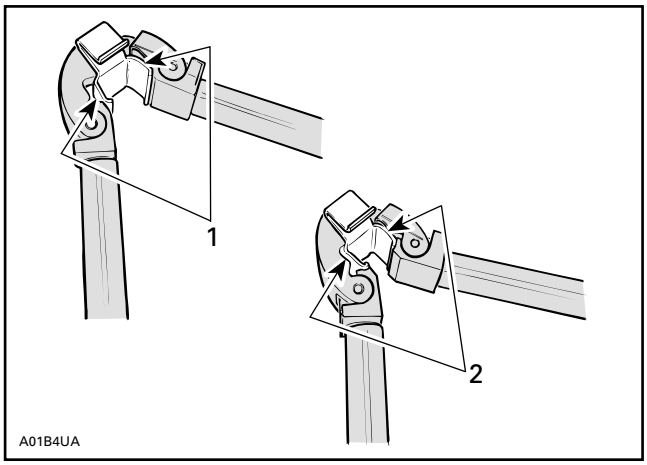
TRACK CLEAT

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)

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.

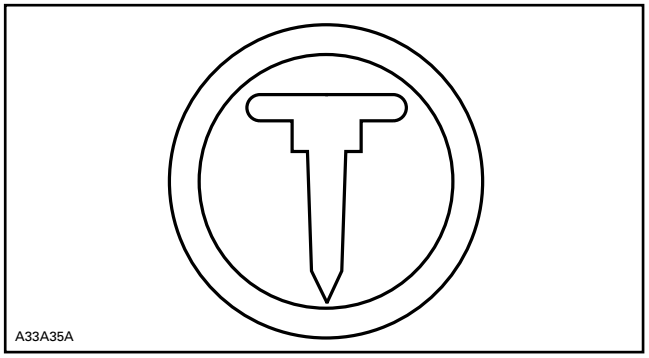
Effects of Studding on the Life of the Snowmobile

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 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

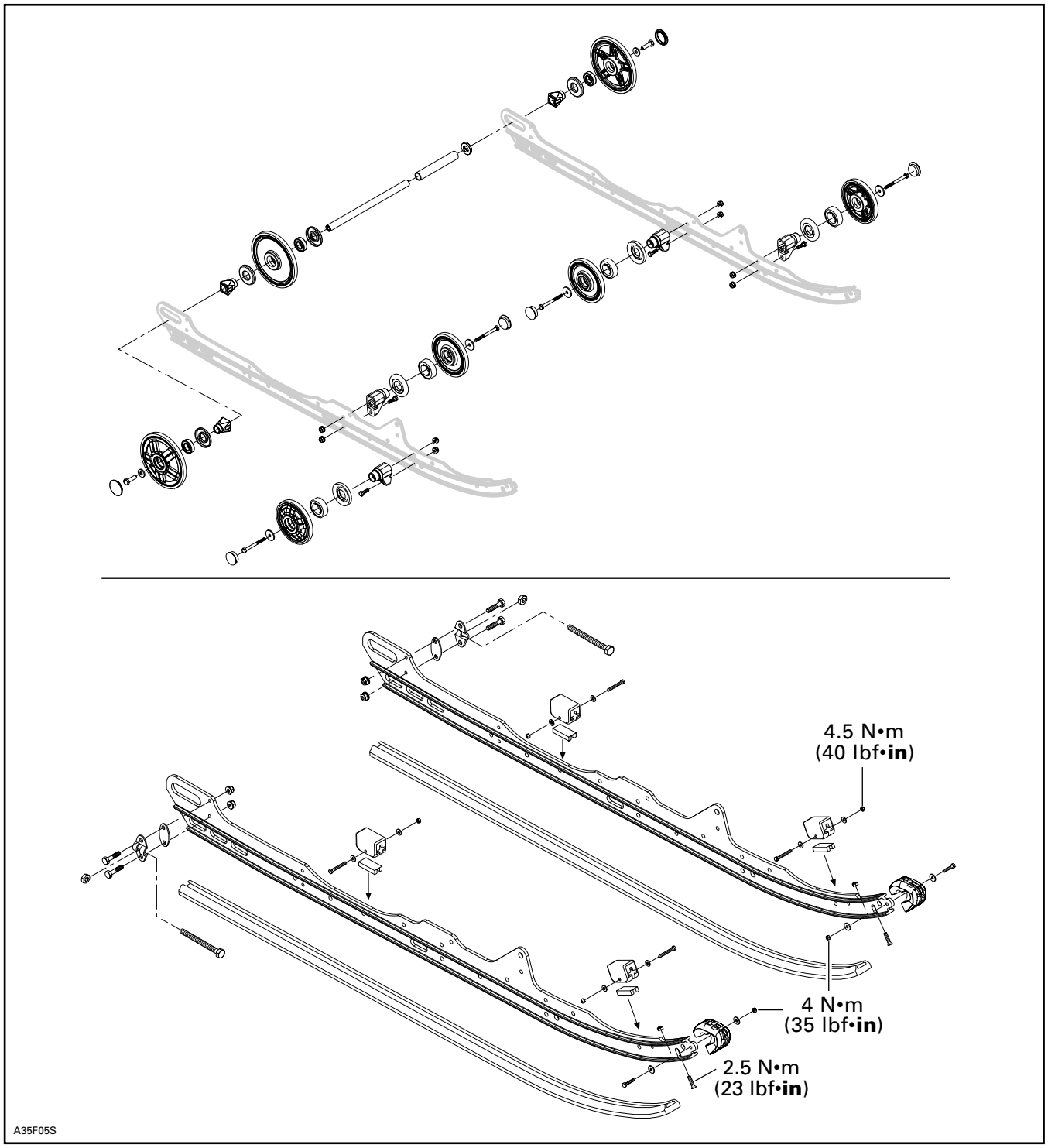
To install studs, refer to the manufacturer's instructions.

MODELS		MACH Z	
TRACK	Profile height	25.4 mm (1 in)	31.8 mm (1.25 in)
	Track length	3.07 m (121 in)	
FRONT PROTECTOR		Standard	
REAR PROTECTOR		25.4 mm (1 in)	
SUPPORT		—	

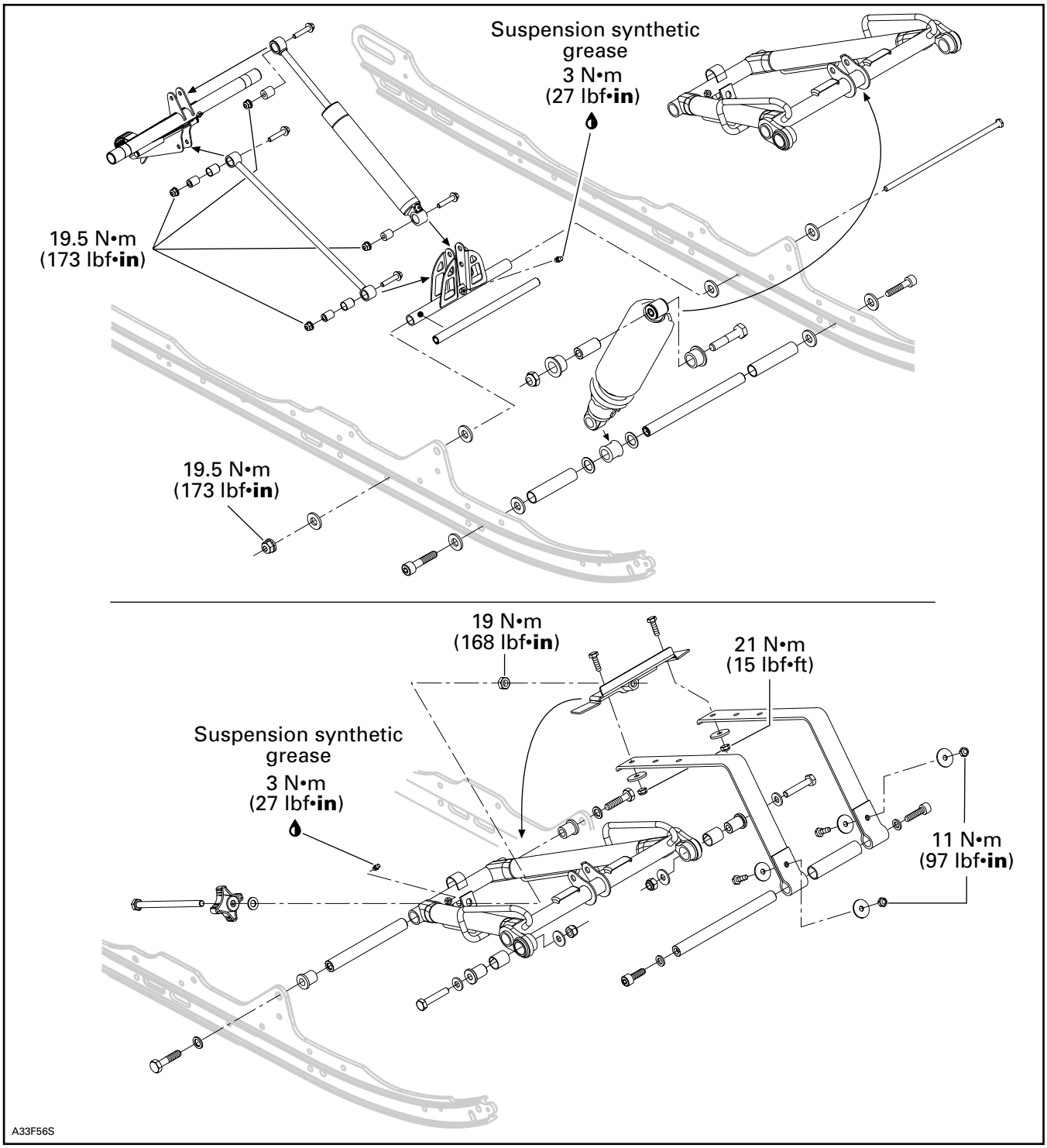
SC SUSPENSION

SERVICE PRODUCTS

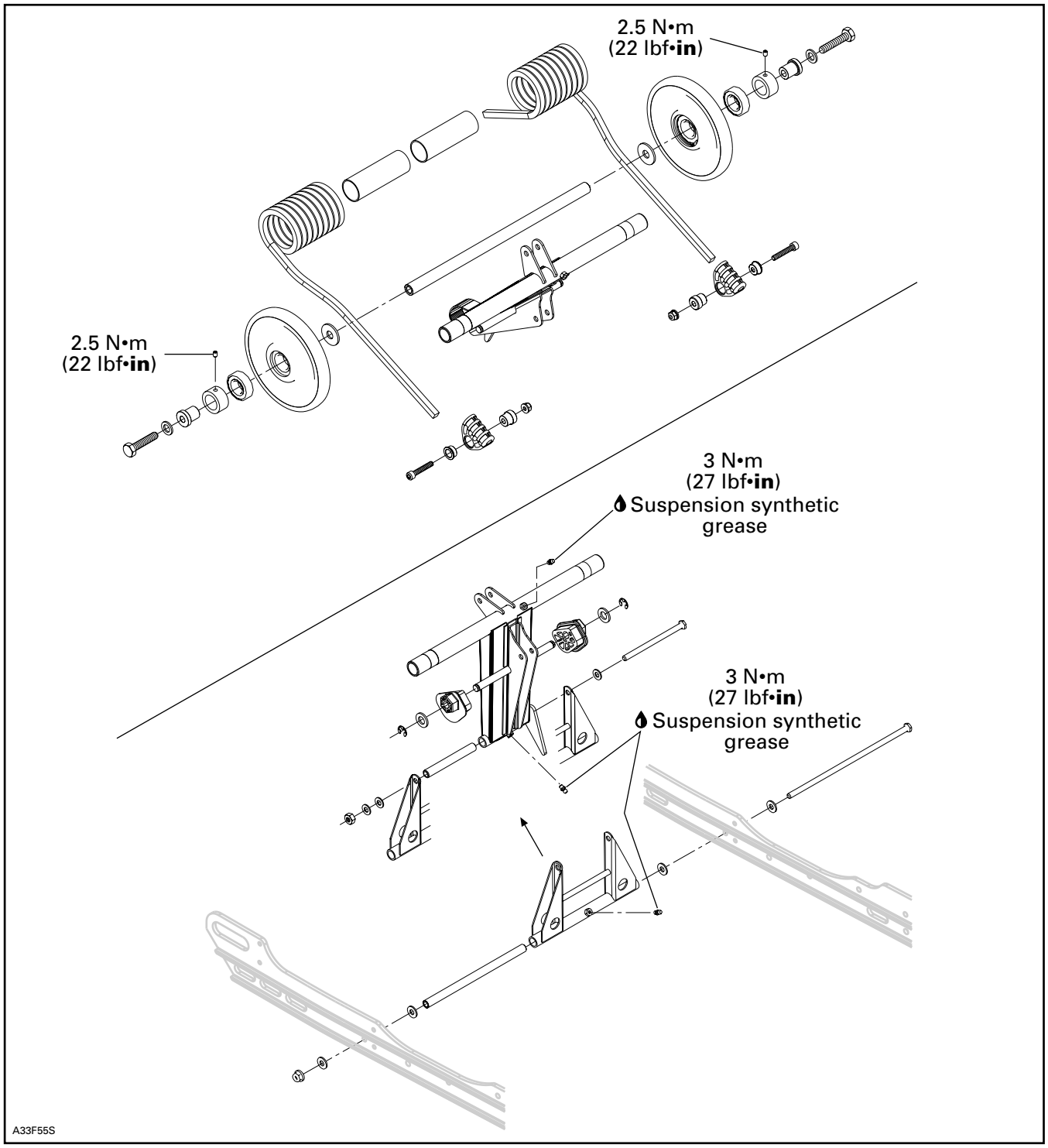
Description	Part Number	Page
suspension synthetic grease	293 550 033	254



RAILS AND IDLER WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND TOP IDLER WHEELS

AXLE SELF-LOCKING SCREWS REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

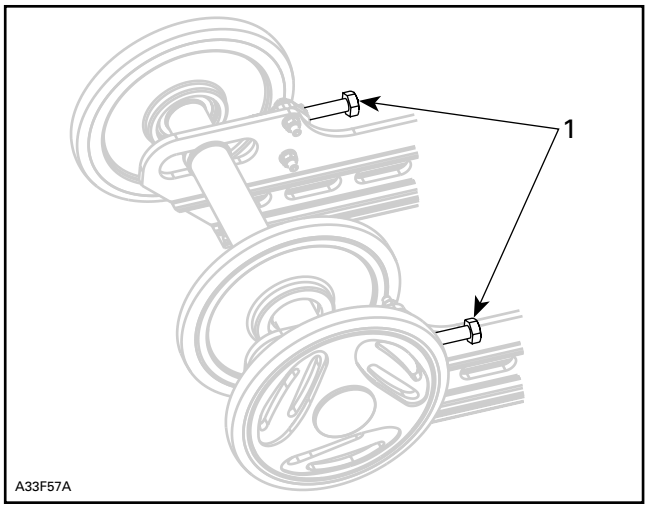
- Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
- Remove the opposite self-locking screw.
- Remove the temporary installed non-self-locking screw.
- If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

Remove screws on rear axle.

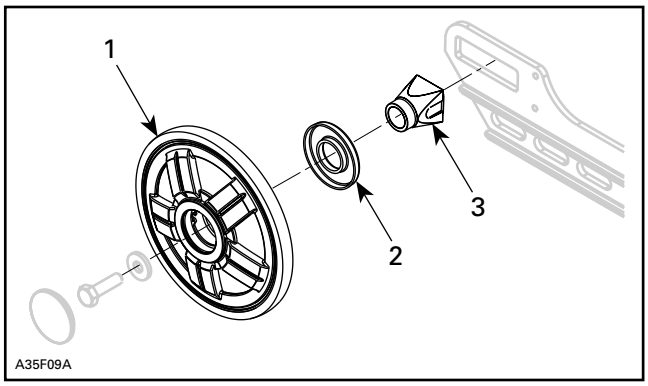
Completely loosen track tension.



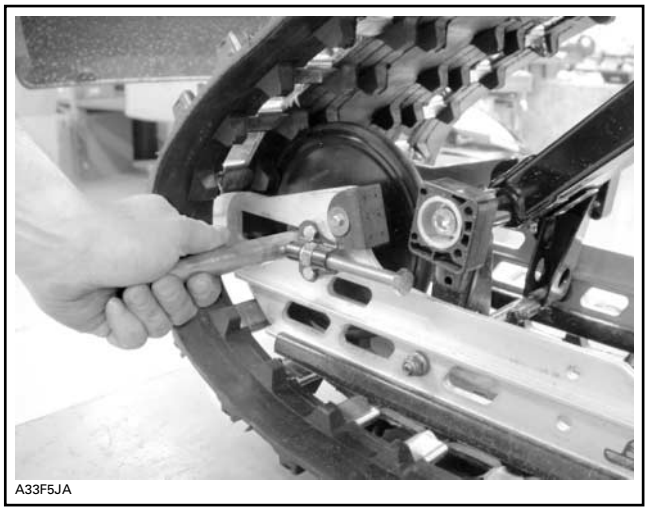
1. Completely loosen track tension

Remove the following on each side of vehicle:

- rear idler wheel
- idler wheel bearing protector
- idler wheel spacer.



REMOVE THE FOLLOWING
1. Idler wheel
2. Bearing protector
3. Spacer



TYPICAL — PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is the reverse of removal procedure.

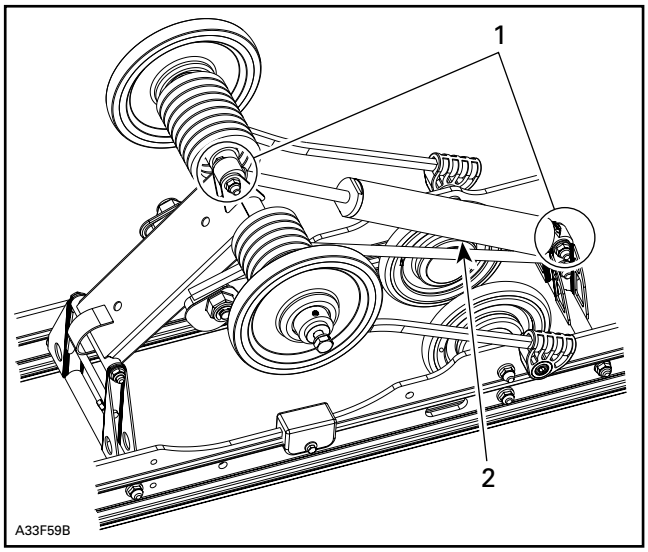
REAR SHOCK ABSORBER REMOVAL

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*

REAR SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

CAUTION: Take care not to damage grease fitting.

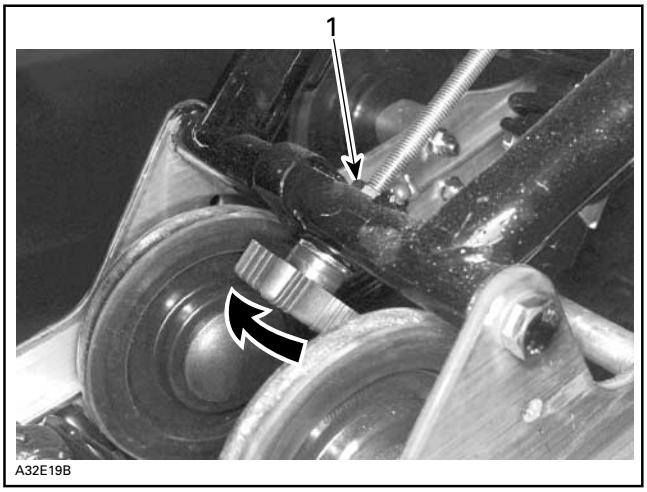
Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Shock upper and lower nut	19.5 N•m (173 lbf•**in**)

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Unfasten one end of stopper strap(s) or loosen the adjuster knob to release shock pressure.

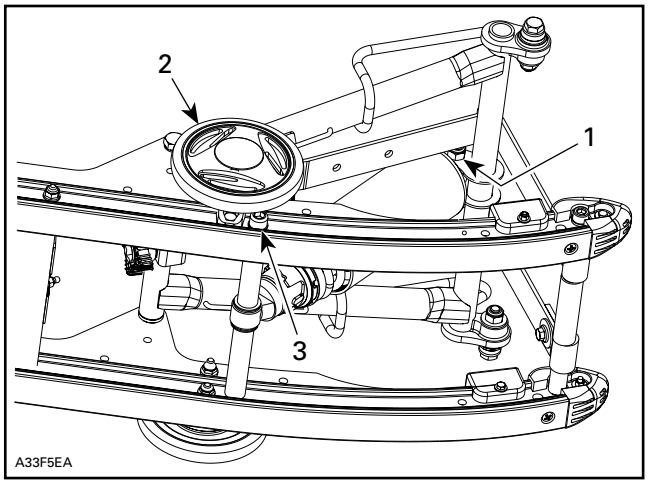


1. Loosen lock nut, turn adjuster knob counterclockwise

Unbolt front shock from the top.

Remove front idler wheels to gain access to 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*

FRONT SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

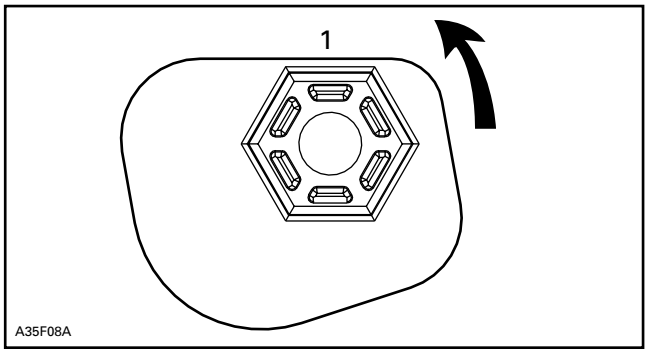
Respect the following tightening torque specification.

DESCRIPTION	TIGHTENING TORQUE
Adjuster lock nut	19 N•m (168 lbf•**in**)
Stopper straps nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap(s) nuts	11 N•m (97 lbf•**in**)

REAR SPRING REMOVAL

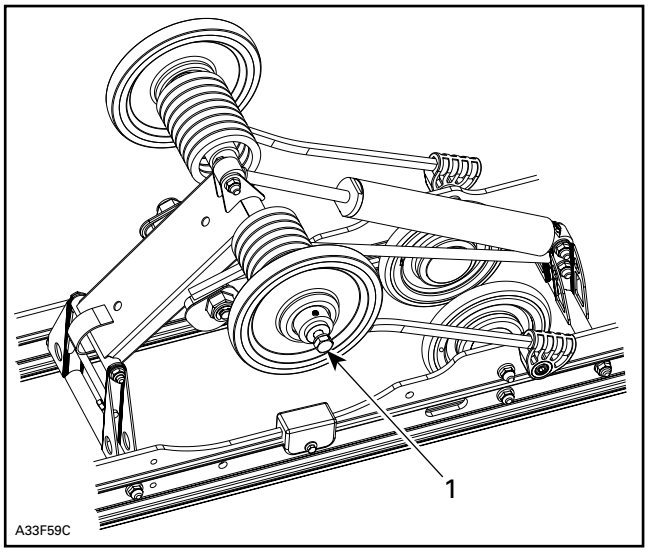
Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.



DECREASE SPRING PRELOAD

Unbolt rear arm top axle from chassis.

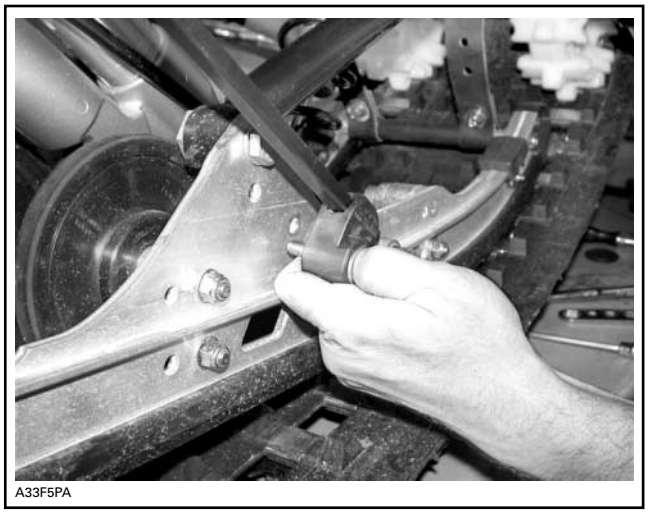


1. Unbolt rear arm

Remove spring supports.

⚠ WARNING

Supports are spring loaded.

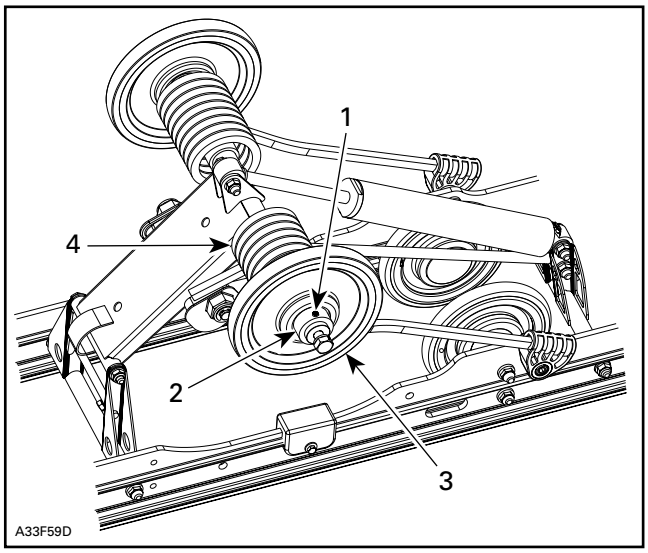


TYPICAL — REMOVE SPRING SUPPORTS

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring
– top idler wheel
– spring.



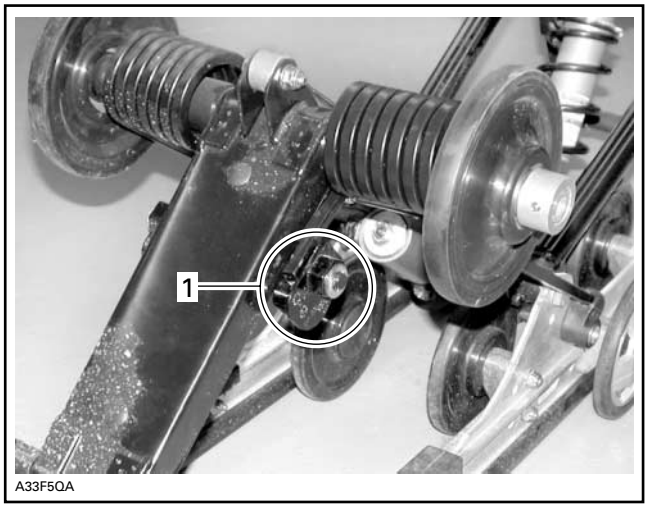
1. Set screw
2. Locking ring
3. Idler wheel
4. Spring

REAR SPRING INSTALLATION

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

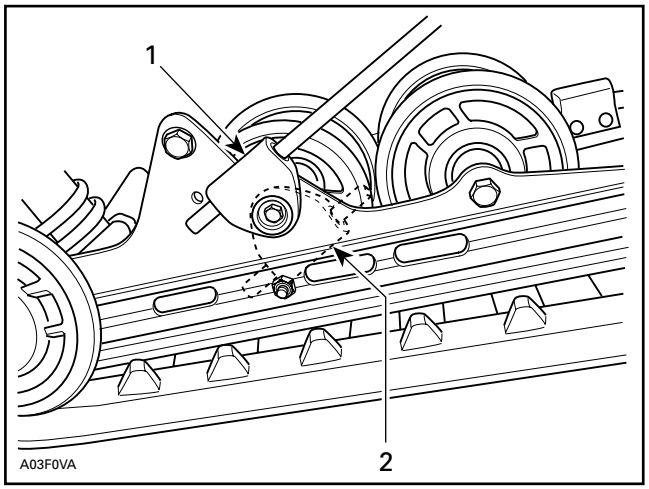
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

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.



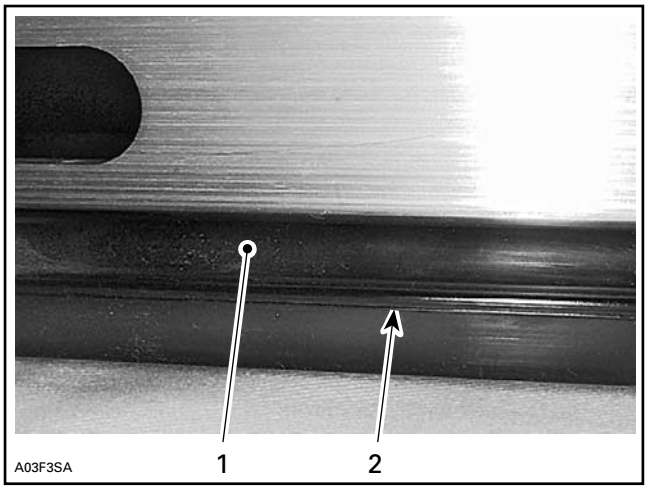
TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

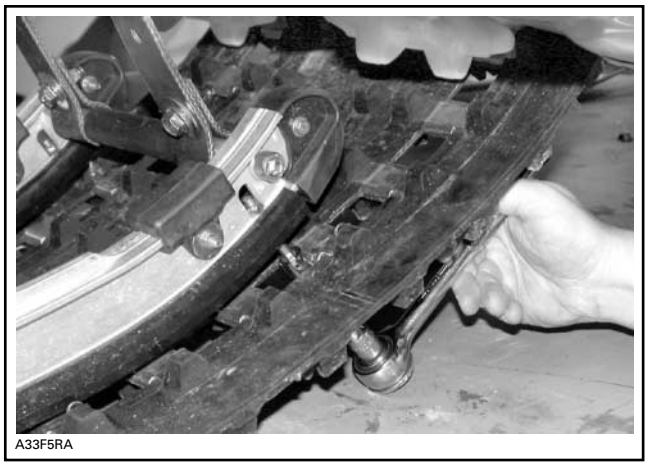
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

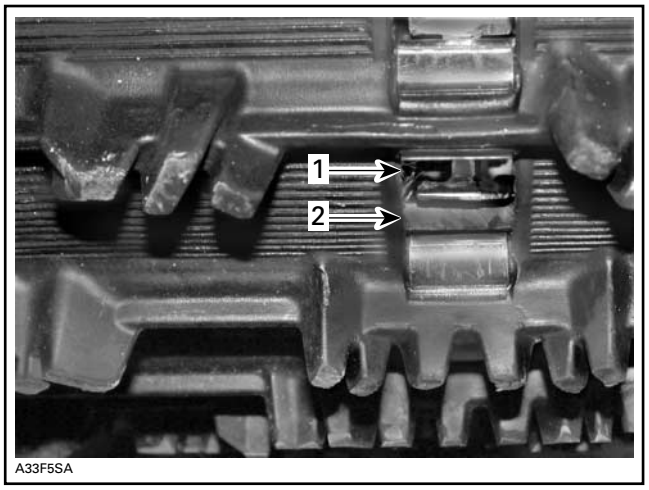
Completely loosen track tension.

Remove front runners nut and screw.



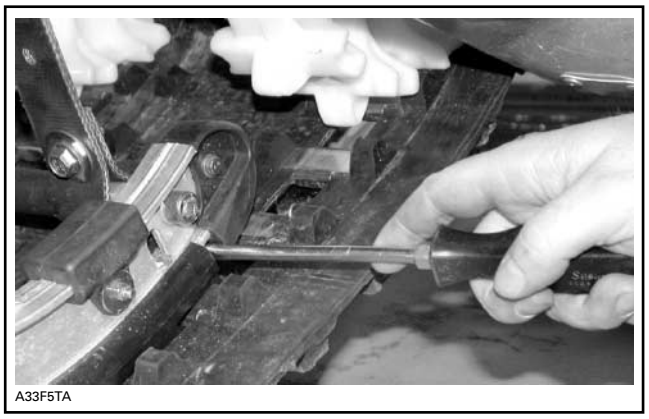
TYPICAL — REMOVE NUT AND SCREW

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

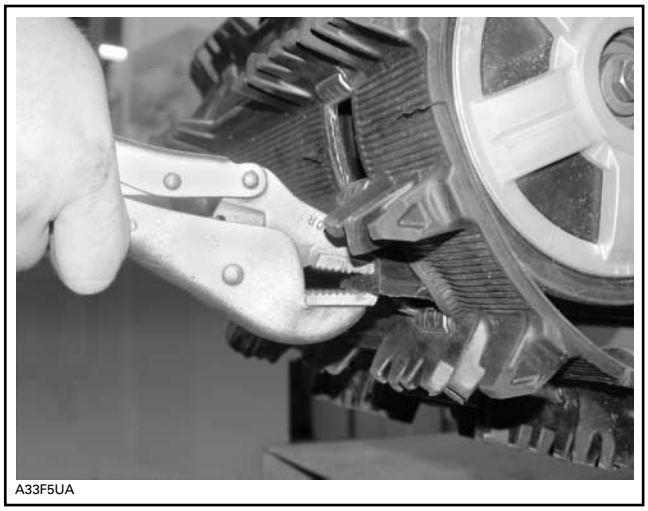
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



TYPICAL — PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

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

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

FRONT ARM REMOVAL

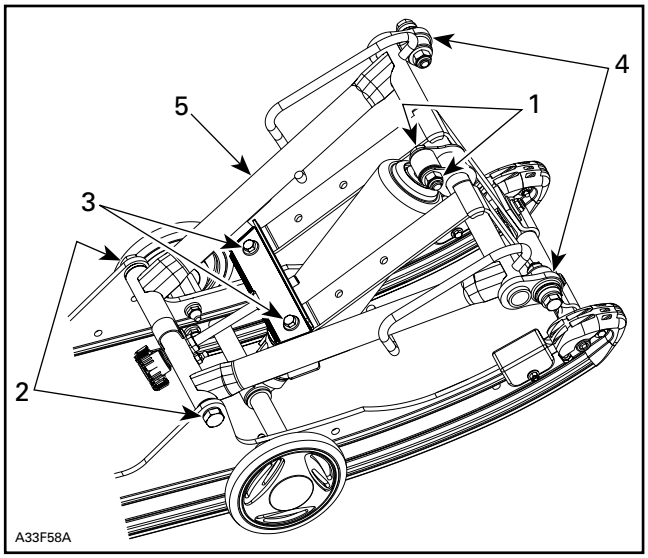
NOTE: Front arm can be removed with suspension in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

– shock upper bolt and nut
– front arm lower bolts and washers
– unfasten one end of stopper strap(s)
– remove front arm upper bolts, nuts and washers.

Remove front arm.



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

FRONT ARM INSTALLATION

Installation is reverse of removal procedure.

Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

REAR ARM/PIVOT ARM REMOVAL

NOTE: Rear arm can be removed with suspension in place.

For rear arm removal, remove the following:

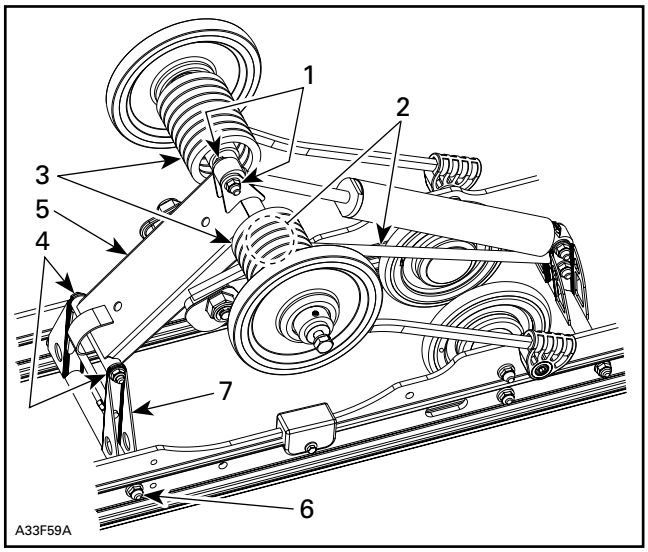
– shock upper bolt and nut
– throttle rod upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm

Remove rear arm.

For pivot arm removal, remove the following:

– bolt, nut and washers holding pivot arm to runners

Remove pivot arm.

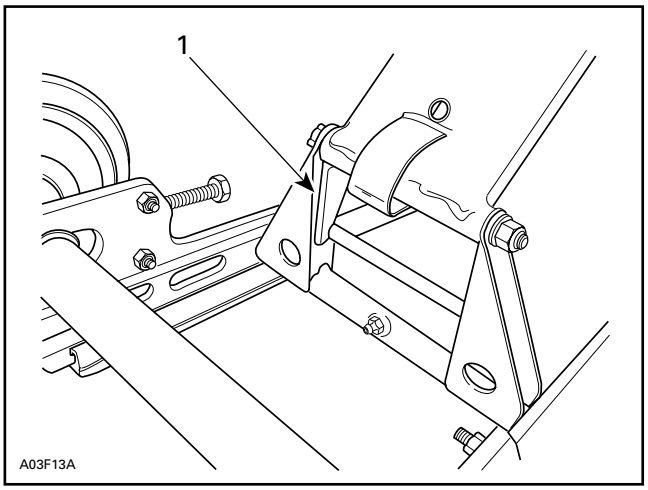


TYPICAL
1. Shock upper bolt and nut
2. Throttle rod upper bolt and nut
3. Rear springs
4. Rear arm/pivot arm screws and washers
5. Rear arm
6. Pivot arm/runners bolts, nuts and washers
7. Pivot arm

REAR 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.



TYPICAL
1. Stroke limiter on rear side

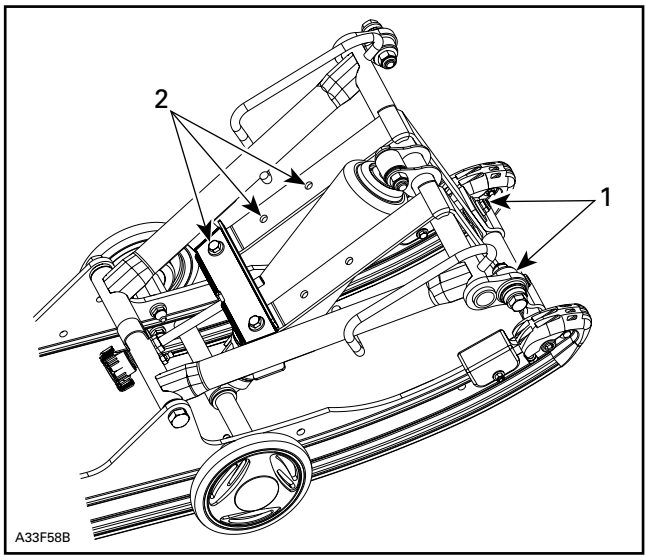
Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)
Rear arm shock upper nut	19.5 N•m (173 lbf•**in**)
Throttle rod upper nut	19.5 N•m (173 lbf•**in**)

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.



1. No adjustment possible
2. 3 adjustments possible

DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

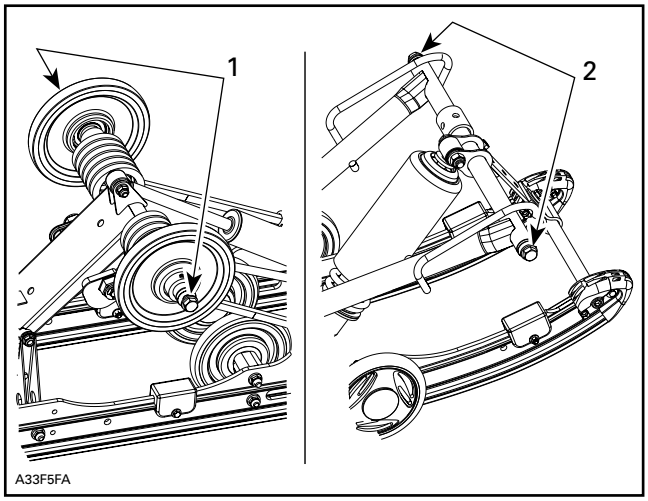
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

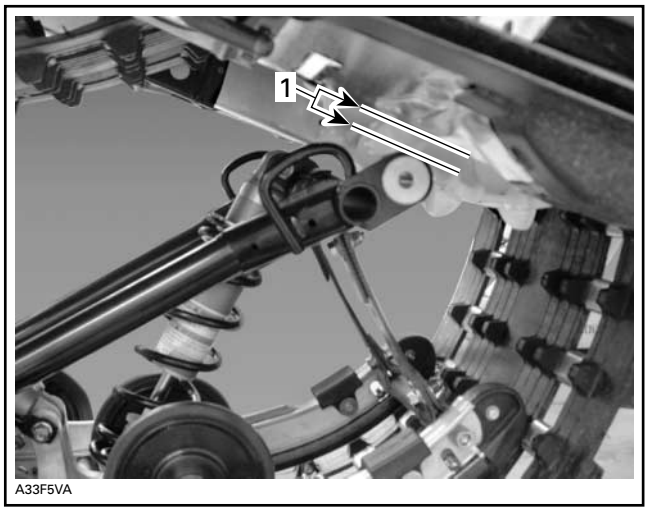
Remove rear arm top axle bolts from chassis.

Remove bolts retaining front arm to tunnel.

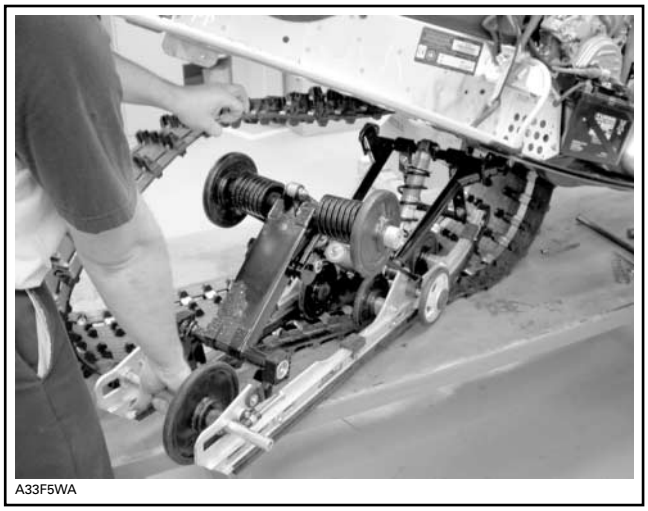


TYPICAL
1. Rear arm bolts
2. Front arm bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance


A33F5WA

TYPICAL — REMOVE SUSPENSION

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.

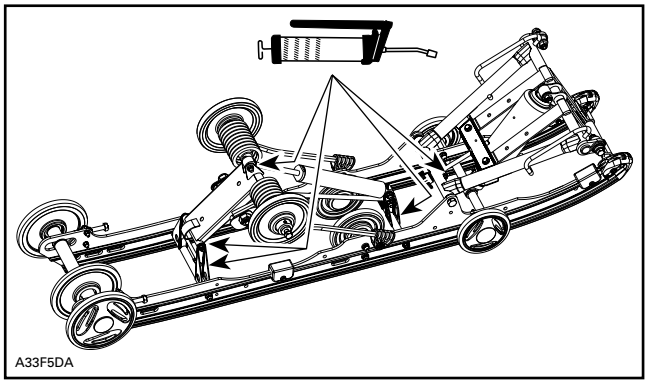
Adjust track tension.

RIDE ADJUSTMENT

Refer to the appropriate *Operator's Guide*.

LUBRICATION

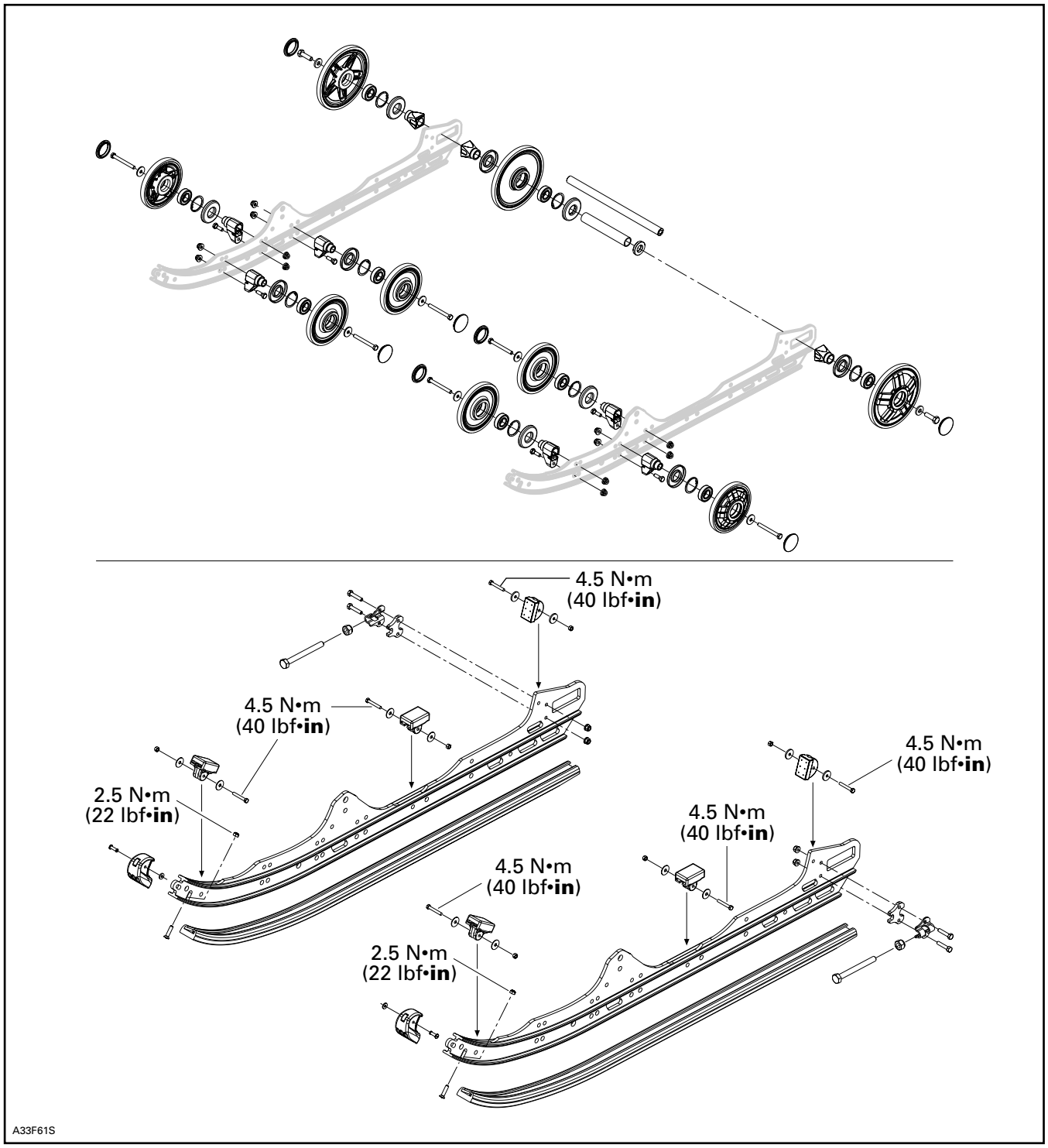
Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).


A33F5DA

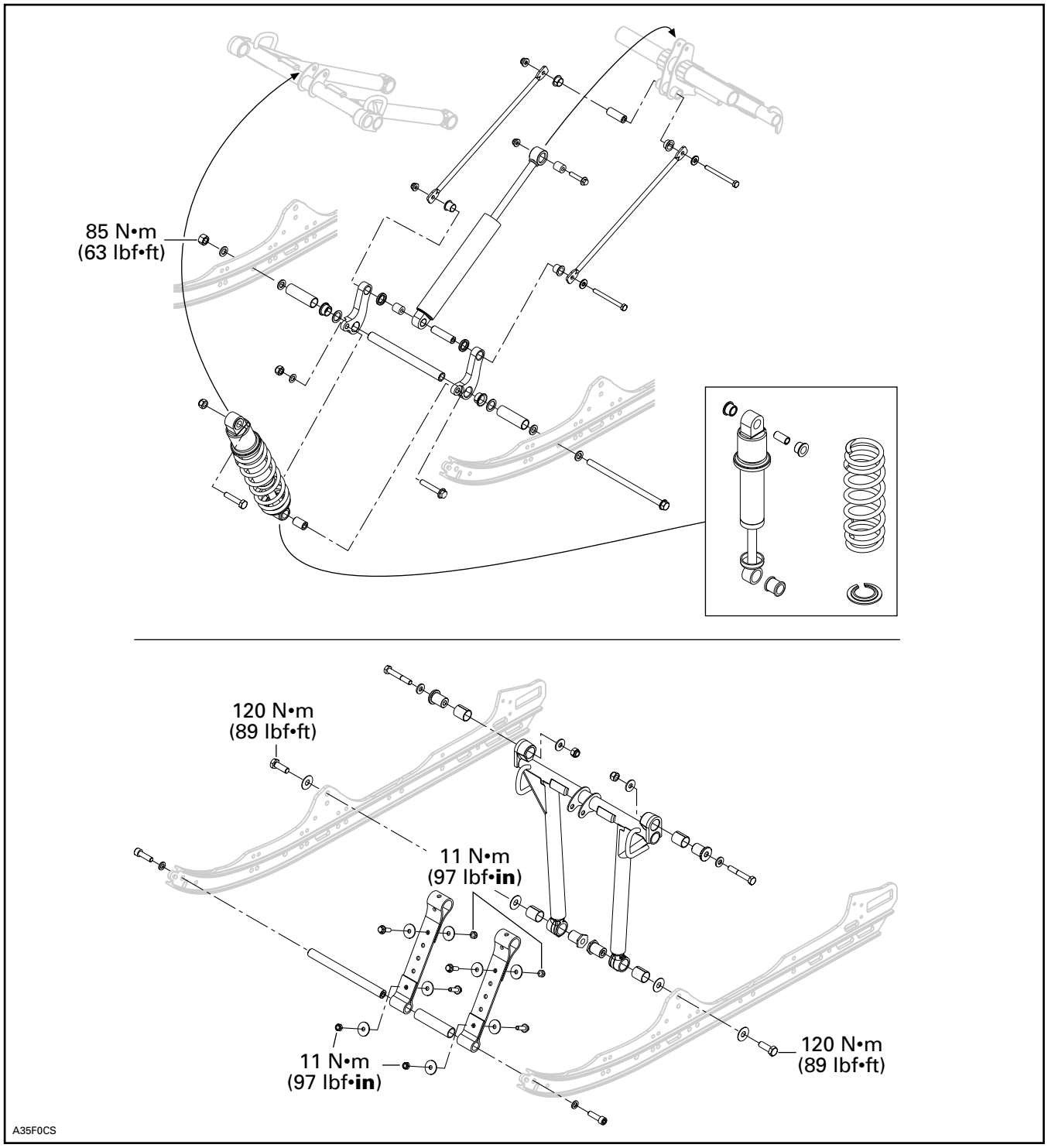
SC 4 SUSPENSION

SERVICE PRODUCTS

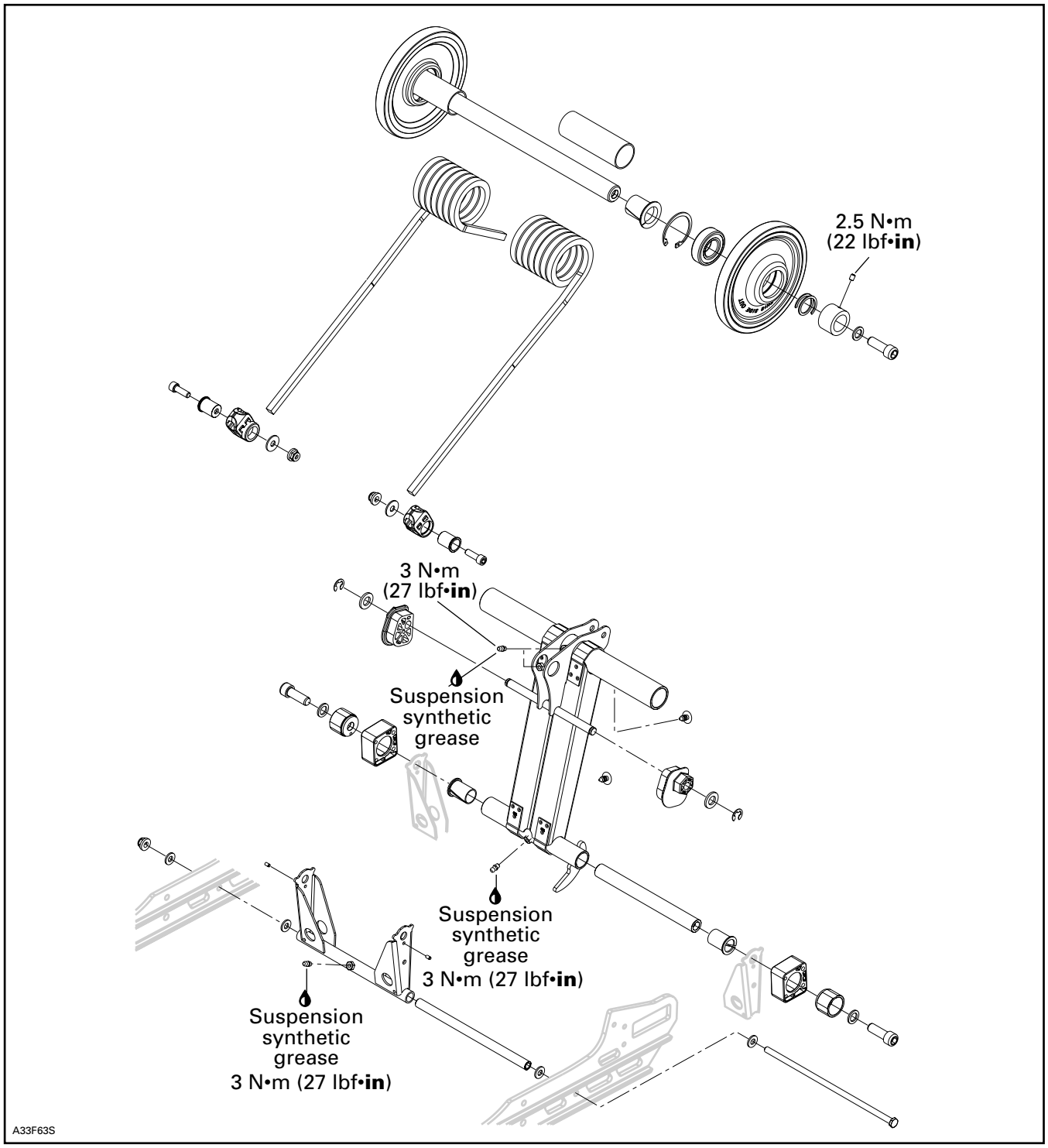
Description	Part Number	Page
suspension synthetic grease	293 550 033	267



RAILS AND IDLER WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND IDLER WHEELS

AXLE SELF-LOCKING SCREW REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent an axle from turning when unscrewing self-locking screws, proceed as follows:

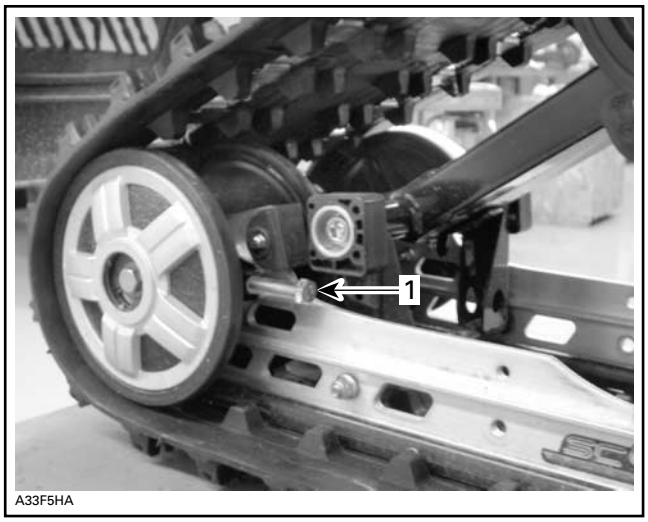
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

Remove screws on rear axle.

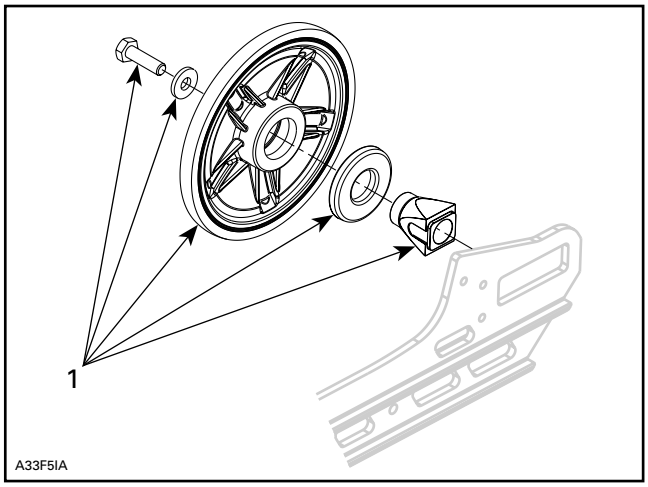
Completely loosen track tension.



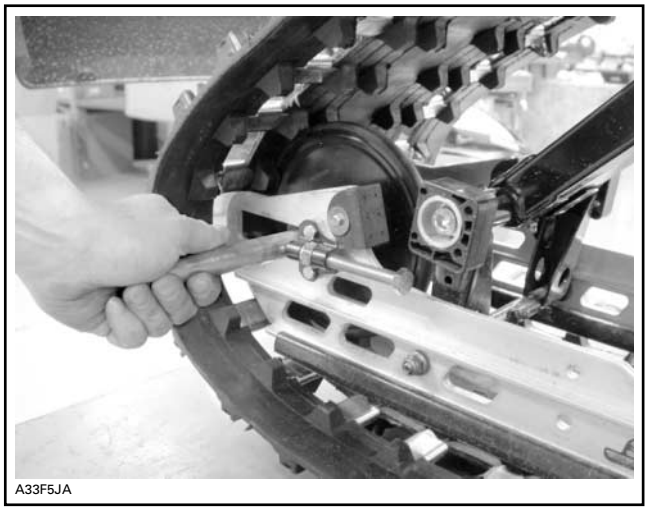
1. Completely loosen track tension

Remove the following:

– rear idler wheels
– idler wheels bearing protector
– idler wheels spacer.



ON BOTH SIDES
1. Remove the following



PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is reverse of removal procedure.

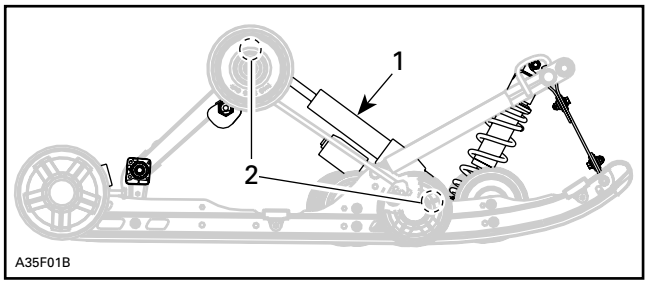
REAR SHOCK ABSORBER REMOVAL

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.

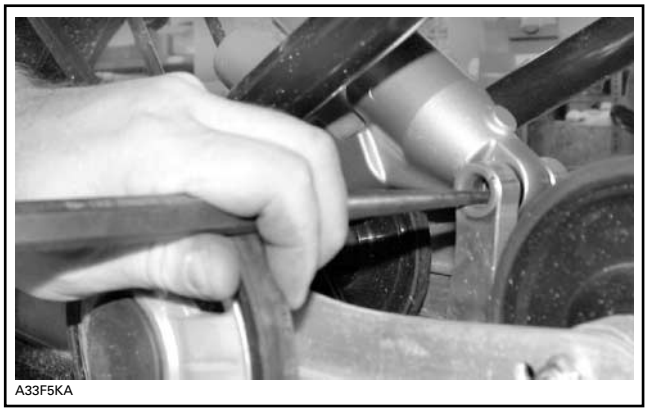


TYPICAL
1. Rear shock absorber
2. Remove bolts and nuts

Using a punch, remove lower shock bar axle.

Pay attention to plastic spacers.

Remove shock.



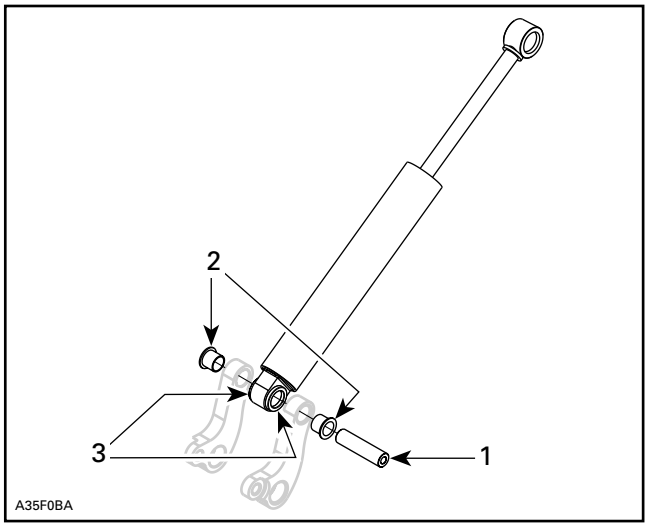
TYPICAL — REMOVE BAR AXLE

REAR SHOCK ABSORBER 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.

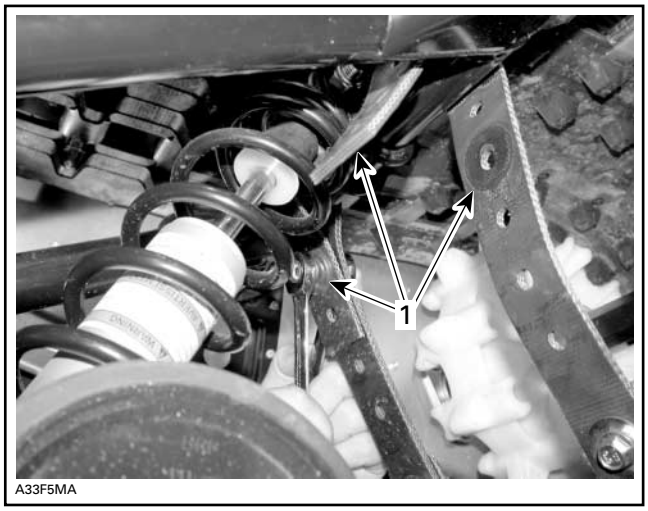


1. Bar axle
2. Swivel bushings
3. Plastic spacers

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

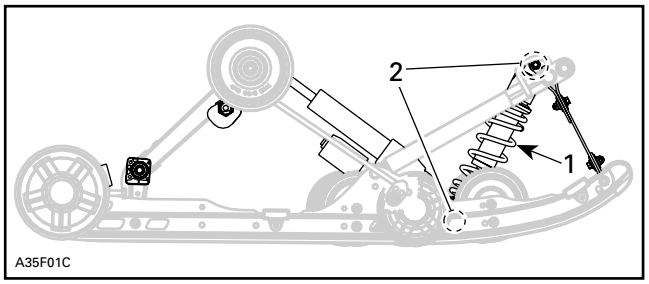
Unfasten one end of stopper straps.



TYPICAL
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.



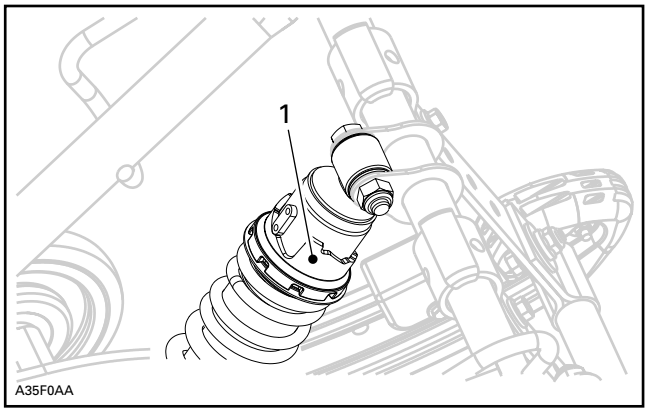
TYPICAL
1. *Front shock absorber*
2. *Remove bolts and nuts*

FRONT SHOCK ABSORBER 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, see photo.



1. *Adjustment ring*

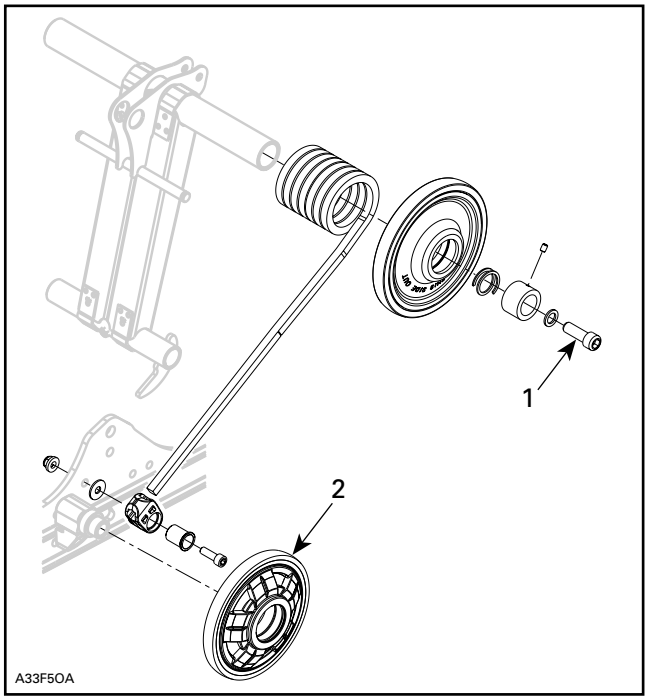
REAR SPRING REMOVAL

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.

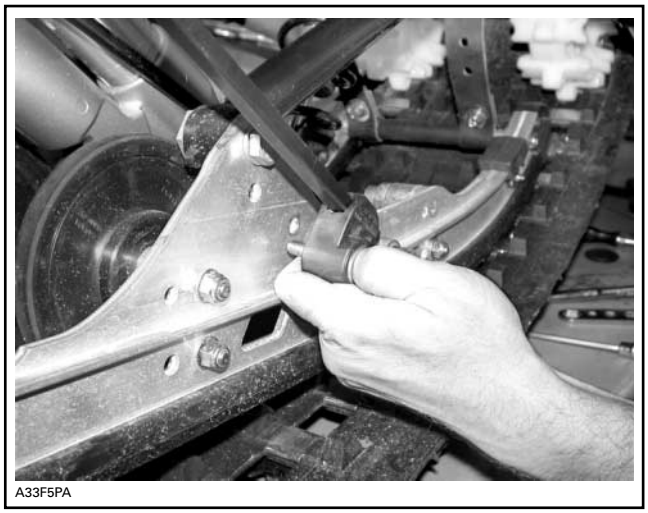


1. *Loosen rear arm top axle from chassis*
2. *Remove idler wheels*

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



REMOVE SPRING SUPPORTS

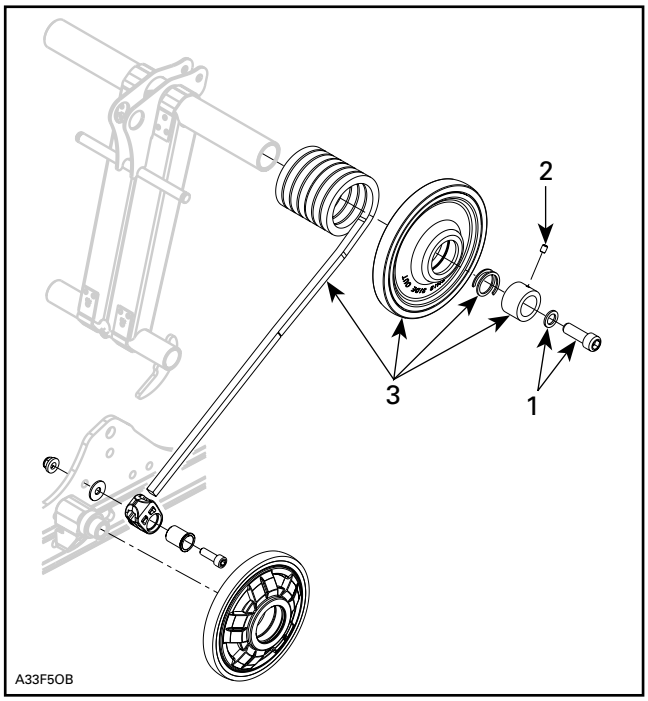
Remove screws and washers from rear arm top axle.

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring

– axle spring
– top idler wheel
– rear spring.



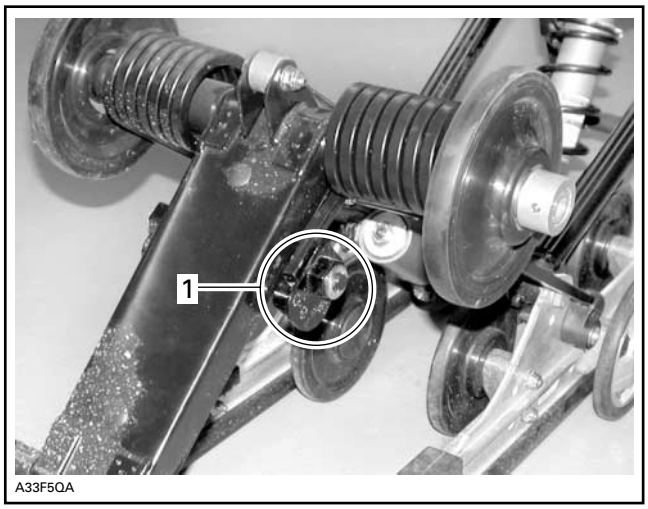
ON BOTH SIDES
1. *Remove screws*
2. *Loosen set screw*
3. *Remove the following*

REAR SPRING INSTALLATION

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

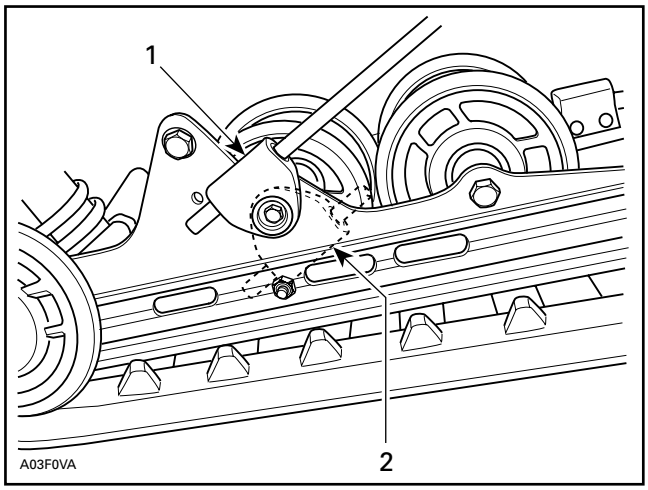
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

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.



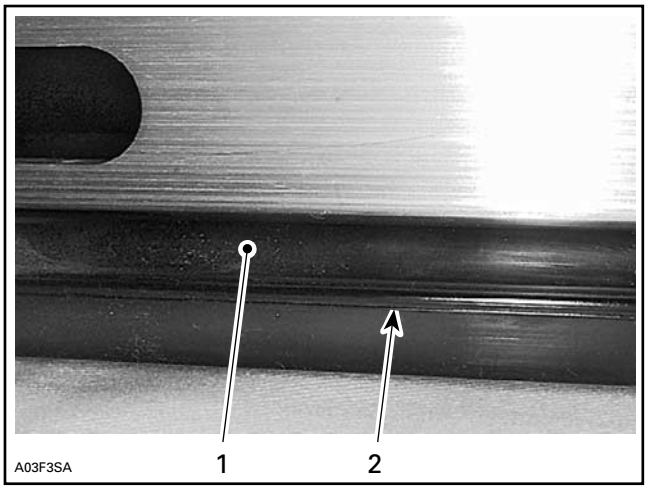
TYPICAL — RIGHT SIDE SHOWN
1. *Right position: upward*
2. *Wrong position*

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. *Slider shoe*
2. *Molding line (wear limit indicator)*

Replace slider shoes when wear limit is reached.

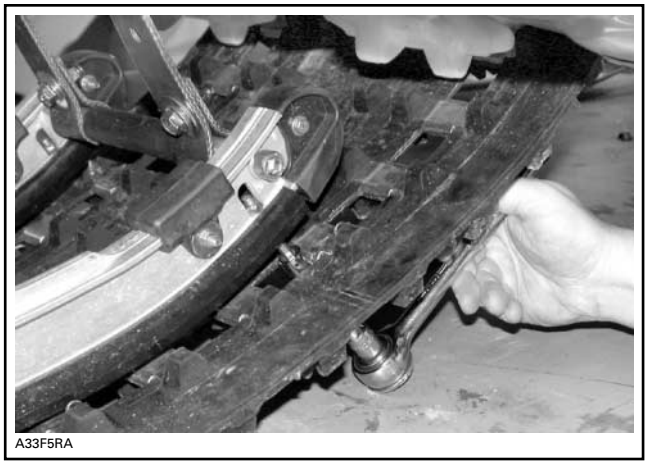
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

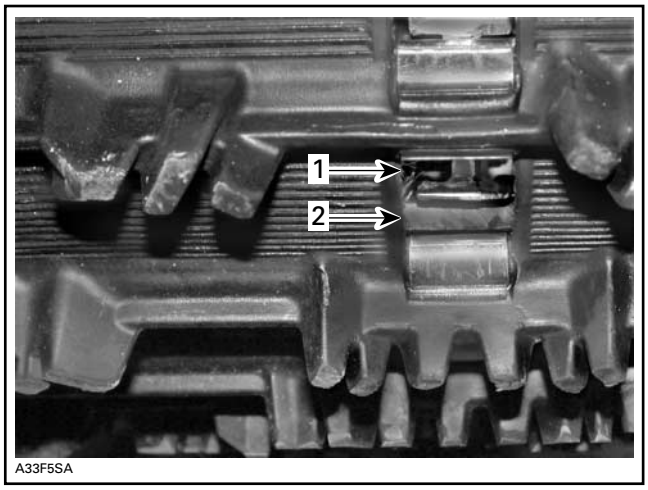
Completely loosen track tension.

Remove nut and screw of each runner.



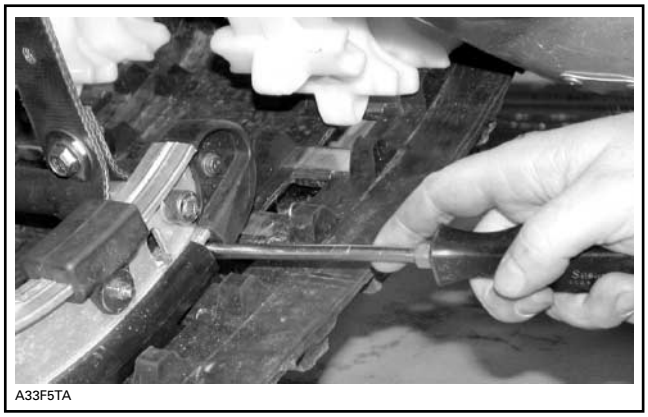
REMOVE NUT AND SCREW OF EACH RUNNER

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 thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.

PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

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

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

FRONT ARM REMOVAL

NOTE: Front arm can be removed with suspension assembly in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

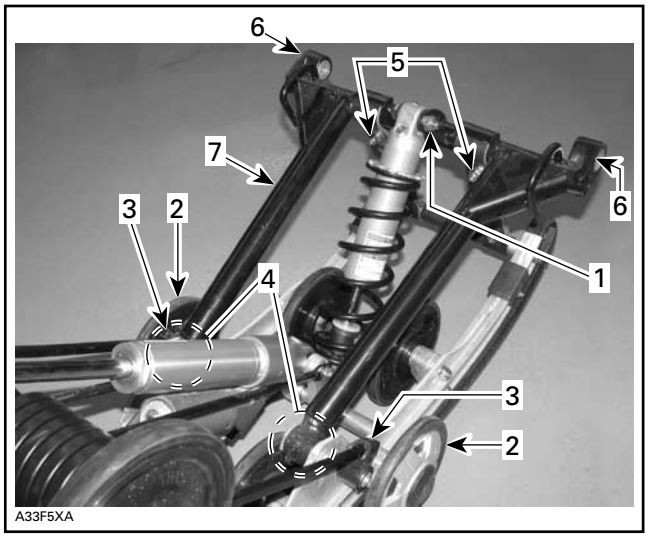
– shock upper bolt and nut
– front idler wheels
– spring supports (to gain access to front arm lower bolts)

⚠ 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.



TYPICAL — 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*

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.

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Stopper straps nuts	11 N•m (97 lbf•**in**)
Front arm lower bolts	120 N•m (89 lbf•ft)

REAR ARM/PIVOT ARM REMOVAL

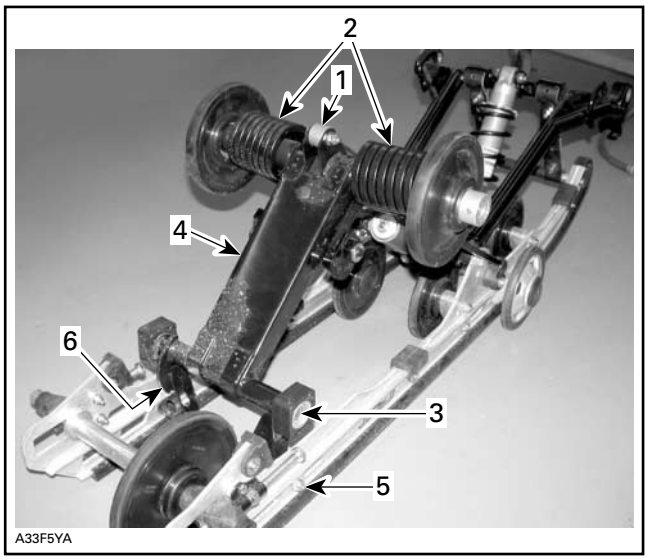
NOTE: Rear arm can be removed with suspension assembly in place.

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 the following:

– 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*

REAR ARM/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.

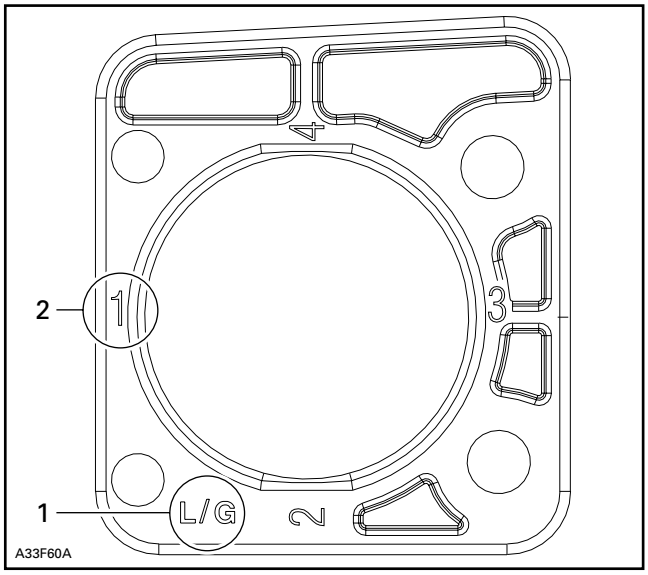
Insert dowel pin into pivot arm hole, dowel pin must exceed block guide by 2 to 2.3 mm (.079 to .091 in).

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Pivot arm/runners nut	25 N•m (18 lbf•ft)
Locking ring set screw	2.5 N•m (22 lbf•**in**)

BLOCK INSTALLATION

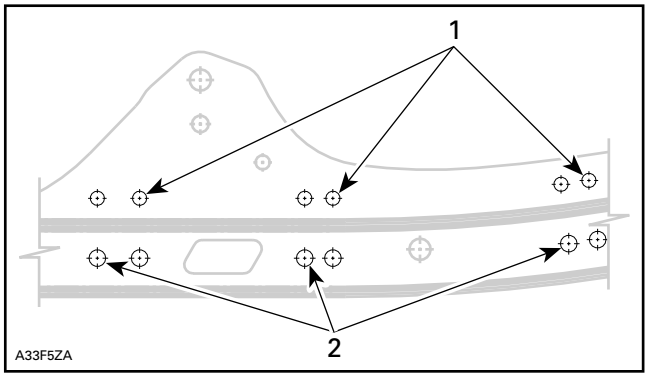
Both blocks are identified R or L (right or left) and have position number (from 1 to 4). At installation make sure to install proper block on proper side with the same adjustment position on both sides.



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.



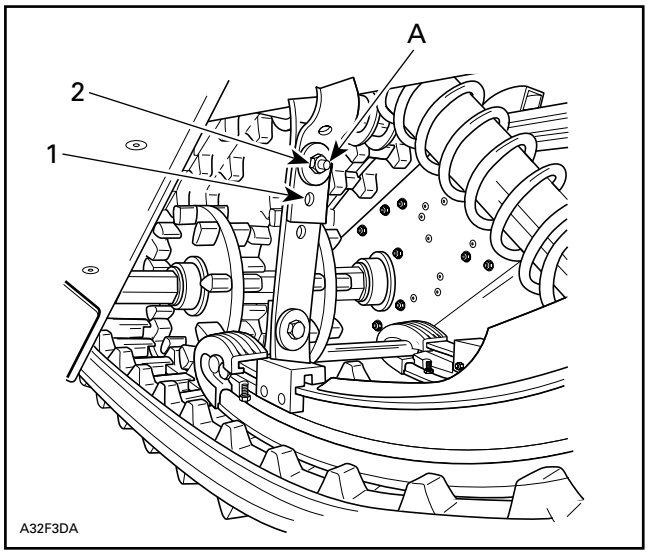
1. *RH side wheels position*
2. *LH side wheels position*

STOPPER STRAP

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

Make sure it is attached through proper hole from the end.

Torque nut to 11 N•m (97 lbf•**in**).



TYPICAL
1. 1st hole
2. 2nd hole
*A. 11 N•m (97 lbf•**in**)*

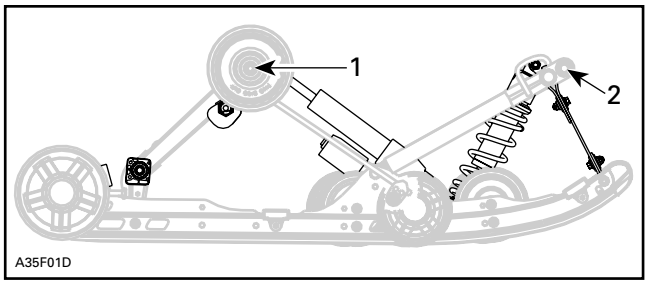
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

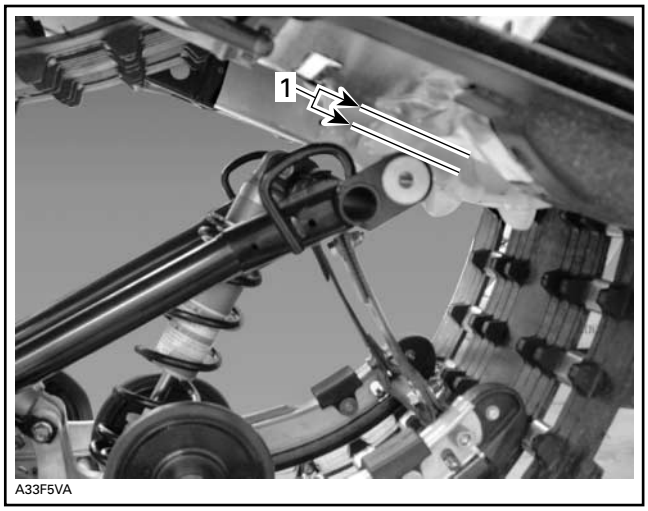
Remove rear arm top axle screws.

Remove front arm top bolts.

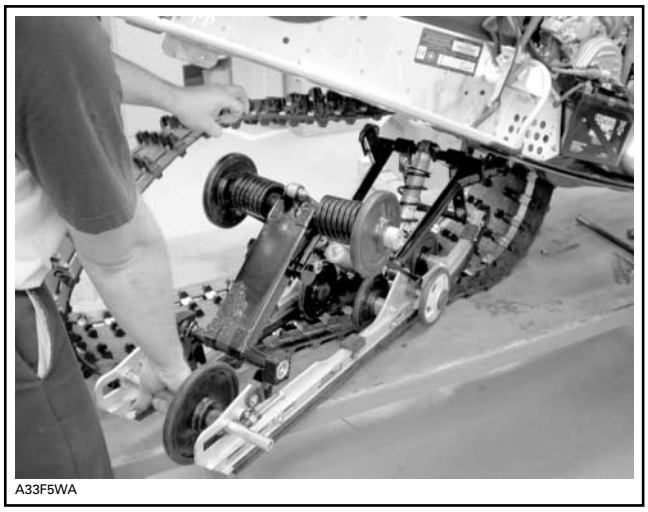


TYPICAL
1. Remove rear arm top axle screws
2. Remove front arm top bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



1. Enough clearance



REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is 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.

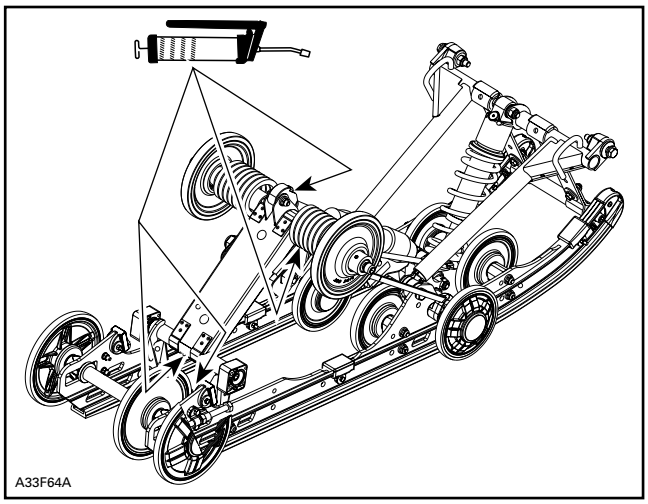
Adjust track tension.

RIDE ADJUSTMENT

Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate pivot arm and rear arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



SHOCK ABSORBER INSPECTION AND SERVICING

SERVICE TOOLS

Description	Part Number	Page
gas fill tool kit (needle type)	503 190 102	271, 276
Gas fill tool kit (needle type)	503 190 102	270
gas shock valve tool (tire valve type)	529 035 570	276
HPG shock holding tool	529 035 769	270
Piston guide	529 026 600	270
Seal guide	529 026 500	270
shock spring remover	529 035 504	269
shock wrench	529 035 727	271
Shock wrench	529 035 727	270

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier HPG shock oil	293 600 035	274
Loctite 271	293 800 005	272
Molykote G-n paste	711 297 433	274

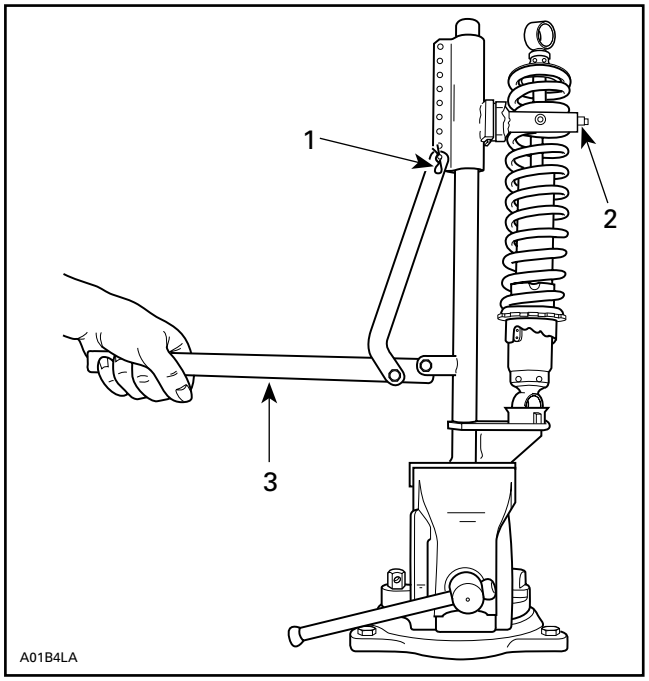
SPRING REMOVAL

Remove shock absorber from vehicle. Refer to the appropriate subsection.

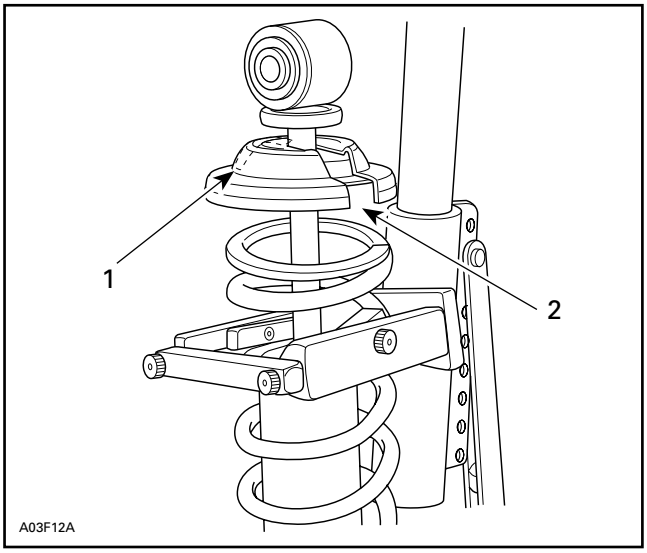
Use shock spring remover (P/N 529 035 504) and put it in a vise. Mount shock in it and turn shock so that a spring coil rests against spring compressor jaw.

Close and lock bar. Place handle horizontally by changing position of clevis pin.

Push down on handle until it locks. Remove spring stopper and cap then release handle.



TYPICAL
1. *Clevis pin*
2. *Bar*
3. *Handle placed horizontally*



TYPICAL
1. *Cap opening*
2. *Spring stopper opening*

Remove stopper.

Remove tool and spring from shock absorber.

SHOCK ABSORBER INSPECTION

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.

Let it stand for 5 minutes.

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.

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)

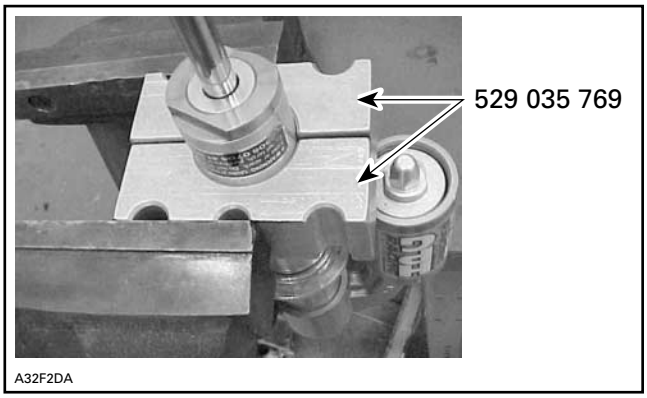
SERVICING TOOL	
SHOCK GAS FILLING	
Gas fill tool kit (needle type) (P/N 503 190 102)	
SHOCK ABSORBER DISASSEMBLY	
Shock size	Tool
C-36 36 mm (1.417 in)	Piston guide (P/N 529 026 600) Seal guide (P/N 529 026 500) Shock wrench (P/N 529 035 727)

Release nitrogen (N) pressure on any HPG T/A shock with internal floating piston (IFP).

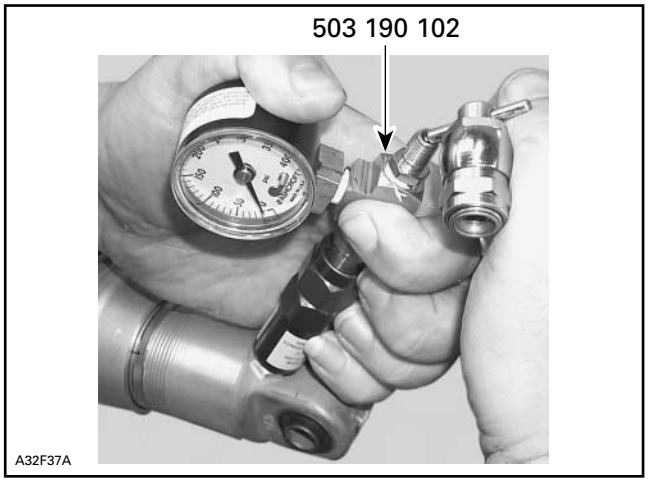
⚠ WARNING

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).



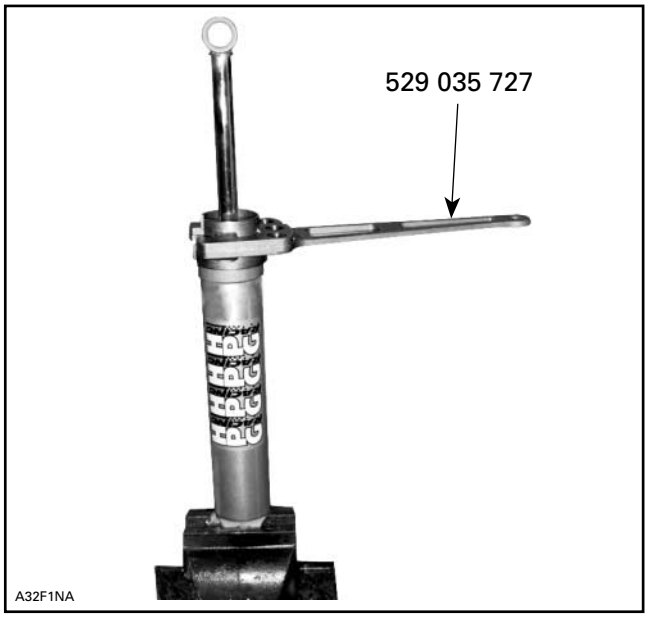
Remove screw on top of valve. Place the needle guide of gas fill tool kit (needle type) (P/N 503 190 102) on the shock valve. Press the detent pin and push forward the needle assembly very slowly towards rubber of needle valve. Push on shock tool valve center rod to release gas pressure.



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

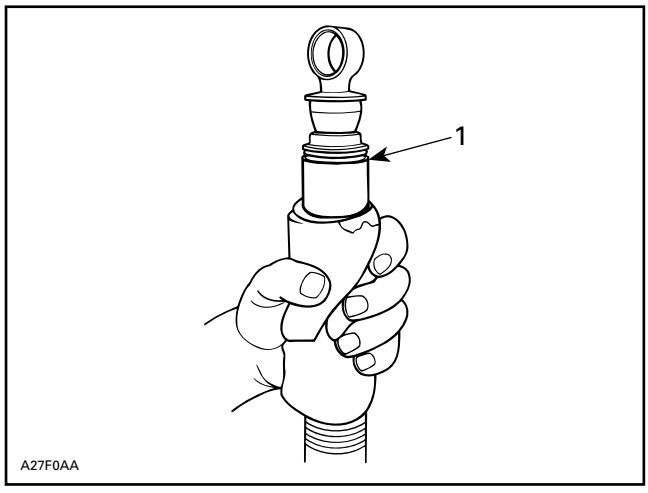
Using a flat tool, pop-out the cap.

Compress the carrier to access and remove the snap ring.

All HPG T/A Shocks

With the seal carrier removed, slowly lift and remove damper rod assembly from the damper body.

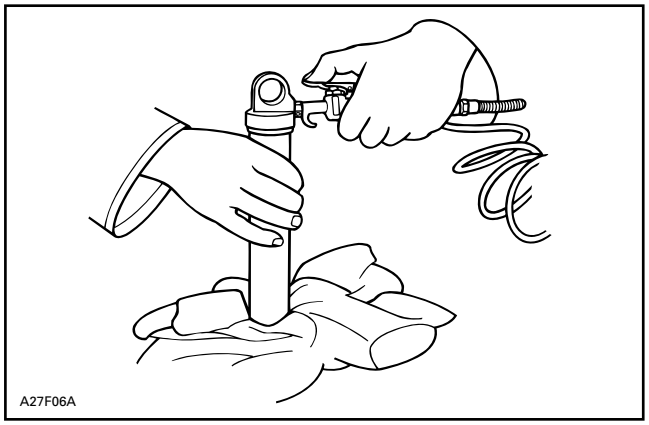
NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.



1. Oil flows

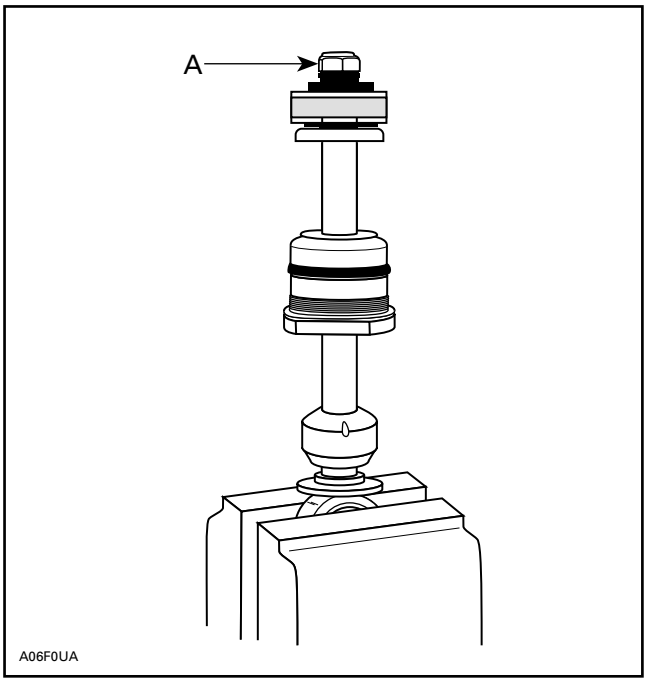
Discard old oil into storage container. Never reuse damper oil during shock rebuild.

Remove valve. 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.



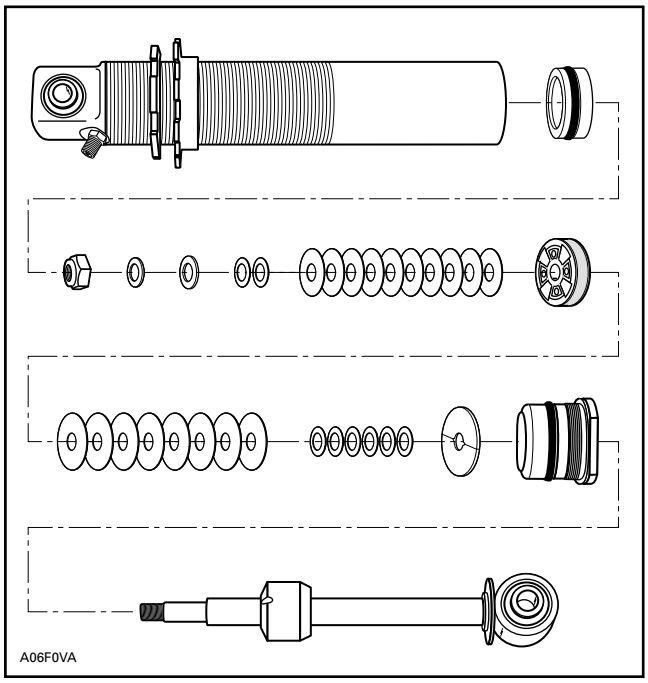
TYPICAL

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.



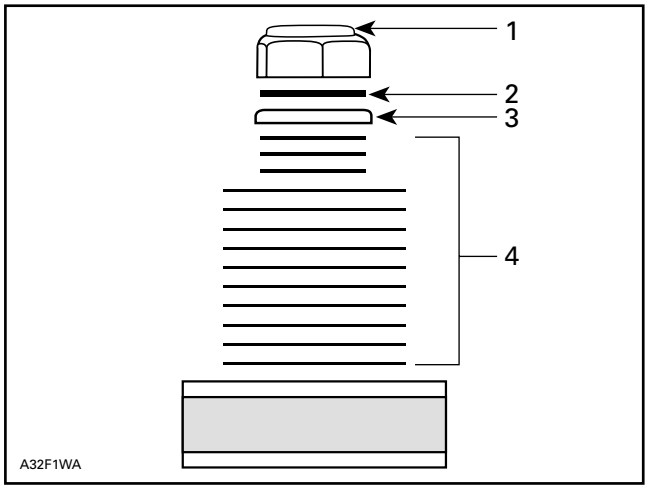
NOTE: As a general rule we suggest replacing the damper rod lock-nut after 4 rebuilds to ensure good locking friction and use Loctite 271 (P/N 293 800 005) each time.

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 27 - 29 N•m (20 - 21 lbf•ft).



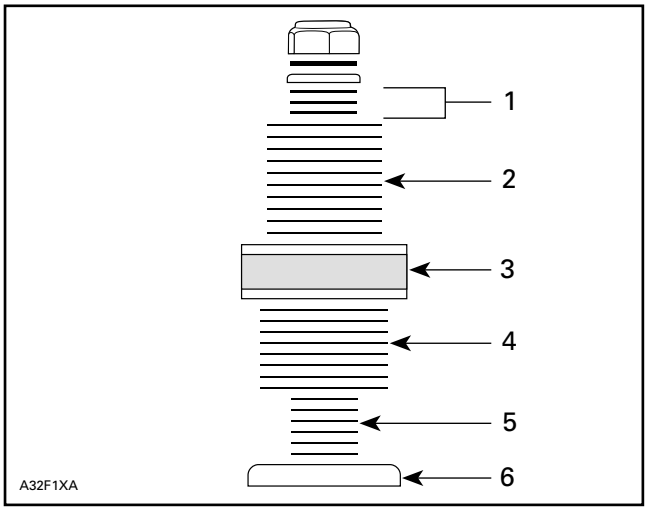
1. Damper nut
2. Spacer
3. Stopper with its round edge facing nut
4. Shim pack

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.

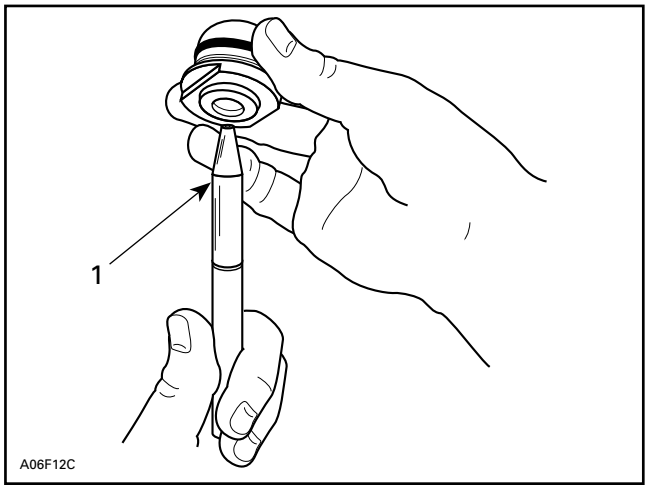


1. Rebound dampening shim pack
2. Rebound dampening shim pack
3. Piston
4. Compression dampening shim pack
5. Compression dampening shim pack
6. Stopper

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.

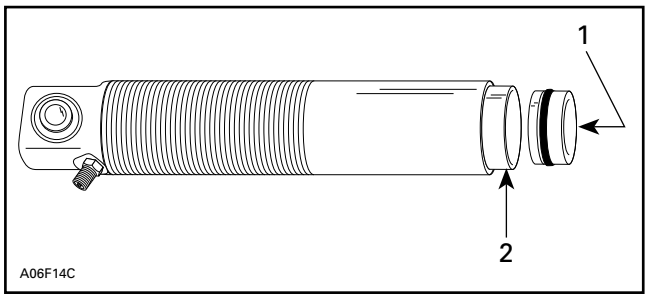
Reassemble damper rod assembly, taking care to properly assemble shim packs as required for your dampening needs. Ensure that the shaft piston is installed with the slits/larger intake holes facing the rebound shim stack.



1. Seal guide

If floating piston has been removed, reinstall floating piston into damper body (ensure that valve has been removed). Use Molykote G-n paste (P/N 711 297 433) to ease O-ring past damper body threads with floating piston guide.

CAUTION: Failure to install IFP correctly could result in shock damage.

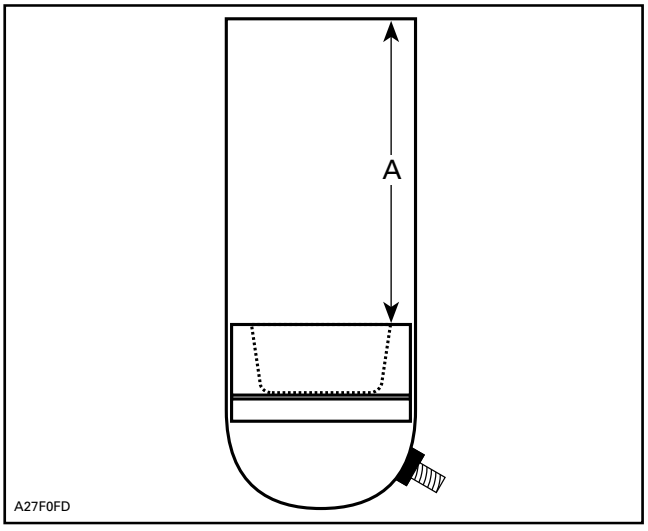


1. Push (slowly) by hand
2. Floating piston guide

NOTE: Lubricate inside of piston guide with Molykote G-n paste (P/N 711 297 433).

Install floating piston to the proper depth refer to following the table.

On all HPG take apart 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)
503 190 655	119.5 (4.70)
503 190 662	121.5 (4.78)
503 190 834	134 (5.28)
503 190 990	171.5 (6.75)
503 190 994	171.5 (6.75)

NOTE: If the floating piston is installed too far into the damper body, light air pressure through damper body valve hole will move piston outward.

NOTE: Reinstall valve after IFP has been installed at correct height and before adding oil.

⚠ WARNING

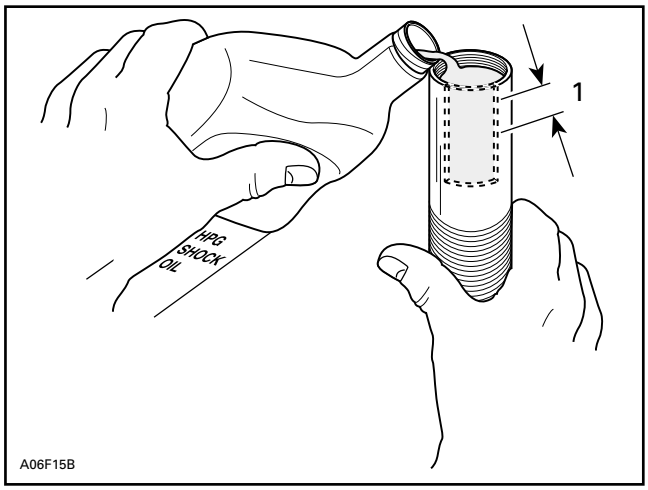
Whenever using compressed air exercise extreme caution, cover damper opening with shop cloth to reduce chance of possible injury.

CAUTION: Moisture laden compressed air will contaminate the gas chamber and rust floating piston.

⚠ WARNING

Always wear protective eye wear whenever using compressed air.

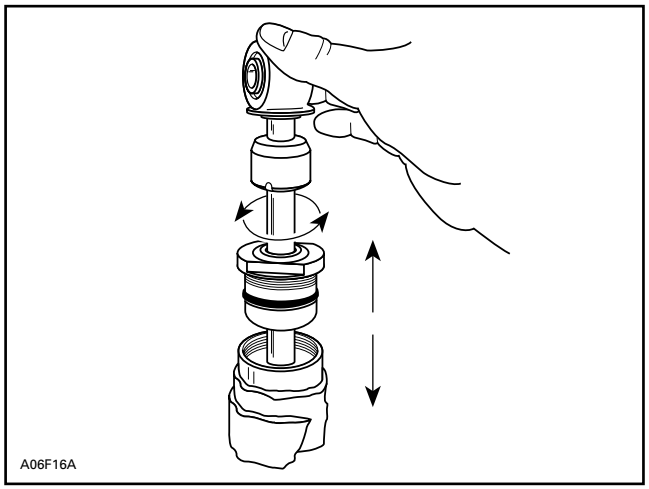
Fill the shock with Bombardier HPG shock oil (P/N 293 600 035) to approximately 10 mm (.393 in), from the base of seal carrier threads.



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 IFP displacement. Torque seal carrier to 90 to 100 N•m (66 to 74 lbf•ft).

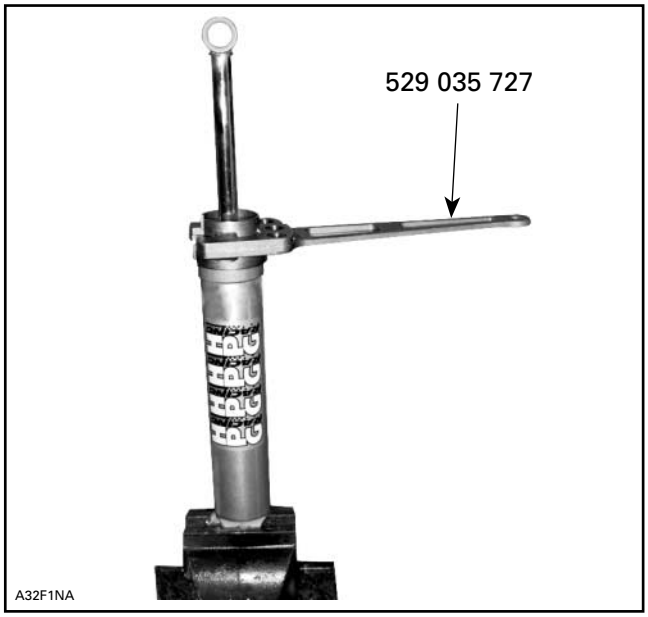
Snap Ring Cap Type HPG T/A Shock

Seal carrier assembly can now be pushed into damper body to pass snap ring grove. Install snap ring into groove.

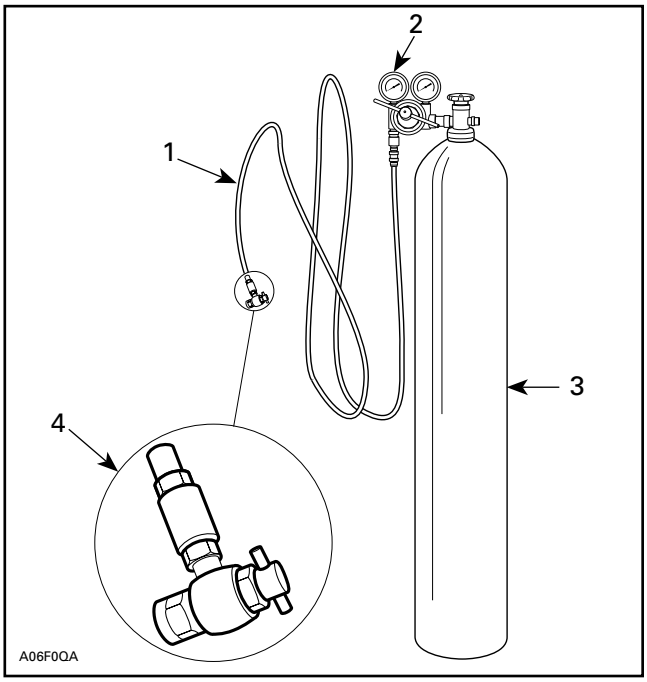
Tap the cap on the shock body.

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.



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.

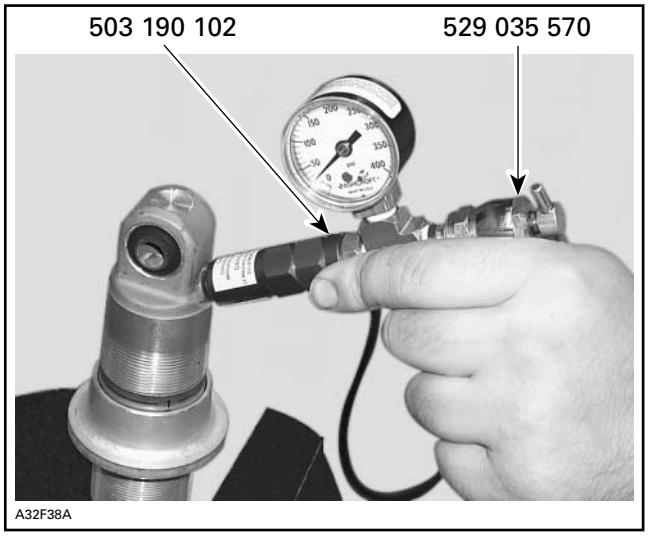
CAUTION: Do not exceed the recommended pressure values.

⚠ WARNING

Whenever working with high pressure gas, use eye wear protection. Never direct gas pressure toward anybody.

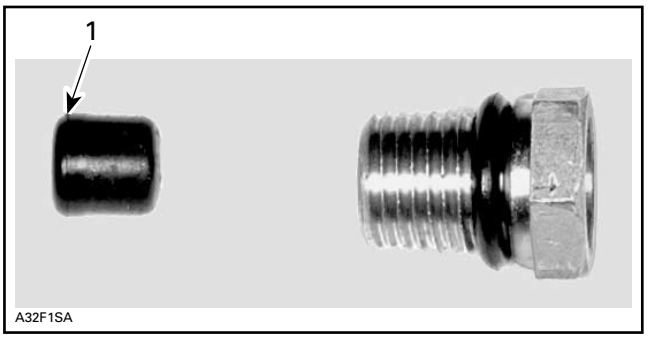
Install the gas fill tool kit (needle type) (P/N 503 190 102) on gas shock valve tool (tire valve type) (P/N 529 035 570). Set the regulator pressure on the nitrogen cylinder as per the shock requirement.

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 and rubber, 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.

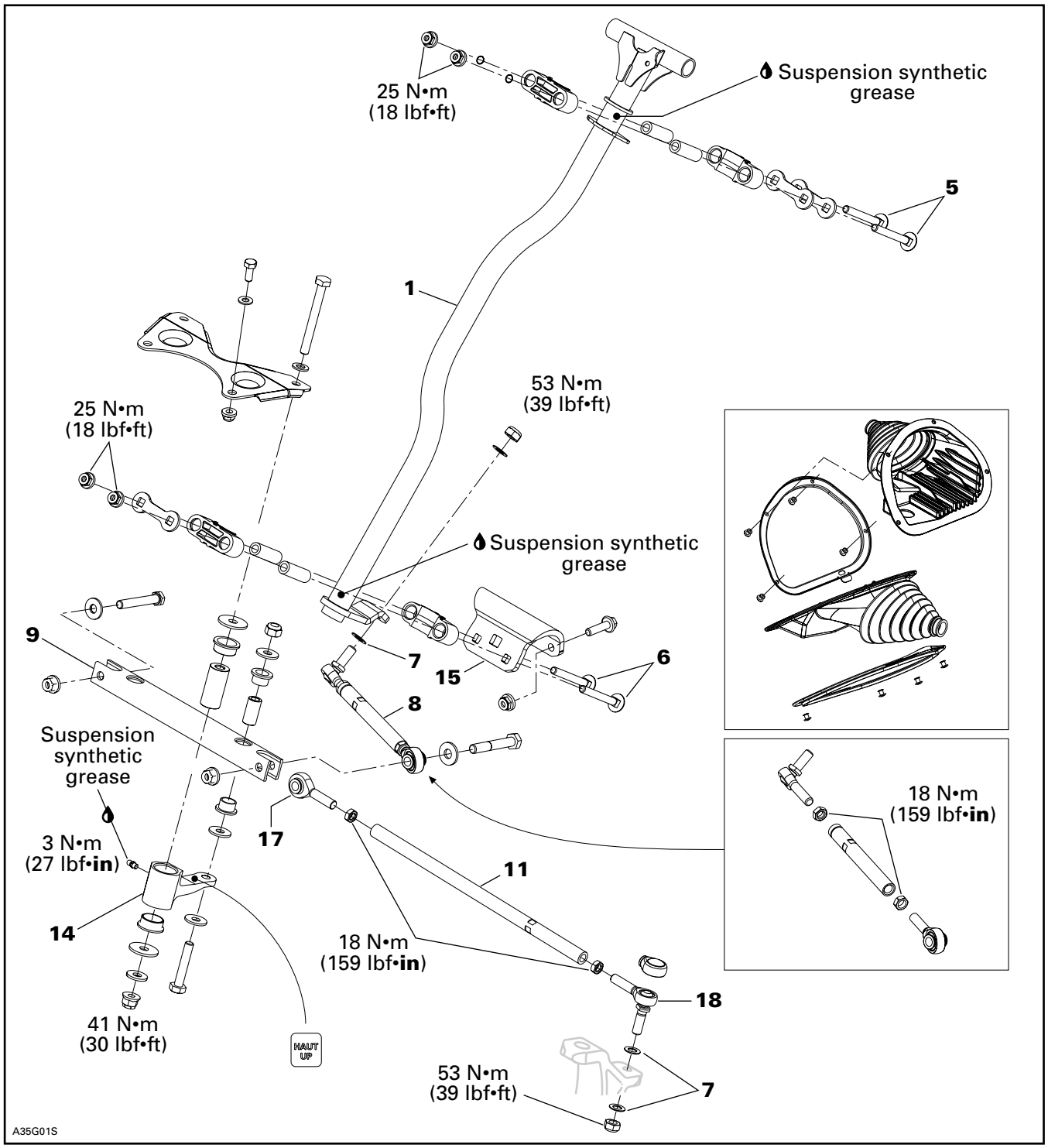
After recharging is complete the rebuilt shock should be bench-tested. Stroke the shock to ensure full travel and smooth compression and rebound action. If the shaft moves in or out erratically this could indicate too much air is trapped inside. If the shaft will not move or has partial travel then it 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.

STEERING SYSTEM

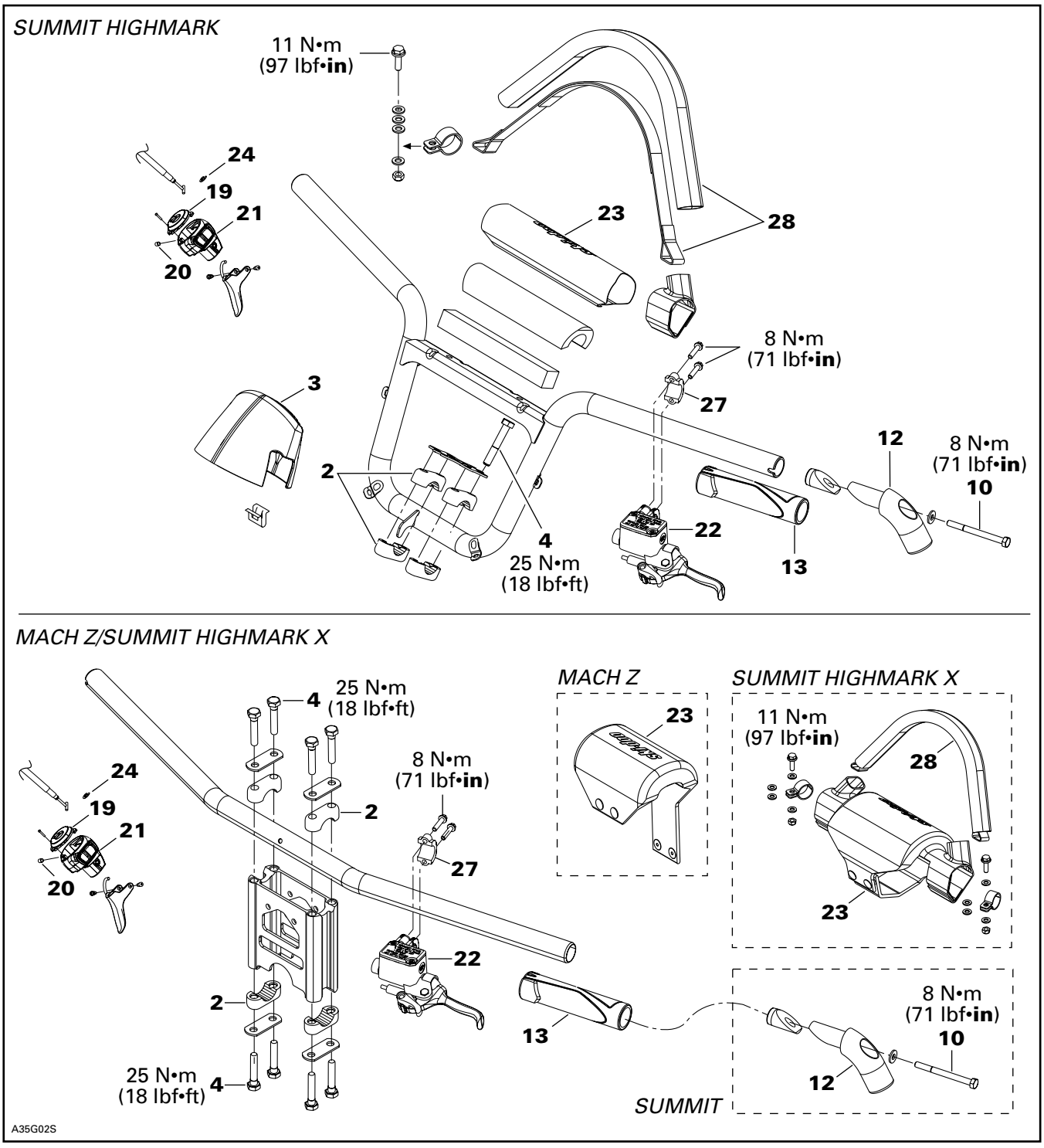
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	289

Linkage Arrangement



Handlebar Arrangement



DISASSEMBLY AND ASSEMBLY

Grip

NOTE: These models feature an integrated heating element in the plastic sleeve of the grip **no. 13**.

CAUTION: Removing grip from handlebar might damage the heating element. Do not remove needlessly.

NOTE: If heating grip does not work and needs to be replaced, the grip can be cut with a knife for removal.

Throttle Side:

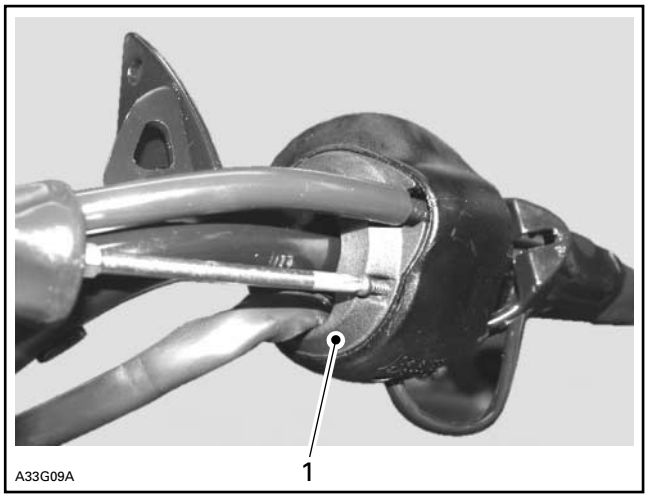
NOTE: Throttle lever housing **no. 21** must come off handlebar along with grip.

Remove steering padding **no. 23**.

Unplug RH harness on top of steering column.

Cut locking ties retaining RH harness to handlebar.

Remove throttle lever housing cover **no. 19**.



1. Throttle lever housing cover

Remove circlip **no. 24** from throttle cable housing.

Unfasten throttle cable from throttle lever, then pull out throttle cable housing from throttle lever housing **no. 21**.

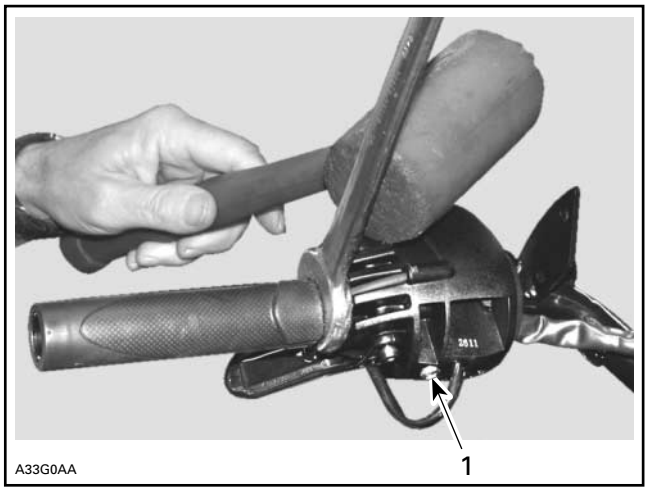
Unscrew screws **no. 10** and remove J-hook **no. 12** from end of grip on so equipped models.

Loosen screw **no. 20** retaining throttle lever housing to handlebar. See photo below.

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.

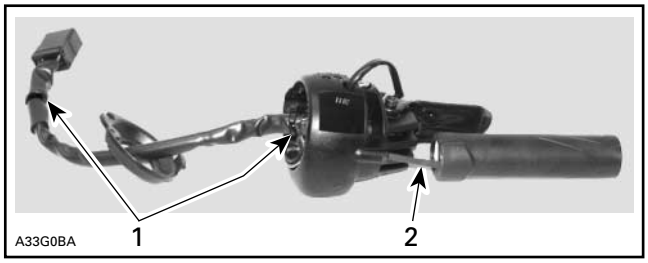
Using a plastic hammer, tap on the side of the wrench end to make the grip slide out.



1. Screw retaining throttle lever housing

Cut locking ties on harness.

Using 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.



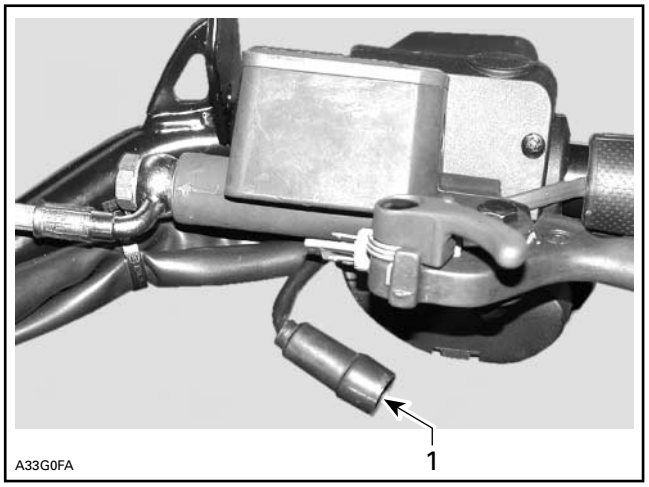
1. Locking ties
2. Heating grip harness

Pull heating grip harness out of throttle lever housing.

For installation refer to GRIP INSTALLATION below.

Brake Side:

Unplug connectors from brake light switch located on master cylinder **no. 22**.



1. Connectors unplugged

Unplug LH harness on top of steering column.

Cut locking ties retaining brake light switch/heating grip harness to handlebar.

Using 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 heating grip wires out of brake light switch/heating 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.

Grip Installation:

Installation is the opposite procedure of the removal but pay attention to the following.

Clean handlebar ends and inside of heating grip with isopropyl alcohol. Let dry before installation.

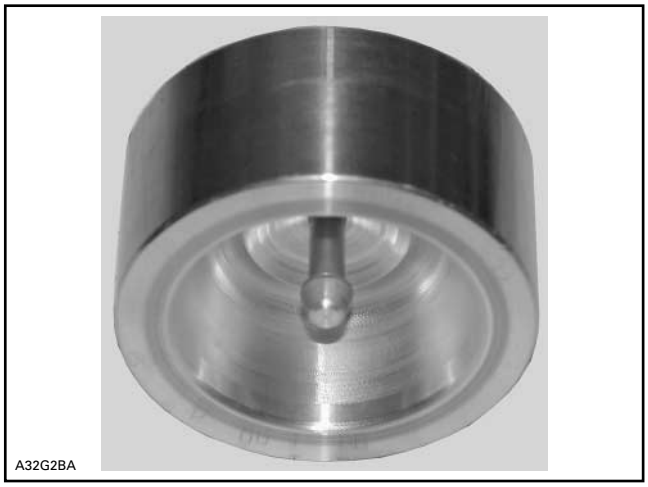
⚠ WARNING

Handlebar end and inside of heating grip must be clean and dry before installing heating grip to ensure proper adhesion.

Position grip on handlebar with its harness aligned with windshield bracket. See next photo.

Use the appropriate insertion tool to properly install grip.

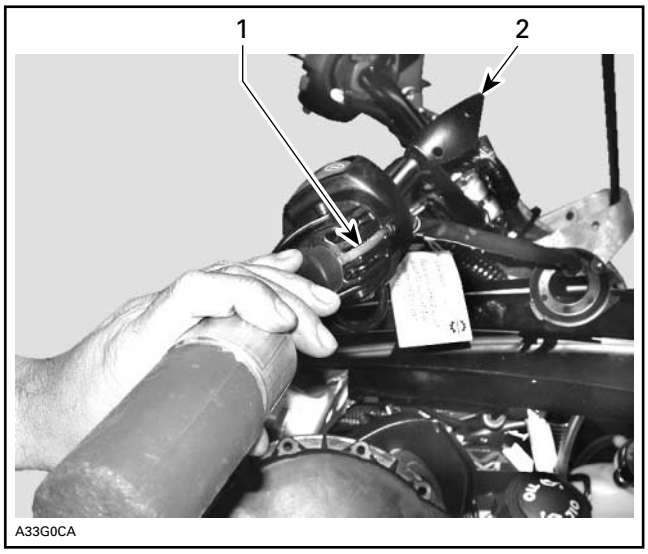
MODEL	TOOL PART NUMBER
Models with straight grips	529 035 897
Models with J-hooks	529 035 936



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.



1. Harness
2. Windshield bracket

Properly route harness then reinstall removed parts.

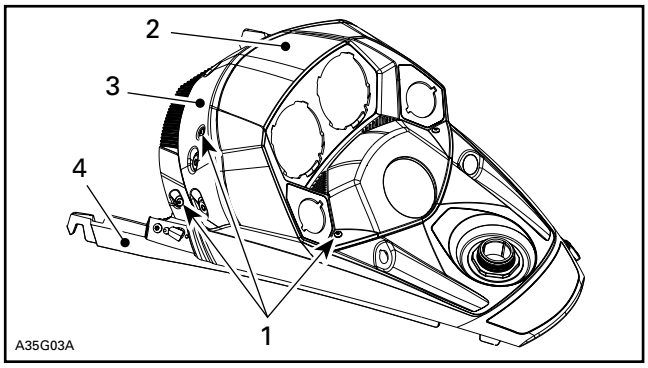
Reinstall terminals and replug connectors. Test grips to ensure they heat properly.

Steering Column

Remove windshield.

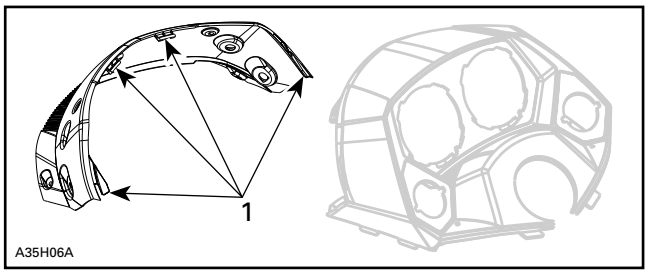
Remove steering padding **no. 23**.

Remove screws retaining indicator support and indicator support door.



1. Remove screws
2. Indicator support
3. Indicator support door
4. Center console

Remove indicator support door.

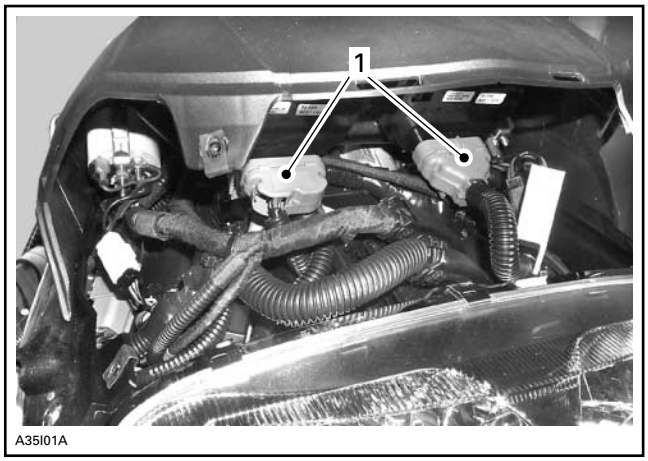


INDICATOR SUPPORT DOOR
1. Locking tab

Slightly lift console to gain access to electrical connector housings.

Unplug the 2 large connector housings.

NOTE: Only one connector for Summit models.

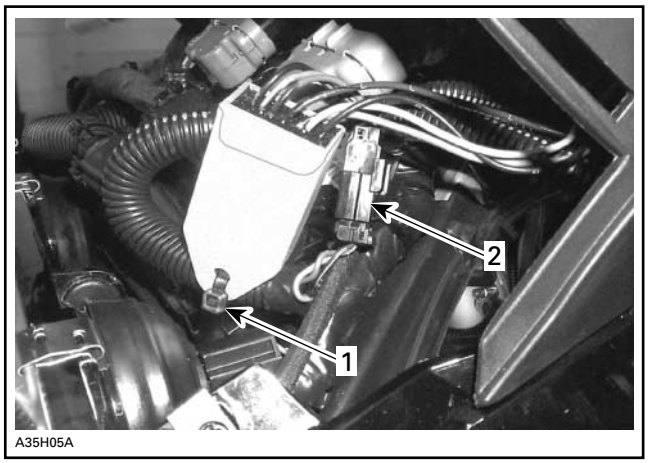


TYPICAL
1. Unplug

Mach Z

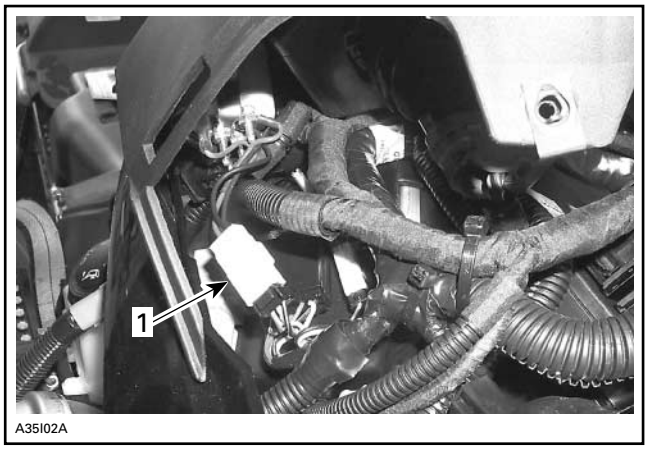
Cut locking tie holding temperature gauge electrical box to harness.

Unplug temperature gauge connector.



TEMPERATURE GAUGE
1. Cut
2. Unplug

Unplug fuel gauge connector.



FUEL GAUGE
1. Unplug

Remove console.

Mach Z and Summit

If applicable, cut locking ties retaining harnesses to steering column **no. 1**.

Unbolt handlebar ass'y from steering column and move it aside.

Remove tuned pipe.

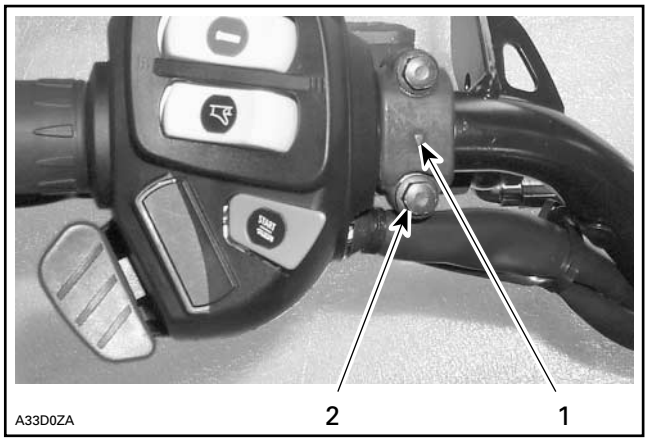
Detach the short tie rod **no. 8** from the steering column. Note that a hardened flat washer **no. 7** goes on each side of steering column lever.

Disengage carriage bolts **no. 5** and **no. 6** from steering column.

Remove plastic U-clamps from steering column.

Pull steering column from top.

If, for any reason, the master cylinder has been removed from handlebar note that its clamp **no. 27** must be installed with the embossed arrow pointing downward. Torque screws to 8 N•m (71 lbf•**in**) beginning with the bottom screw.



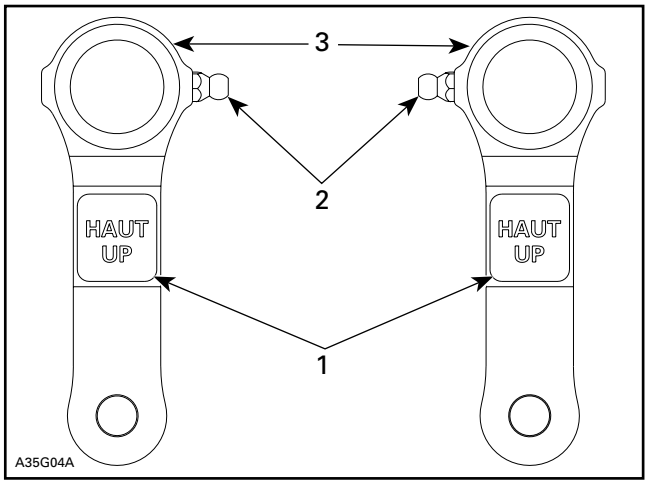
1. Arrow on clamp pointing downward
2. Tighten bottom screw first

Refer to HANDLEBAR POSITION ADJUSTMENT for handlebar reinstallation.

RH and LH Swivel Arm

At assembly respect UP mention.

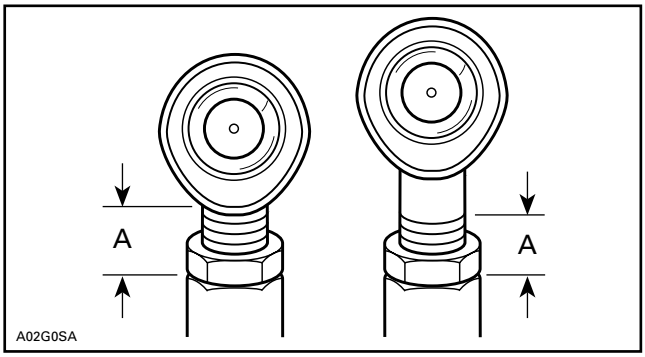
Grease fitting **no. 16** of swivel arms **no. 14** must face toward center of vehicle.



1. UP mention
2. Grease fittings
3. Swivel arms

Ball Joint (left hand and right hand threads)

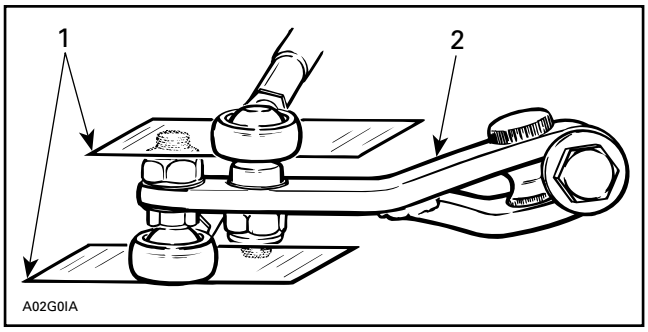
The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).



TYPICAL
A. 20 mm (25/32 in) max.

The ball joint **no. 17** and **no. 18** should be restrained when tightening the tie rod end lock nut. Align it so the tie rod end is parallel to the steering arm when assembled on the vehicle, refer to the following illustration.

For proper torque specifications refer to the specific exploded view for the vehicle being serviced.



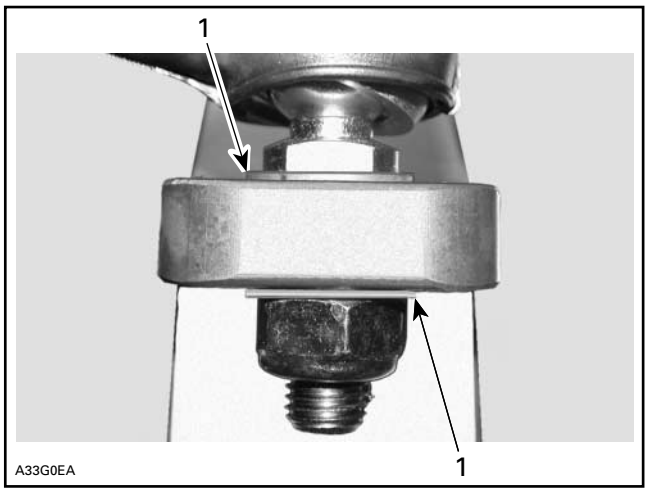
TYPICAL
1. Parallel with steering arm
2. Steering arm

⚠ WARNING

The cut off section of the ball joint must run parallel with the swivel bar no. 9. When tightening lock nuts, restrain ball joint with appropriate size wrench. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).

Hardened Washer

Install a hardened washer **no. 7** on each side of the ski leg and each side of the steering column lever.



TYPICAL
1. Hardened washers

INSPECTION

Check skis and runners for wear. Replace as necessary. Refer to FRONT SUSPENSION.

Check the general condition of the steering system components for wear. Replace if necessary.

Heating Grip Element

Refer to ELECTRICAL SYSTEM section for checking heating element **no. 13** of grip.

Ball Joint (left hand and right hand threads)

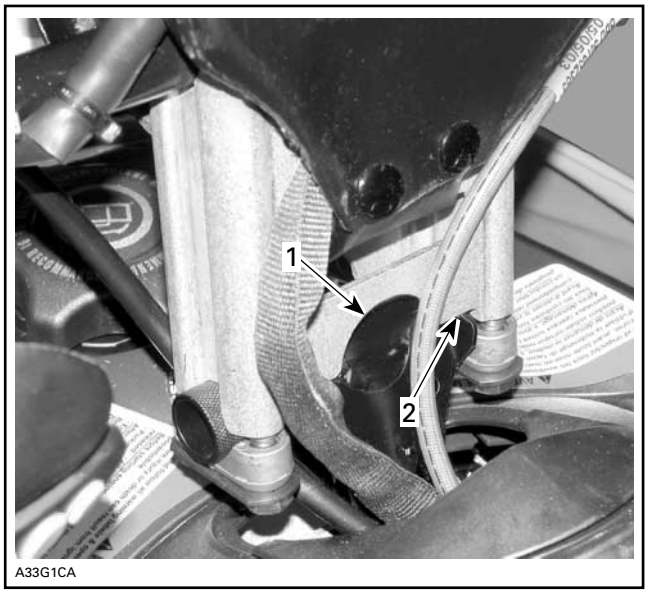
Inspect ball joint ends **no. 17** and **no. 18** and small tie rod ends for wear or looseness, if excessive, replace them.

ADJUSTMENT

Handlebar Extension

Mach Z/Summit Highmark X

When installing handlebar extension **no. 29**, ensure to position the rounded opening at the bottom and to tilt the extension so that it rests against steering support stopper.

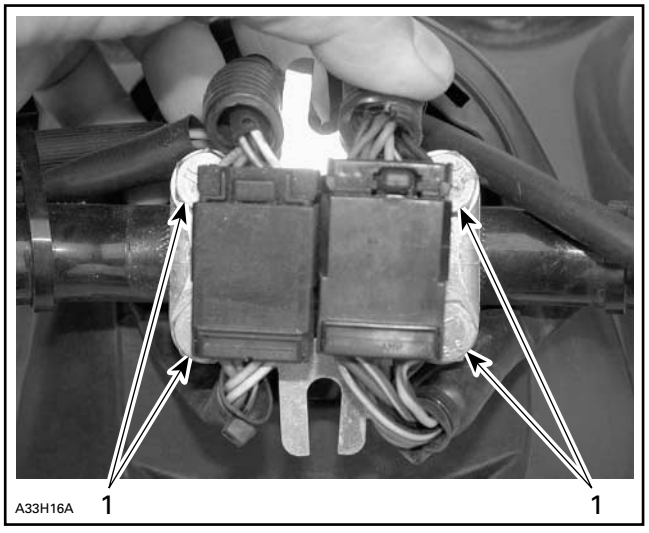


1. Opening here
2. Extension against stopper

Handlebar Position Adjustment

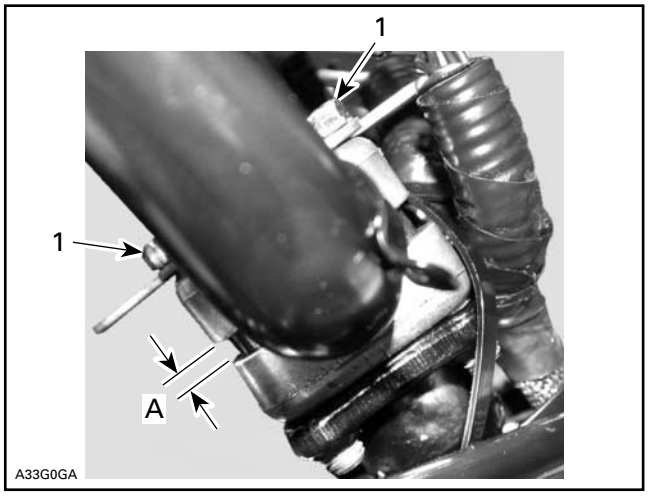
The handlebar position can be adjusted to suit driver's preferences.

Loosen all 4 bolts **no. 4** retaining handlebar to steering column.



TYPICAL
1. Four bolts

Move handlebar to the desired position. Torque all 4 bolts **no. 4** to 25 N•m (18 lbf•ft).



TYPICAL
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 no. **2.**

⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Readjust throttle lever housing **no. 21** 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.

Handlebar Strap

Summit

Ensure to position strap **no. 28** 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.

Position strap between rubber band and screw end to protect the rubber band.

Retaining clip and hardware must be installed in the same position on both strap ends.

J-Hook Adjustment

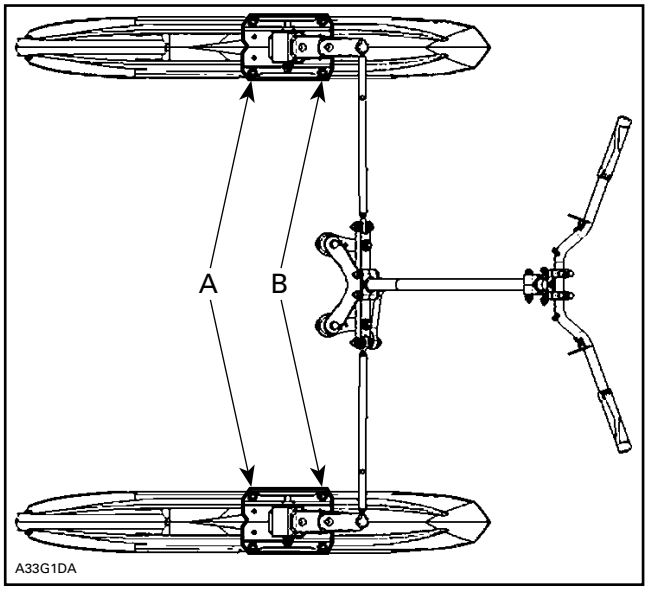
Summit

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.

STEERING ADJUSTMENT (SKIS)

Toe-Out

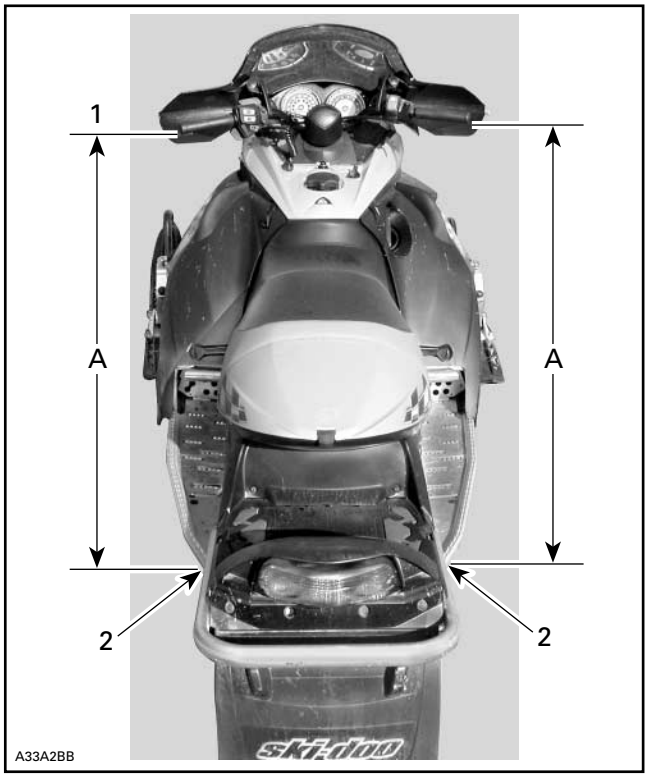
A difference measured between the front edge of the ski bridge "A" and rear edge of ski bridge "B" as viewed from the top.



Ski alignment and toe-out are performed by adjusting length of left and right tie rods **no. 11**.

– Position handlebar so that it is in 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 relative to each side.

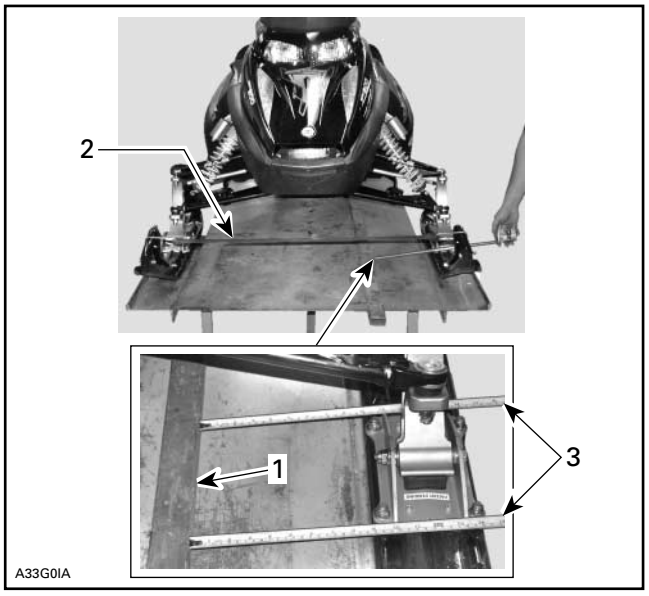


1. Equal distance "A" on each side
2. Same reference point

– Hook a rubber cord in front of skis to keep them closed and to take all slack from steering mechanism.
– Leave the vehicle on the ground on its own weight.
– Place a straight edge against pre-adjusted track and measure the distance between front and rear of ski bridge.

MODEL	TOTAL TOE-OUT ± 1 mm (± 3/64 in)
All RT Series	2 (5/64)

NOTE: To reduce tolerance when measuring, set one ski to proper toe-out (half the total toe-out) then measure from that ski to the opposite ski.



TYPICAL
1. *Straight edge*
2. *Rubber cord*
3. *Measure at rear and front of ski bridge*

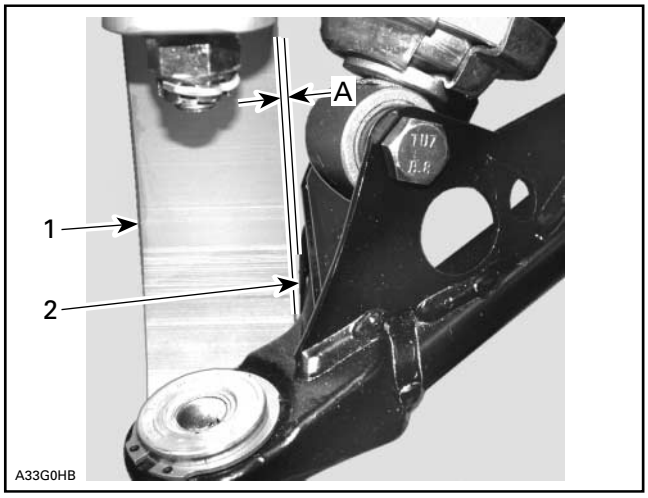
If adjustment is needed:

– Loosen jam nuts of both tie rods **no. 11**.
– Turn the tie rod to change its length.
– Retighten jam nuts.

⚠ WARNING

Never lengthen tie rod so that the external unengaged threaded portion of ball joint exceeds 20 mm (25/32 in).

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 the handlebar is fully turned.



RIGHT 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 then check for bent parts.

LUBRICATION

⚠ WARNING

Do not lubricate throttle cable or housing.

Use suspension synthetic grease (P/N 293 550 033) on:

– Grease fitting **no. 16** of LH and RH swivel arms.
– Lower and upper steering column bushings.

FRONT SUSPENSION

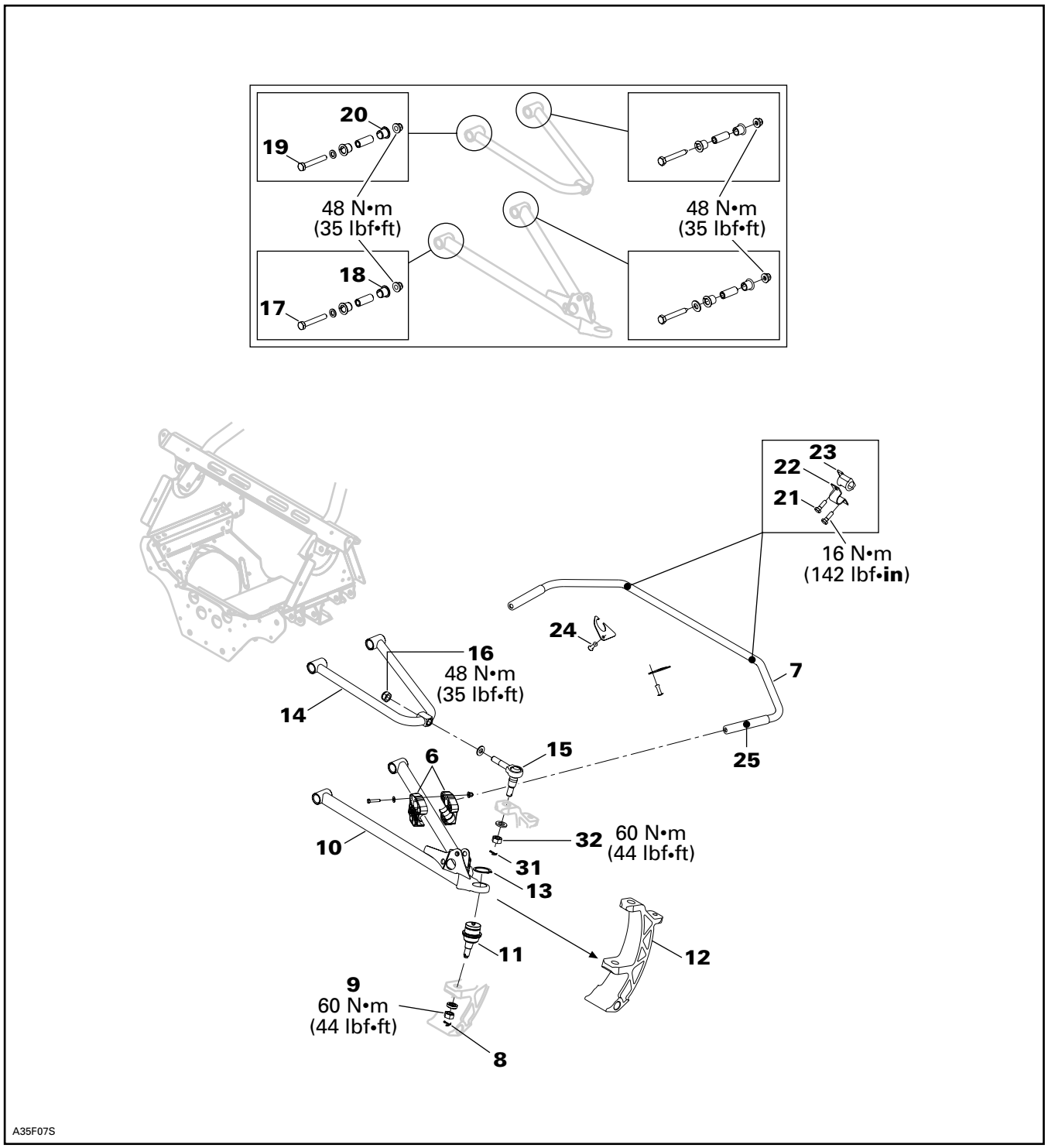
SERVICE TOOLS

Description	Part Number	Page
A-arm nut wrench	529 035 876	301
ball joint installer	529 035 975	301
ball joint lock tool	529 035 945	302
ball joint remover	529 035 827	297–298
ball joint remover support	529 035 873	297
ball joint support	529 035 875	301
shock absorber spring remover	529 035 504	295

SERVICE PRODUCTS

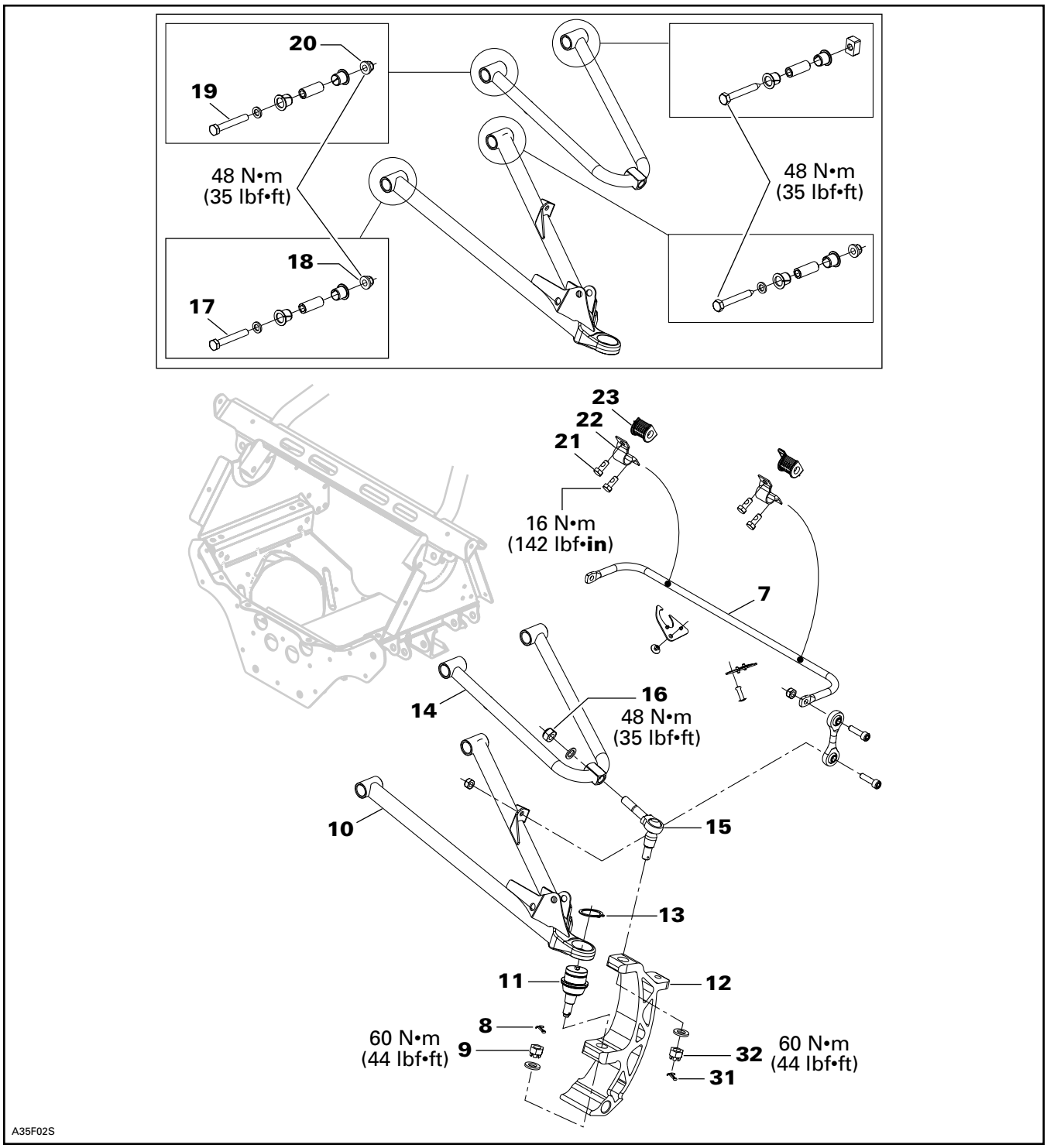
Description	Part Number	Page
pulley flange cleaner	413 711 809	301
suspension synthetic grease	293 550 033	304

Summit



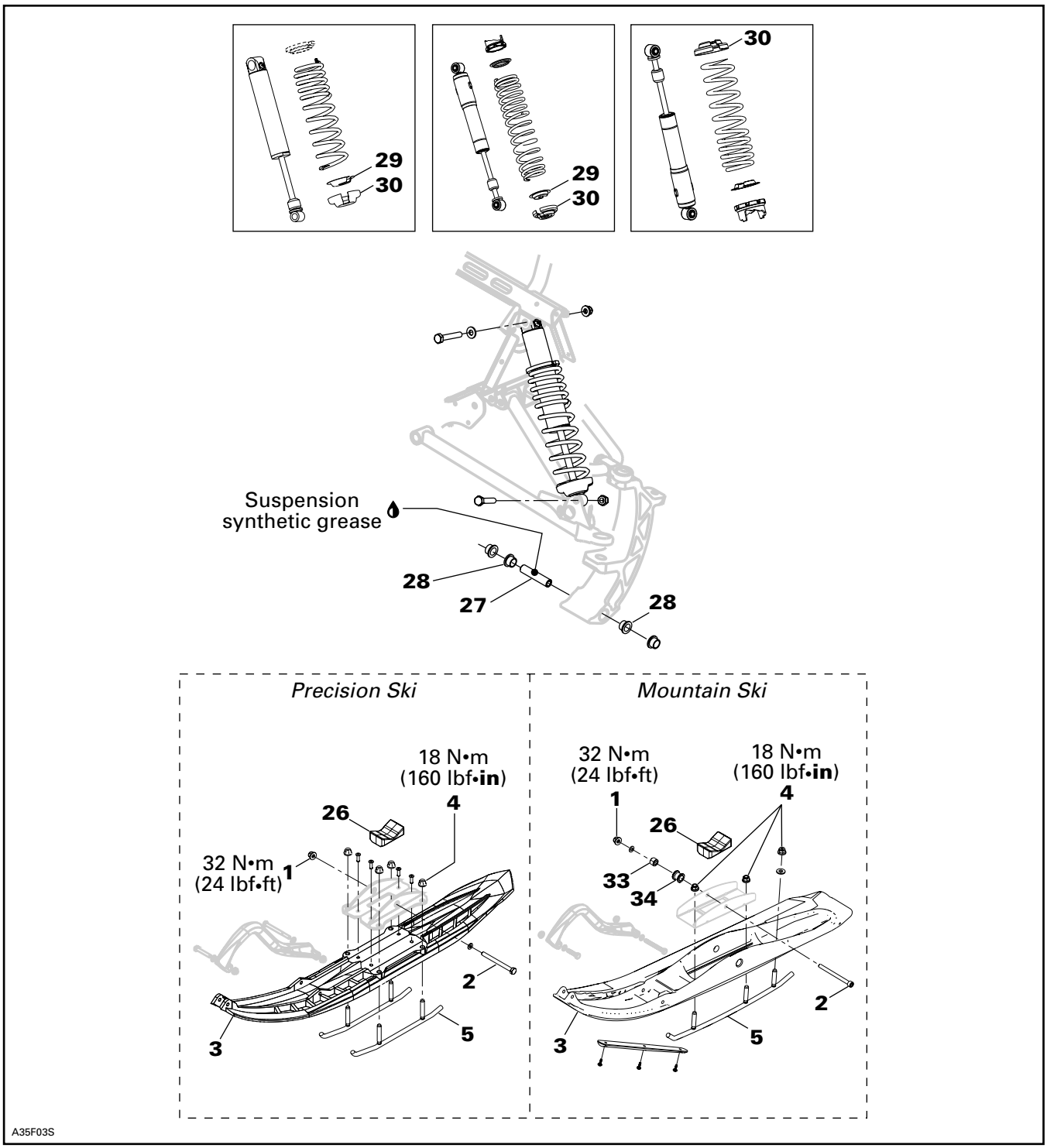
SUSPENSION ARMS, SKI LEG AND ANTI-SWAY BAR

Mach Z



ARMS, SKI LEG AND ANTI-SWAY BAR

Summit and Mach Z



SHOCK ABSORBERS AND SKIS

NOTE: The same procedure applies on both sides.

GENERAL INSPECTION

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.

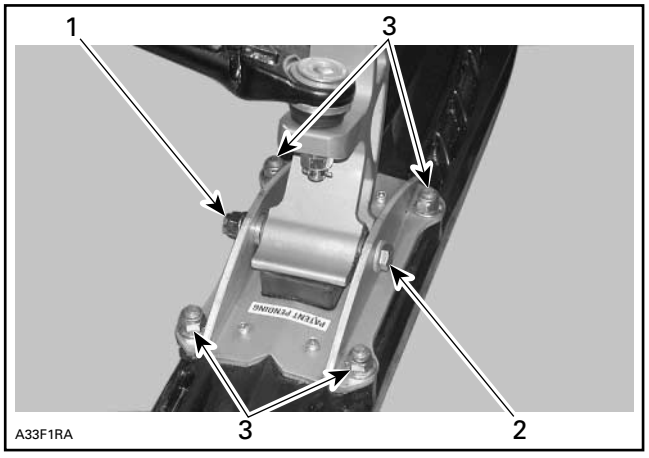
DISASSEMBLY

Ski

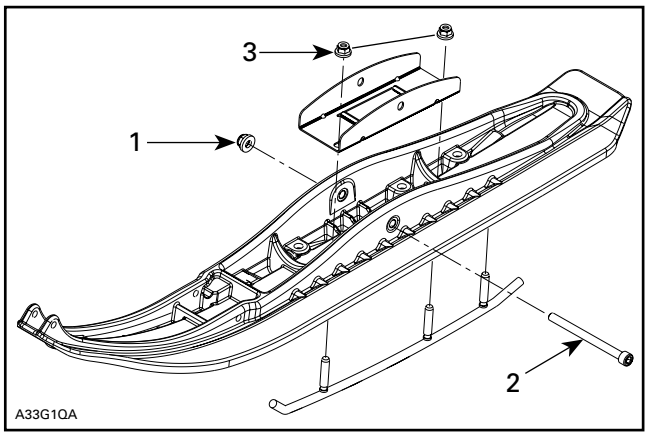
Lift front of vehicle and support it off the ground.

Unscrew nut **no. 1** then pull screw **no. 2** out. Remove ski **no. 3**.

Unscrew nuts **no. 4** and remove ski runners **no. 5**.



PRECISION SKI
1. *Unscrew nut*
2. *Remove screw*
3. *Ski runner nuts*



MOUNTAIN SKI
1. *Unscrew nut*
2. *Remove screw*
3. *Ski runner nuts*

Shock Absorber

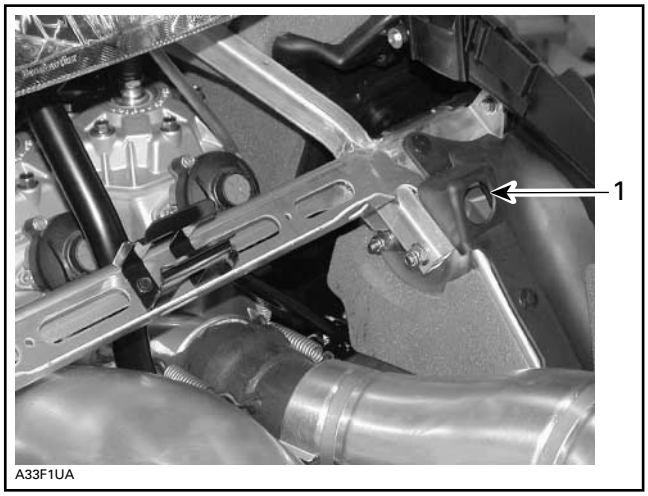
Lift front of vehicle and support it off the ground.

Open hood.

Reduce spring preload by turning adjusting cam accordingly.

Remove lower screw then upper screw of shock absorber.

NOTE: To retain upper screw while unscrewing nut, remove access plug in engine compartment.

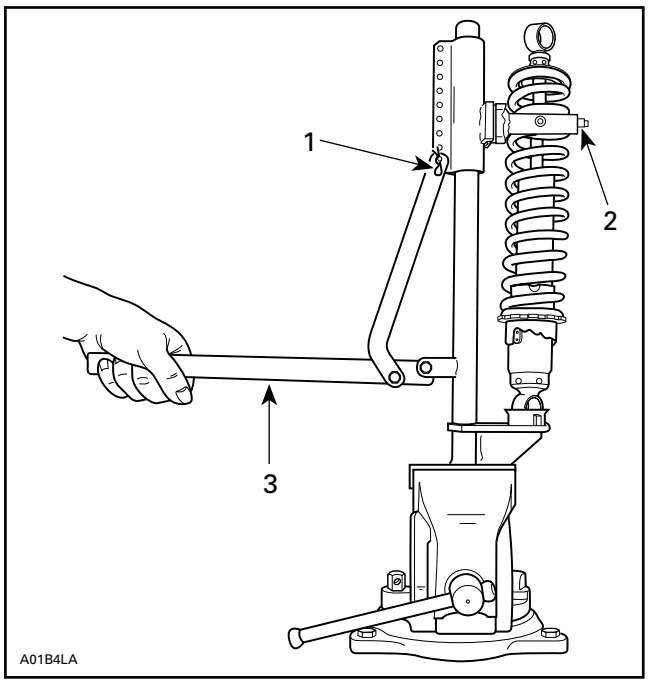


TYPICAL
1. *Access hole to reach upper screw*

For shock absorber spring disassembly use shock absorber spring remover (P/N 529 035 504) in a vise.

Mount shock absorber in it and turn shock absorber so that spring coils match spring compressor.

Close and lock the bar. Adjust the handle at horizontal position by changing the position of the clevis pin.

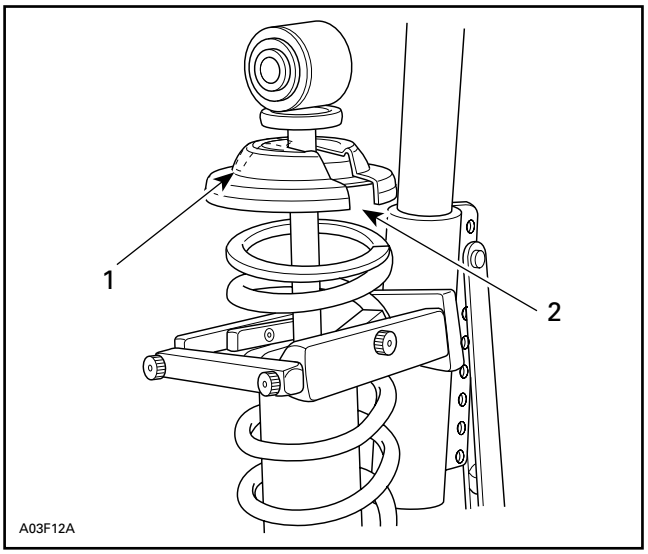


TYPICAL
1. *Clevis pin*
2. *Bar*
3. *Handle horizontal*

Push down on the handle until it locks. Remove spring stopper then release handle.

Mach Z

At assembly, cap opening **no. 30** must be 180° from spring stopper **no. 29** opening.



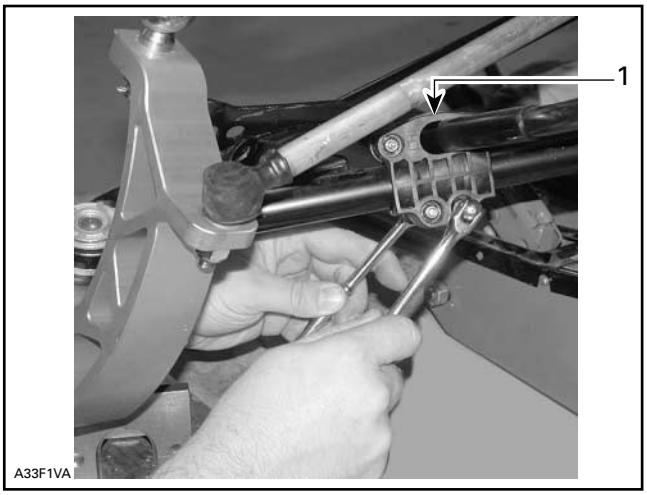
1. *Cap opening*
2. *Spring stopper opening*

Lower Arm

Remove shock absorber.

Summit

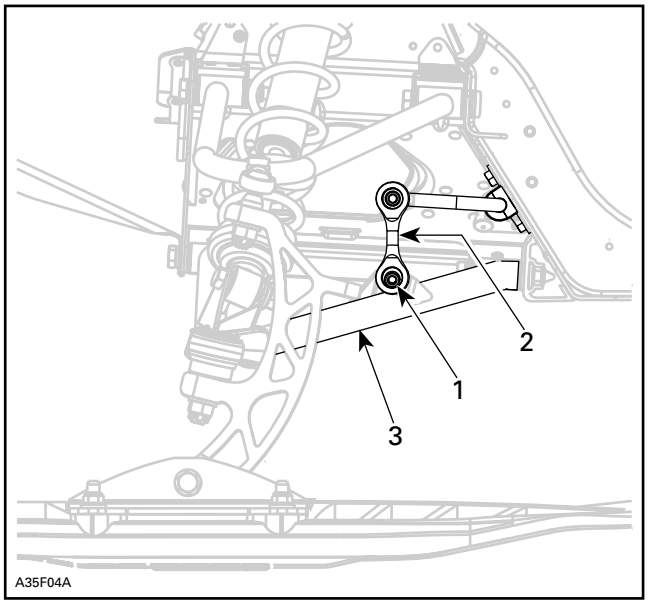
Remove sliding blocks **no. 6** of anti-sway bar **no. 7**.



1. *Sliding blocks*

Mach Z

Remove screw retaining link rod to lower A-arm.



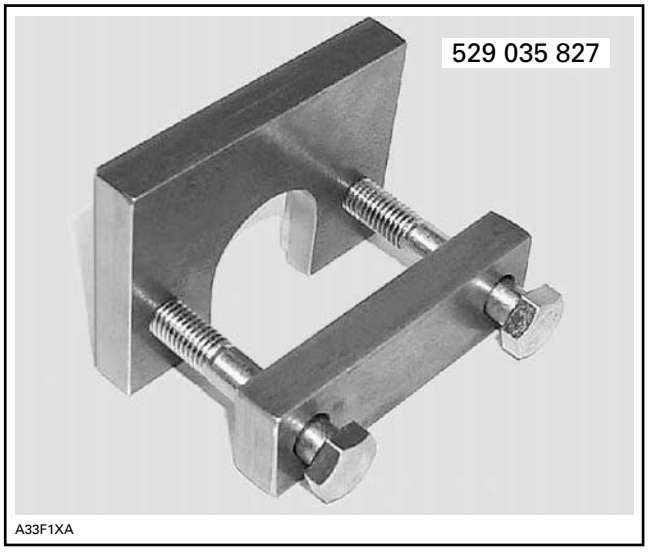
1. *Remove screw*
2. *Link rod*
3. *Lower A-arm*

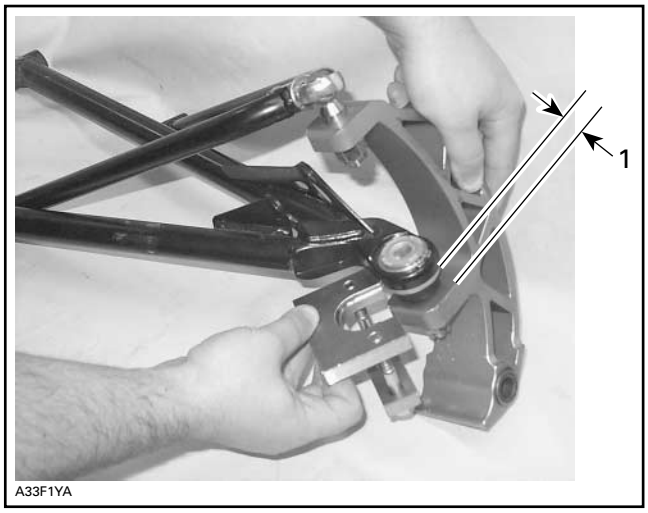
Summit and Mach Z

Remove cotter pin **no. 8** and unscrew ball joint nut **no. 9**.

Raise lower arm **no. 10** so that ball joint **no. 11** becomes parallel with ski leg **no. 12**.

Install ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.



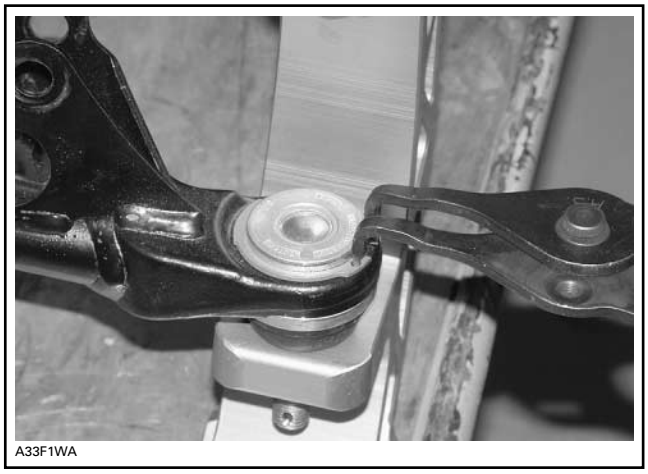


TYPICAL
1. *Ball joint parallel with ski leg*

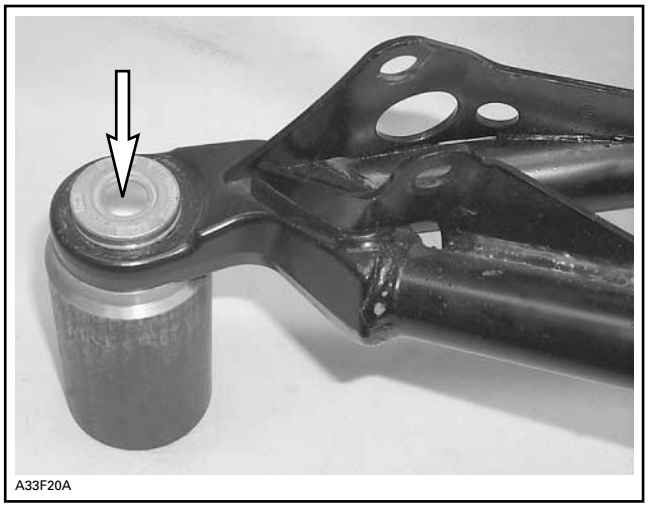
Remove lower arm **no. 10** from frame. For front screw **no. 17** removal, hold nut **no. 18** from engine compartment.

To remove ball joint, proceed as follows:

– Remove snap ring **no. 13**.
– Install ball joint remover support (P/N 529 035 873) under joint.
– Press joint out.



TYPICAL



TYPICAL

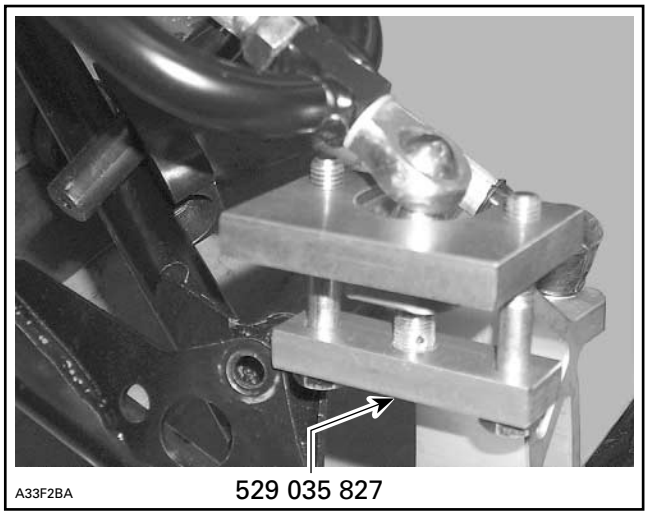
Tie Rod

Refer to STEERING SYSTEM section and remove tie rod from ski leg.

Upper Arm

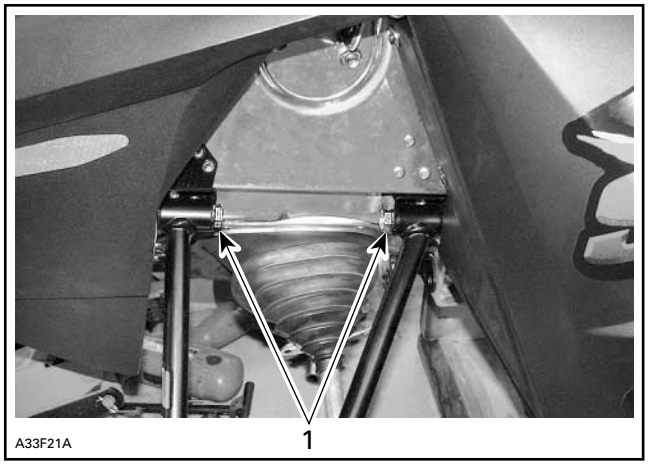
Remove cotter pin **no. 31** and unscrew ball joint nut **no. 32**.

Install ball joint remover (P/N 529 035 827) and detach ball joint **no. 15** from ski leg.



Use a 11 mm (7/16 in) open wrench to hold ball joint housing and unscrew nut **no. 16**, then remove ball joint from upper arm.

Remove upper arm **no. 14** from frame. For screws **no. 19** removal, hold nuts **no. 20** from engine compartment.



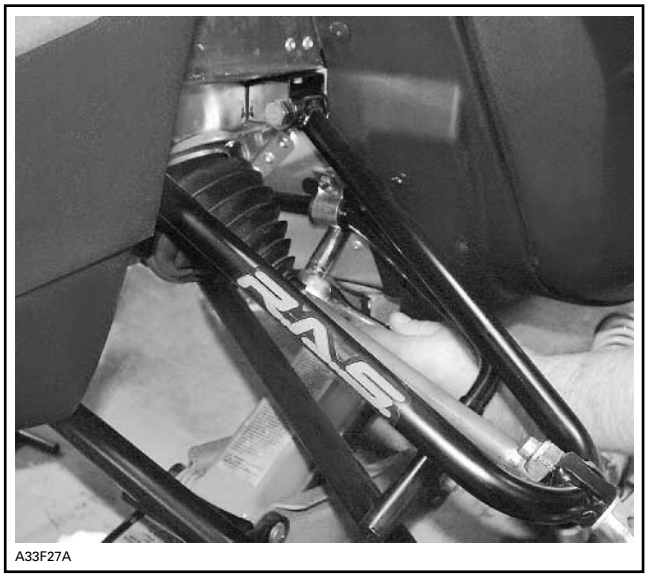
1. Remove screws while holding nuts from engine compartment

Anti-Sway Bar

Summit

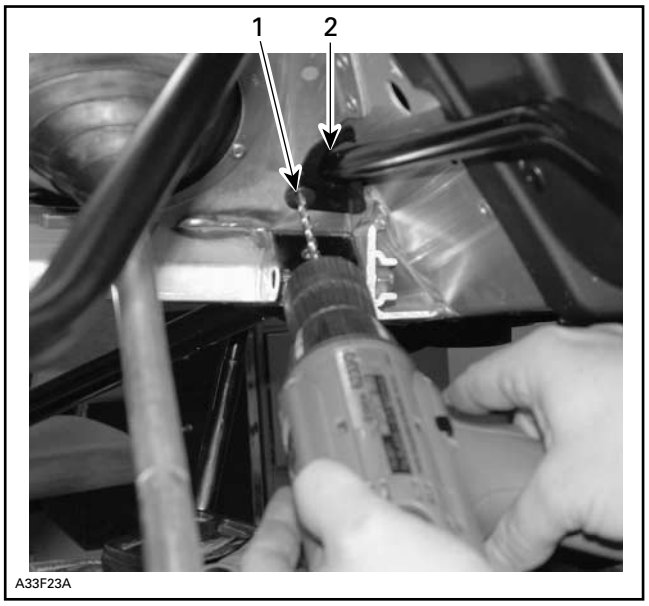
Remove shock absorbers, anti-sway bar slider blocks and unfasten lower ball joints from ski legs.

Remove screws **no. 21** from retaining clamps.


A33F27A

Remove clamps **no. 22** and bushings **no. 23**.

Using a 4.8 mm (3/16 in) drill bit, drill rivet **no. 24** out. Remove cap.



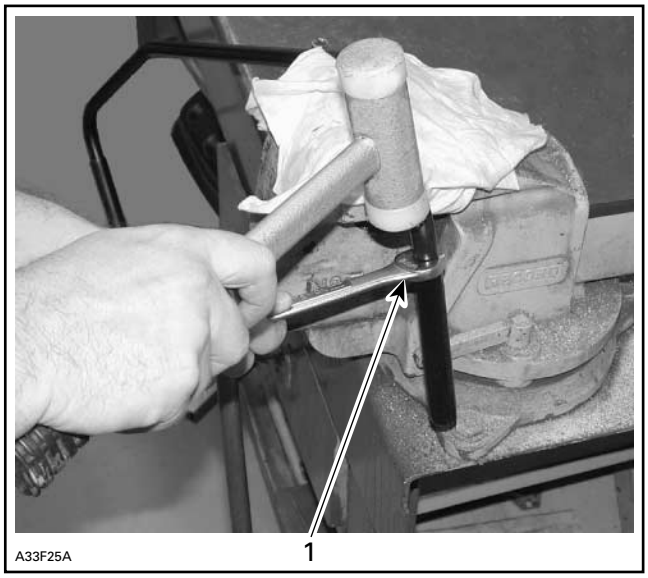
A33F23A

1. *Drill rivet out with a 4.8 mm (3/16 in) drill bit*
2. *Cap*

Lift front of vehicle enough so that anti-sway bar **no. 7** can be rotated downward to allow to slide it out.


A33F24A

To remove bushing **no. 25**, use a 13 mm (1/2 in) open wrench and tap bushing out as shown.



A33F25A

1. *Use a 13 mm (1/2 in) open wrench to push bushing out*

Mach Z

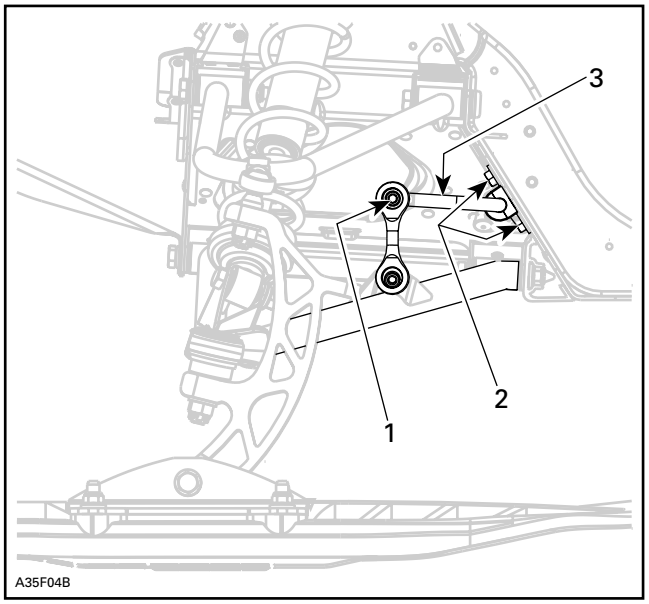
Remove screws retaining link rod to anti-sway bar.

Remove screws **no. 21** from retaining clamps.

Remove retaining clamps **no. 22** and bushings **no. 23**.

Turn handlebar completely to the right.

Remove anti-sway bar **no. 7**.



1. *Remove screws*
2. *Remove retaining clamps and bushings*
3. *Anti-sway bar*

INSPECTION

Check all plastic bushings for wear. Replace as required.

Check condition of ski leg **no. 12**. Replace as required.

Check for straightness of lower and upper arms. Replace as required.

Check condition of ball joints. Replace as required.

Check skis and runners **no. 5** for wear, replace as necessary.

Check condition of ski stopper **no. 26**. Replace it when deteriorated.

To check condition of shock absorber, refer to sub-section SHOCK ABSORBER INSPECTION AND SERVICING in section REAR SUSPENSION.

INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Nuts with a cotter pin: After applying the proper torque, continue tightening as necessary to allow cotter pin insertion. Ensure to properly secure cotter pin.

⚠ WARNING

Always install new cotter pins at assembly and properly bend their ends.

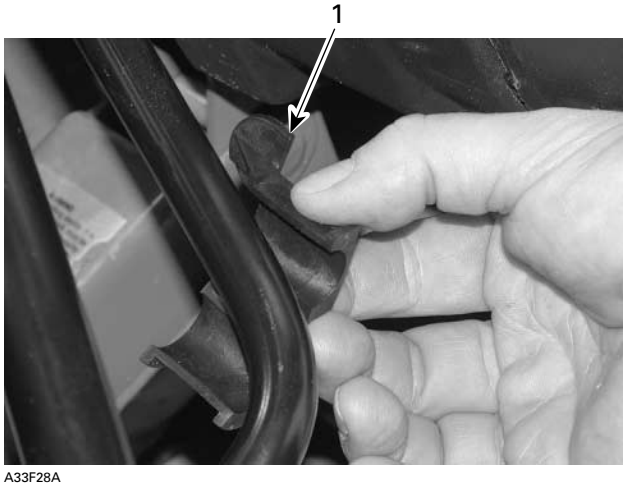
Anti-Sway Bar

Summit

Ensure to properly position anti-sway bar before insertion in frame.

Summit and Mach Z

Install the anti-sway bar bushing **no. 23** making sure to place its tab over the access hole located on the LH side.

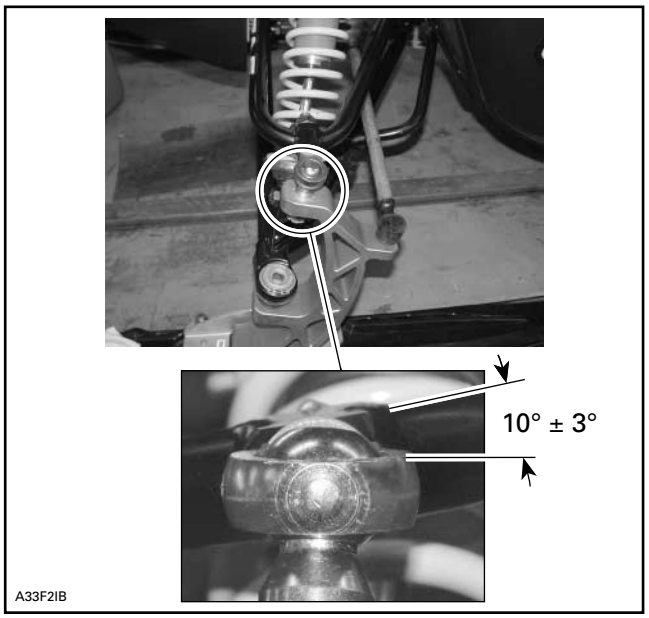


1. *Install bushing as shown*

TYPICAL
1. Tab here to obstruct access hole

Upper Arm

When installing ball joint **no. 15** to upper arm, 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.



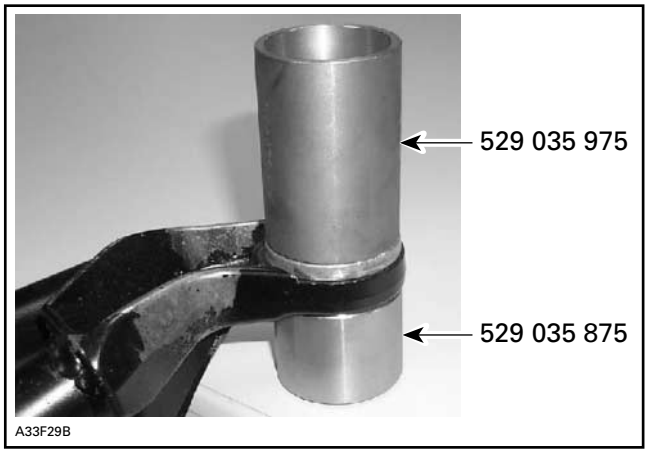
Lower Arm

Position lower arm below anti-sway bar.

Prior to installing ball joint in lower arm, ensure to clean the tapered surfaces with the pulley flange cleaner (P/N 413 711 809). Surface contacts must be clean and free of dirt, oil and grease. Apply the cleaner on a rag then use the rag to clean the surfaces of ball joint and ski leg.

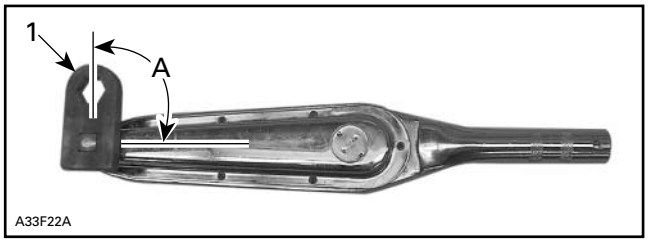
To install ball joint, proceed as follows:

- 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 ball joint in.
- Install snap ring **no. 13** with its opening toward front of vehicle.

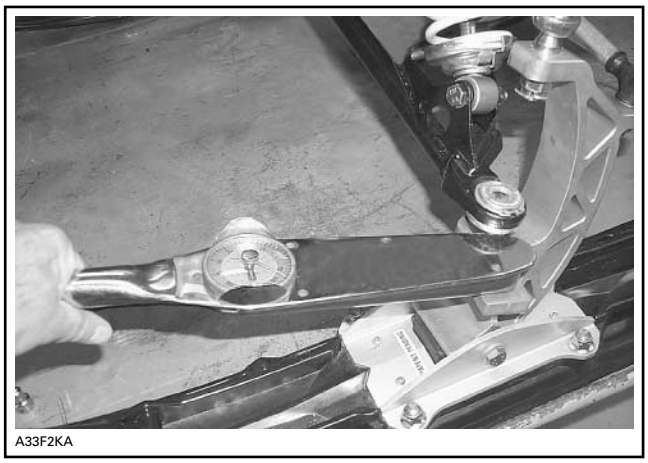


To properly torque ball joint nut, use the A-arm nut wrench (P/N 529 035 876).

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

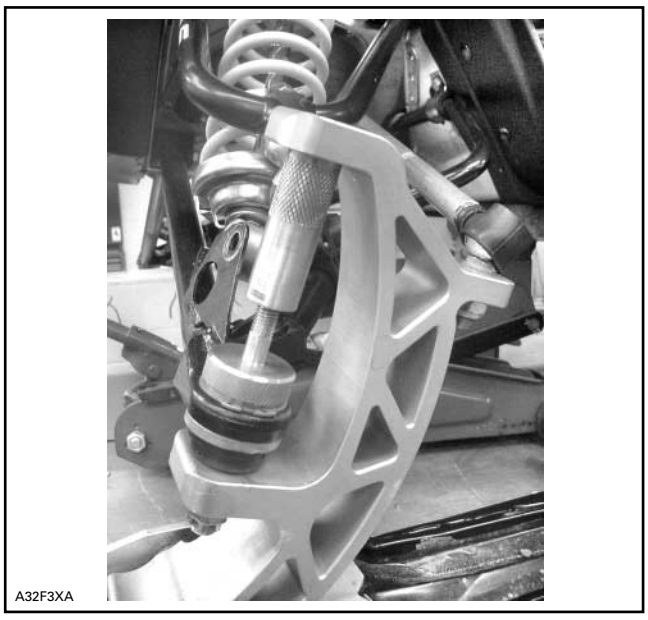


1. Tool perpendicular (90°) to torque wrench
A. 90°



Use ball joint lock tool (P/N 529 035 945) to restrain ball joint during nut tightening.

NOTE: The upper arm ball joint has to be removed in order to use this tool. Also remove the small screw from top of ball joint to allow proper seating of tool.

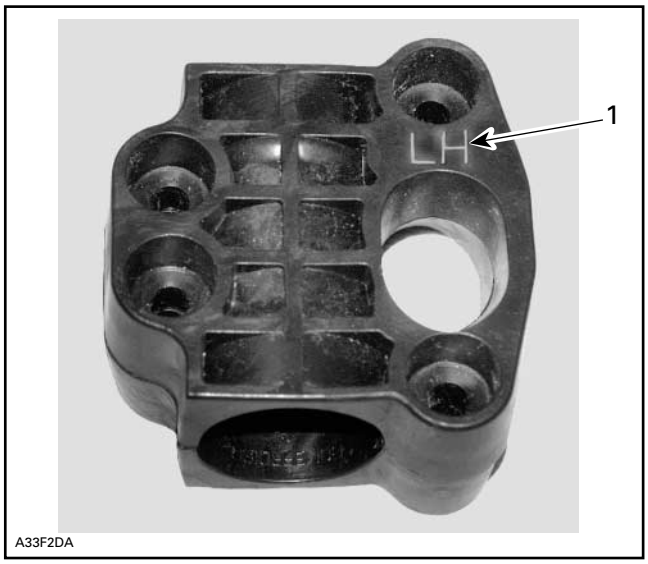


TYPICAL

Anti-Sway Bar

Summit

Notice that LH and RH sliding blocks are different. Look for their molded identification with LH or RH letters.

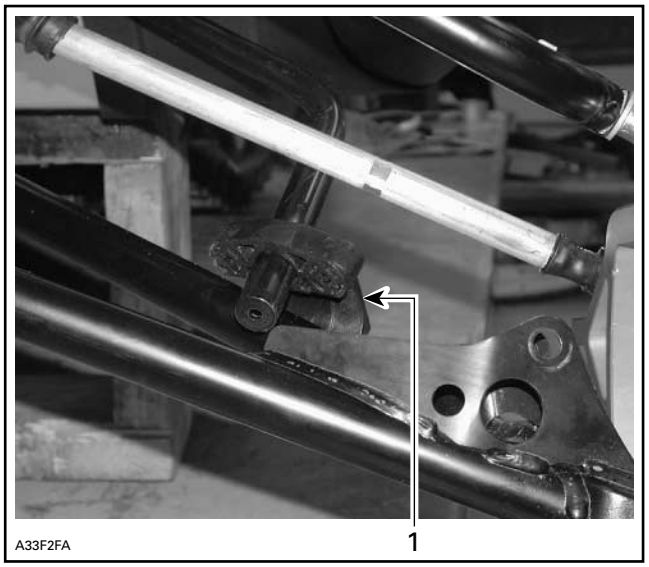


1. Molded identification for proper side installation

To install sliding blocks:

– Temporarily rotate the rear block by 180°.
– Insert on anti-sway bar end and push beyond the lower arm.
– Rotate block back by 180° to its normal position.
– Install the other block half.
– Install screws and nuts.
– Ensure blocks slide easily when compressing and releasing suspension.

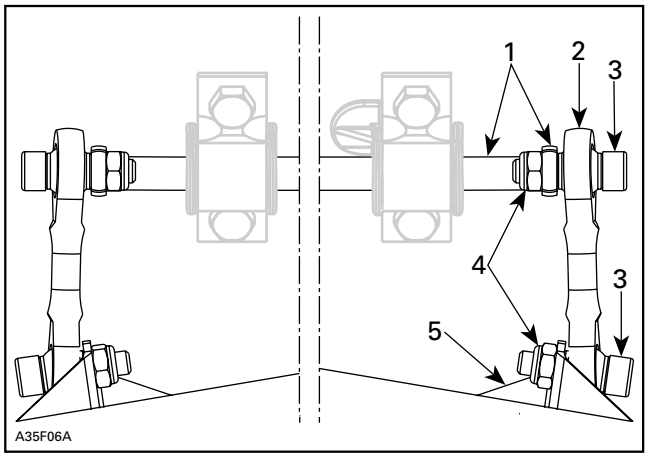
1. Temporarily rotate block by 180° for its insertion



1. Push block on bar end beyond lower arm then rotate back to its normal position

Mach Z

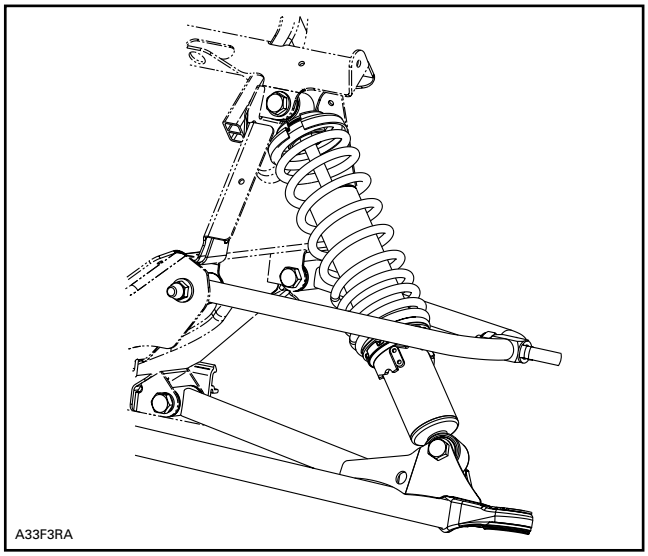
Secure anti-sway bar to link rod as per next illustration.



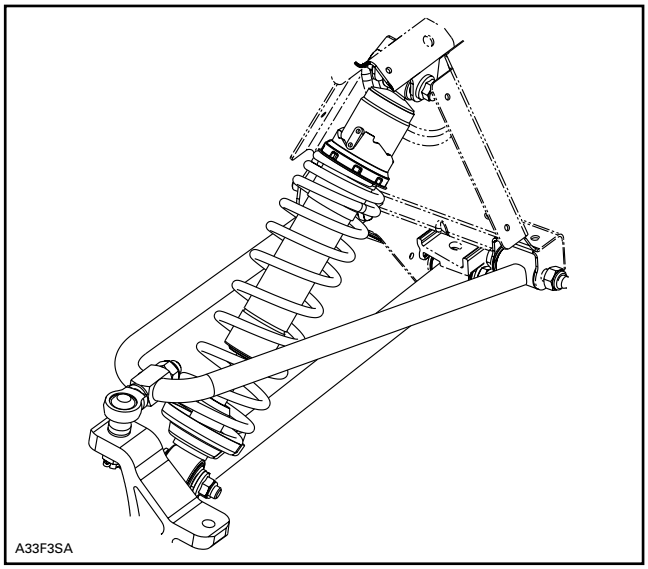
LOOKING FROM THE FRONT OF THE VEHICLE
1. *Anti-sway bar*
2. *Link rod*
3. *Allen screw*
4. *Elastic nut*
5. *Lower A-arm*

Shock Absorber

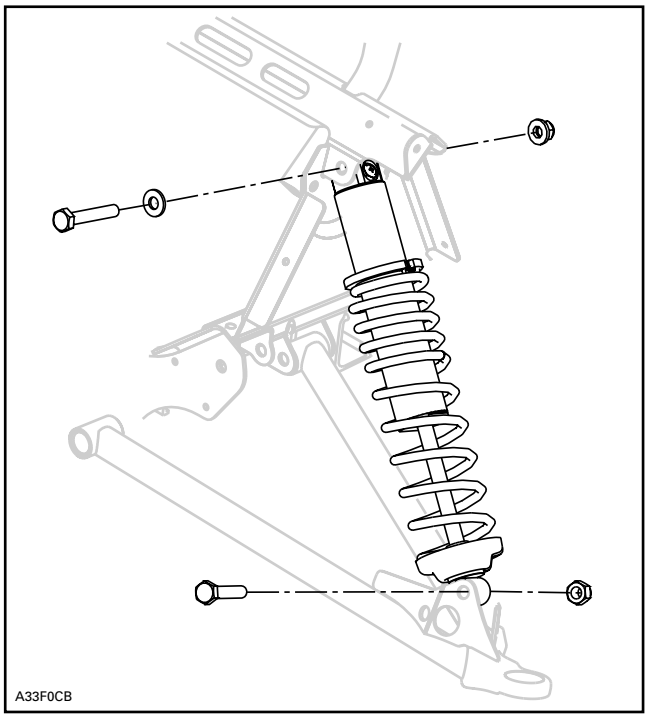
Ensure to reinstall shock absorber in the proper position according to model.



SUMMIT



MACH Z



SUMMIT AND MACH Z (EUROPE MODELS)

Readjust spring preload.

Ski

Apply suspension synthetic grease (P/N 293 550 033) between bushing **no. 28** and spacer **no. 27** and also on inner tube of ski leg.

Summit

Install bushing **no. 29** and spacer **no. 30** inward on each ski leg for the wide ski stance. Install outward for narrow ski stance.

⚠ WARNING

Install skis with proper side facing inward. Refer to warning on ski.

Adjustment

Proceed with ski alignment. Refer to STEERING SYSTEM.

BODY

SERVICE TOOLS

Description	Part Number	Page
adjustment wrench	529 035 891	307
Supertanium™ drill bit	529 031 800	306

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.

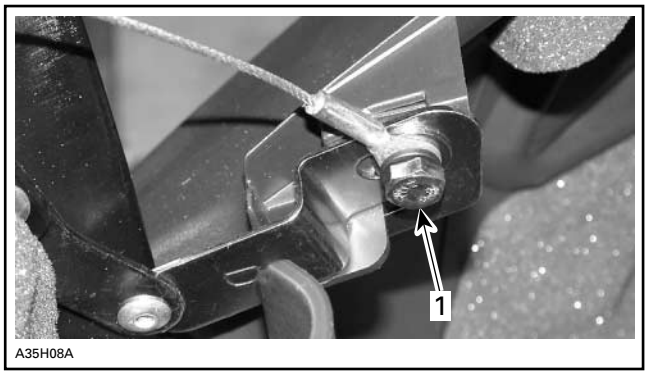
Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

HOOD

Removal

Remove bolts retaining hood hinge to front bumper.



1. Hinge bolt

Remove hood.

Installation

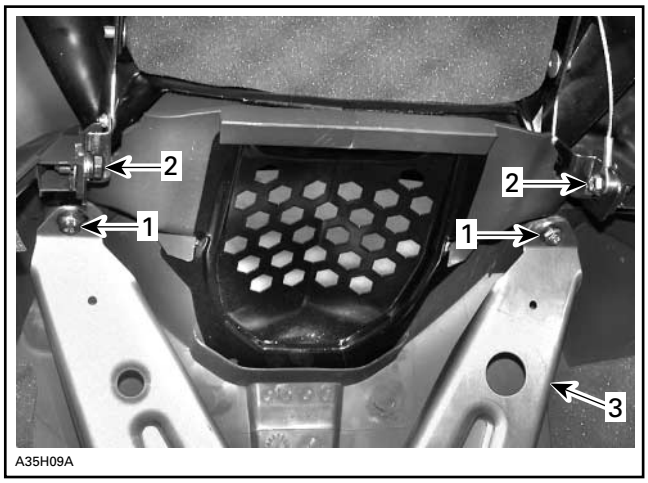
The installation is the reverse of removal procedure.

FRONT BUMPER

Removal

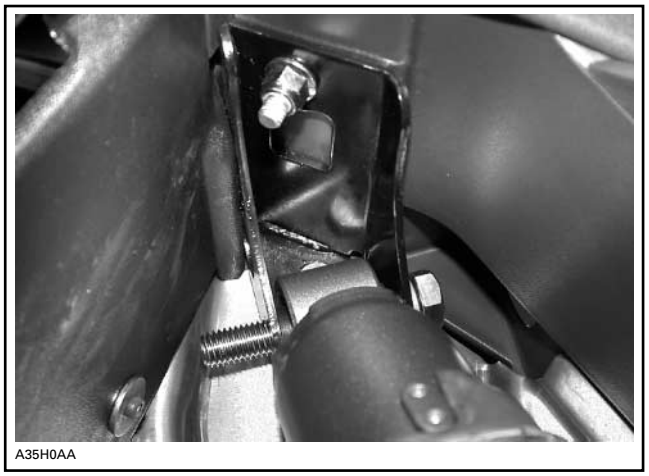
Remove hood.

Unscrew bolts retaining front bumper to frame.



1. Bumper bolts
2. Hinge bolts
3. Frame

Remove bolts near upper shock absorber brackets.


A35H0AA

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.

Remove bottom pan.

Installation

The installation is the reverse of removal procedure.

WINDSHIELD

Removal

To remove the windshield, open hood then pull the bottom part of windshield until its pins come out of rubber grommets.

Installation

The installation is the reverse of removal procedure.

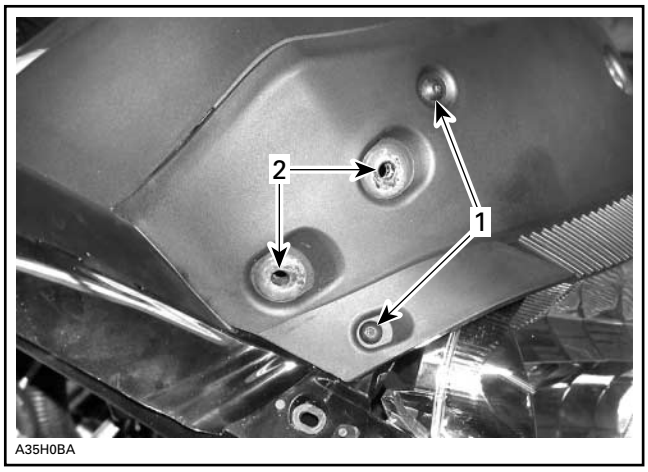
ACCESS PANEL

Removal

Open hood.

Remove windshield.

Remove retaining screws, one on each sides.



A35H0BA

1. Access panel screws
2. Rubber grommet for windshield

Installation

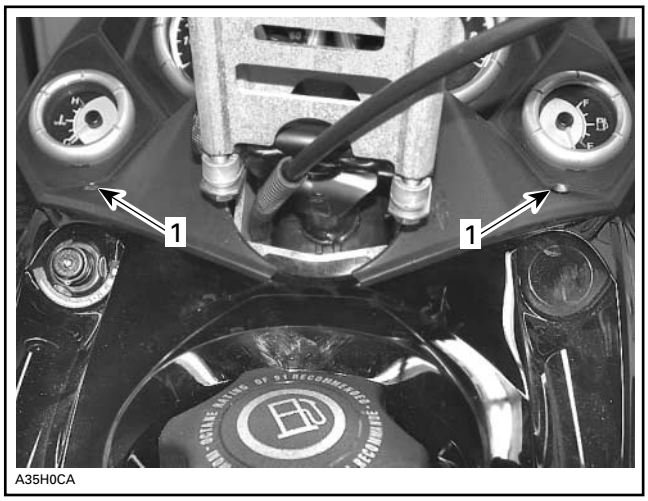
The installation is the reverse of removal procedure.

INDICATOR PANEL

Removal

Open hood and remove the access panel.

Remove the indicator panel screws.



A35H0CA

1. Indicator panel screws

Lift indicator panel and unplug all connectors.

Installation

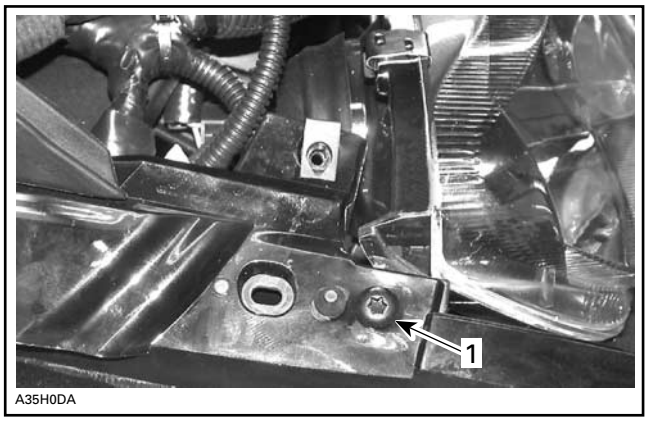
The installation is the reverse of removal procedure.

CONSOLE

Removal

Remove the indicator panel.

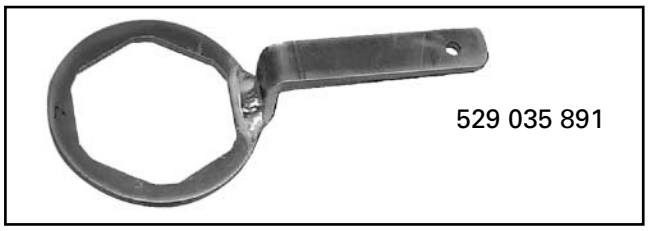
Remove the screws near headlamp. One on each side.



A35H0DA

1. Console screw

Using the adjustment wrench (P/N 529 035 891), unscrew the fuel tank nut.



A35H0EA

Lift up the console and unplug all connectors.

Install fuel tank cap.

Installation

The installation is the reverse of removal procedure.

SEAT

Cleaning

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.

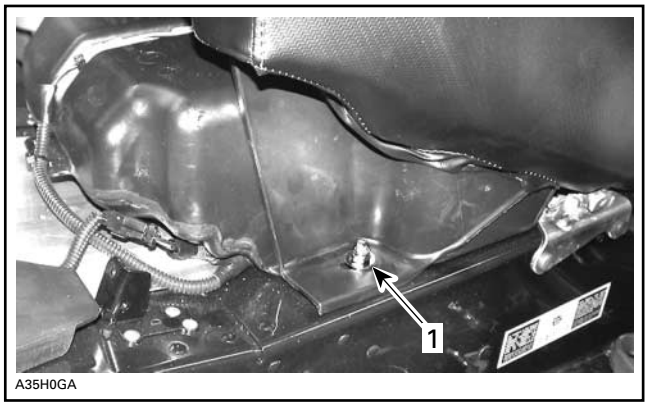
Removal

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.

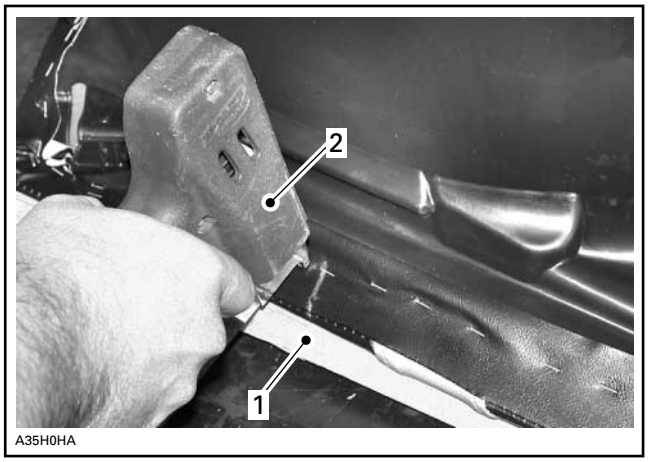
Cover Replacement

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.



TYPICAL
1. Piece of wood
2. Tacker

After seat cover installation, cut all around the excess of material.

Installation

The installation is the reverse of removal procedure.

NOTE: The seat must be inserted under console.

PLASTIC MAINTENANCE AND REPAIR

Maintenance

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:

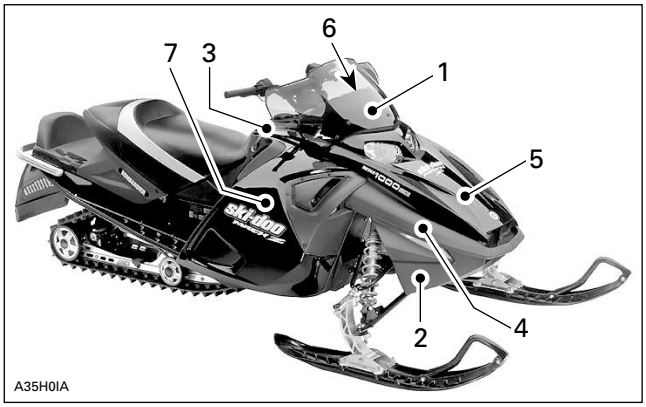
- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- varsol
- naphtha
- acetone
- strong detergents
- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

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

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

Polycarbonate 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	311–312

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic chaincase oil	413 803 300	311

FRAME CLEANING

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.

FRAME WELDING

Aluminum Frame

– No welds should be done on aluminum frame except if mentioned or required on a BRP bulletin.
– Use ER-5356 rods for MIG or TIG welding.

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug electronic module. On models equipped with a battery, also unplug the negative cable. This will protect the electronic module and battery against damage caused by flowing current when welding.

CAUTION: If welding is to be done near plastic material, it is recommended to either remove the part from the area or to protect it with aluminum foil to prevent damage.

FRAME COMPONENT REPLACEMENT

Drilling Procedure

When drilling self-piercing rivets, 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.

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.


A03H2FA

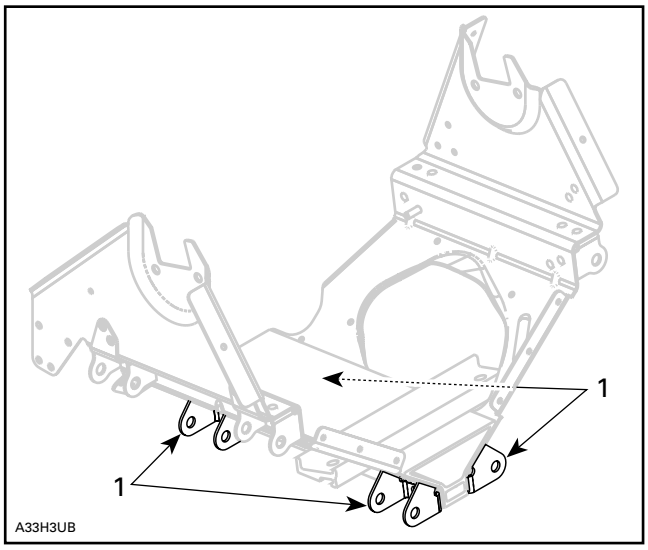
TYPICAL

Cut rivet using a chisel.

Remove riveted part.

Drive out remaining rivet head using a punch.

Lower A-arm Bracket



1. Lower A-arm brackets

To Remove the Lower A-arm Brackets, do the Following:

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.

For the Installation of Lower A-arm Brackets, do the Following:

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)

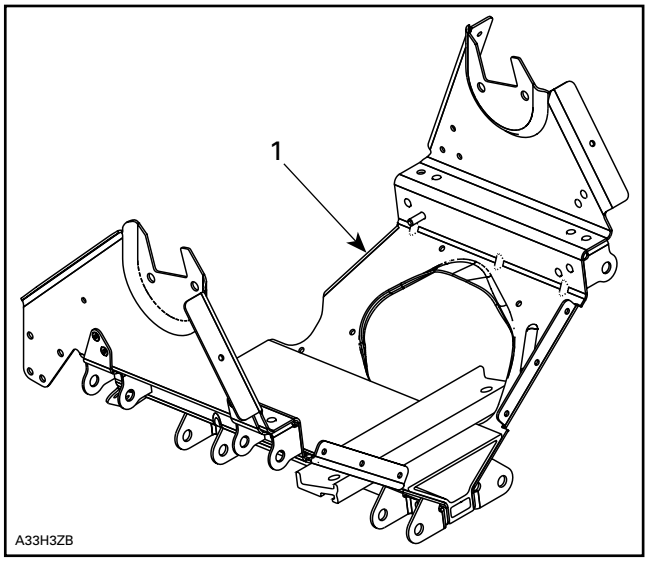
NOTE: Bolt head should be on the RH side of the vehicle.

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



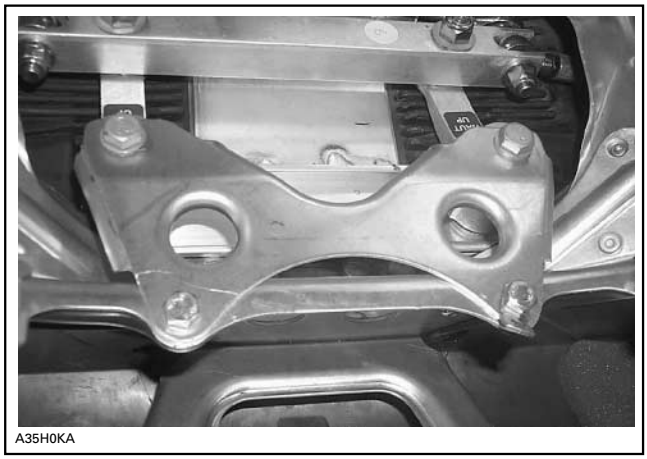
1. Front cross member

To Remove the Front Cross Member, do the Following:

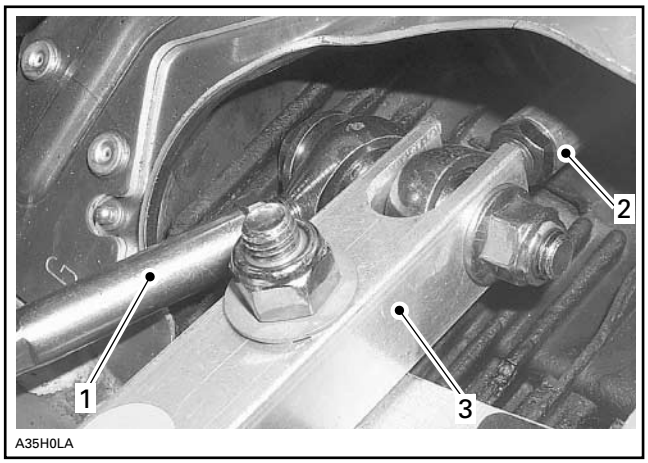
Remove:

– side panels

– hood
– muffler
– tuned pipe
– front bumper brace
– pivot support


A35H0KA

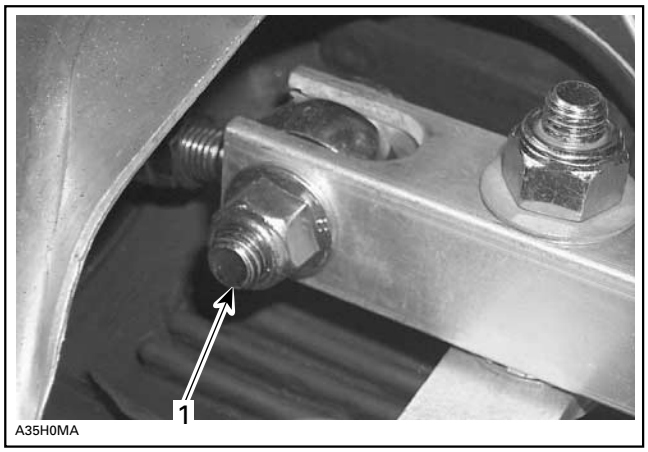
– bolt holding short tie-rod and LH tie-rod to swivel bar



A35H0LA

1. *Short tie-rod*
2. *Tie-rod*
3. *Swivel bar*

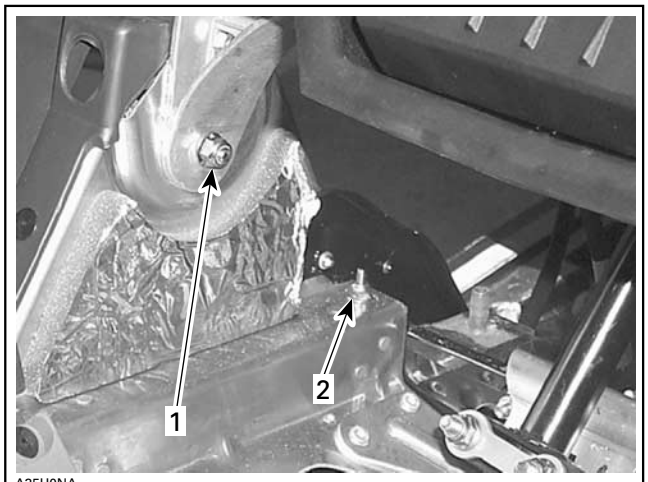
– bolt holding RH tie-rod to swivel bar



A35H0MA

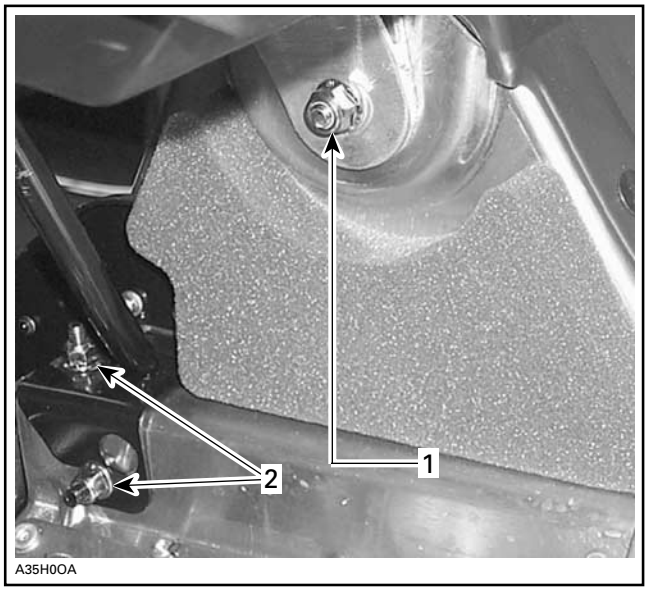
1. *RH tie rod bolt*

– 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.

To Install the Front Cross Member, do the Following:

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)

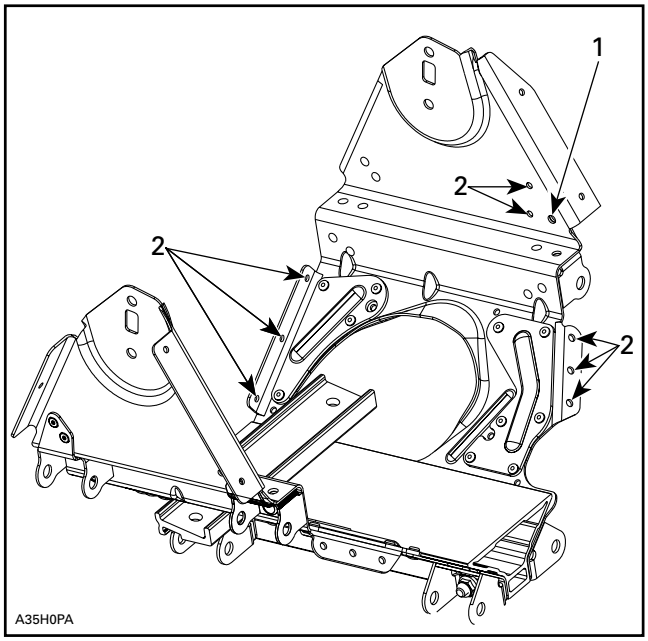
NOTE: Place head of bolts and washer towards the front of the vehicle.

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)

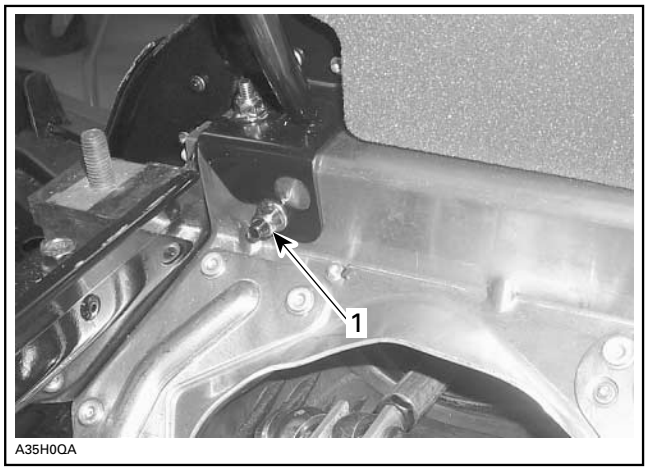


1. *M6 bolt*
2. *M5 bolts*

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

LH Support

Unscrew engine and lift it.

Remove the countershaft and its bearing. Refer to CHAINCASE.

Remove the LH handle support.

Drill rivets holding engine support to frame.

Unscrew both engine support bolts. Note bolts's location.

Remove engine 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 to install and adjust countershaft properly.

RH Support

Unscrew engine and lift it.

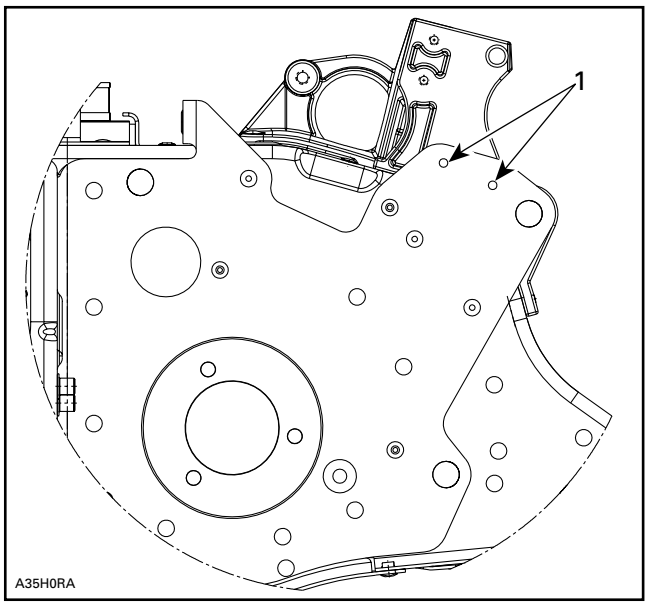
Remove the RH handle support.

Remove chaincase housing. Refer to CHAINCASE.

Drill all rivets holding engine support to frame.

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/SUMMIT 1000 SDI

MODEL			MACH Z 1000 SDI	SUMMIT 1000 SDI
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 (1)		± 100 RPM	7900	
Piston ring type		1st	Semi-trapezoidal	
		2nd	—	
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)	0.115 to 0.151 (.0045 to .0059)	
	Wear limit	mm (in)	0.20 (.0079)	
Maximum crankshaft end play (2)	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	
Ignition type			Inductive	
Spark plug	Make and type		NGK BR9ECS (6)	NGK BR8ECS
	Gap	mm (in)	0.8 mm (.0315)	
Ignition timing BTDC (3) (7)		mm (in)	7.87 (.3098)	
Trigger coil (4)		Ω	190 to 300	
Generating coil (4)	Low speed	Ω	—	
	High speed	Ω	—	
Lighting coil (4)		Ω	0.145 to 1.185	
High tension coil (4)	Primary		—	
	Secondary		—	
Battery			12 V, 18A•h	
Headlamp		W	60/55 (H4)	
Taillight and stoplight		W	8/27	
Tachometer and speedometer bulbs		W	N.A.	
Fuel and temperature gauge bulbs		W	2 x 3	N.A.

MODEL			MACH Z 1000 SDI	SUMMIT 1000 SDI
Fuse	Starter solenoid	A	30	
	Fuel level sensor	A	0.25	N.A.
FUEL SYSTEM				
Throttle body type			Dell'Orto	
Idle speed		± 200 RPM	1600	
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		Ethyl glycol/water mix (50% coolant, 50% distilled water). Use coolant specifically designed for aluminum engines.	
	Premixed		P/N 219 700 362 — 12 x 1 L	
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	21/49 EUR: 23/49
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	3400	3500 EUR: 3400
	Spring color		Green/Purple	Pink/White EUR: Green/White
	Spring length	mm (in)	130.2 (5.126)	124.5 (4.90) EUR: 110.7 (4.36)
	Pin (with roller (P/N 417 222 762))		Steel solid (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°/30°
Pulley distance	Z	mm (in)	27.5 (1.083)	
Offset	X	mm (in)	37.0 ± 0.5 (1.457 ± 0.2)	
	Y – X	mm (in)	1.23 (.0484)	

MODEL			MACH Z 1000 SDI	SUMMIT 1000 SDI
Drive belt part number			417 300 189	
Drive belt	Width [10]	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 [8]	kg (lbf)	11.30 (24.91)	
Track	Width	mm (in)	381 (15)	406 (16)
	Length	mm (in)	3074 (121)	4115 (162)
	Profile height	mm (in)	25.4 (1.0)	58.5 (2.303)
			31.8 (1.25)	
Track adjustment	Adjustment deflection	mm (in)	30 to 35 (1.181 to 1.378)	
	Force [9]	kg (lbf)	7.3 (16)	
Suspension type	Track		SC 4	SC 162 in
	Ski		R.A.S. A-arm	
BRAKE				
Brake fluid reservoir		mL (U.S. oz)	60 (2.0)	
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)	Manual start		236 kg (519 lb)	240 kg (529 lb)
	Electric start		248 kg (546 lb)	
Length		mm (in)	2930 (115.4)	3435 (135.2)
Width		mm (in)	1217 (47.9)	1139 (44.8)
Height		mm (in)	1046 (41.2)	1125 (44.3)
Ski stance (carbide to carbide)		mm (in)	1195 (47.0)	1025 to 1080 (40.35 to 42.52)
Toe-out		mm (in)	0.00	
Camber			0°	
Ground contact area		cm^2 (in^2)	6910.2 (1071.083)	10251.96 (1589.057)
Ground contact pressure	Manual start		3.35 kPa (.486 PSI)	2.30 kPa (.334 PSI)
	Electric start		3.52 kPa (.510 PSI)	
Frame material			Aluminum	
Bottom pan material			Impact resistant copolymer	
Hood material			Surlyn	
CAPACITIES				
Fuel tank		L (U.S. gal)	40 (10.6)	
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)	
Cooling system		L (U.S. oz)	6.4 (216.4)	7.4 (250.2)
Injection oil reservoir		L (U.S. oz)	3.7 (125.112)	

MODEL		MACH Z 1000 SDI	SUMMIT 1000 SDI
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		(5)	
Exhaust manifold screws		21.5 N•m (16 lbf•ft)	
Magneto ring nut		130 N•m (96 lbf•ft)	
Crankcase nuts or screws	M6	9 N•m (80 lbf•**in**)	
	M8	29 N•m (21 lbf•ft)	
Crankcase/engine support nuts or screws		35 N•m (26 lbf•ft)	
Cylinder head nuts or screws		55 N•m (41 lbf•ft)	

TECHNICAL DATA LEGEND

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

MAG: Magneto

N.A.: Not Applicable

P/N: Part Number

PTO: Power Take Off

R.A.S.: Response Angle Suspension

RER: Rotax Electronic Reverse

RPM: Revolution Per Minute

TRA: Total Range Adjustable

VSA: Variable Sheave Angle

W: Watt

(1) The maximum horsepower RPM applicable on the vehicle. It may be different under certain circumstances and BRP reserves the right to modify it without obligation.

(2) Crankshaft end-play is not adjustable on these models. Specification is given for verification purposes only.

(3) At 3500 RPM with headlamp turned on.

(4) All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.

(5) Drive pulley retaining screw: torque to 100 to 120 N•m (74 to 89 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Retorque screw to 110 to 120 N•m (81 to 89 lbf•ft).

(6) **CAUTION: Do not attempt to adjust gap on spark plug BR 9 ECS. The specification is given for verification purpose only. If found out of specification, replace with a new one.**

(7) 995 SDI: with APS (Air pressure Sensor) disconnected.

(8) Force applied midway between pulleys to obtain specified tension deflection.

(9) Force or downward pull applied to track to obtain specified tension deflection.

(10) Minimum allowable width may not be less than 3.0 mm (1/8 in) of new drive belt.

WIRING DIAGRAMS

SERVICE TOOLS

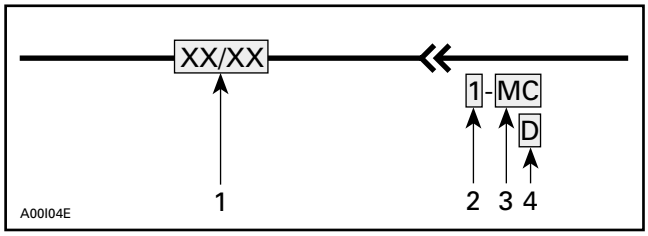
Description	Part Number	Page
connector crimping tool	529 035 909	332
crimper die	529 035 906	332

Wiring diagrams can be found at the end of this subsection.

WIRING DIAGRAM LEGEND

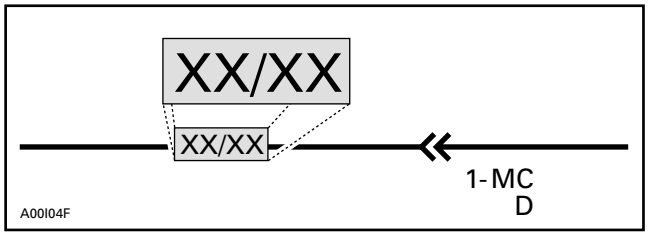
⚠ WARNING

Ensure all terminals are properly crimped on the wires and all connector housings are properly fastened.



1. *Wire colors*
2. *Connector housing area*
3. *Housing code per area*
4. *Wire connector location in housing*

WIRE COLORS



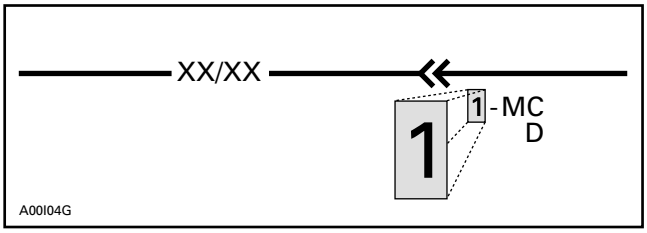
The first color of a wire is the main color, second color is the stripe.

Example: YL / BK is a YELLOW wire with a BLACK stripe.

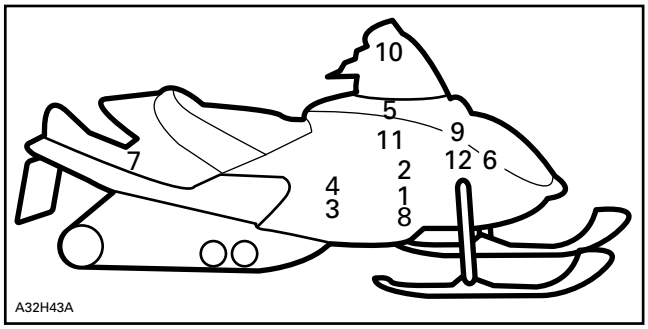
COLOR CODE					
BE	—	BEIGE	OR	—	ORANGE
BK	—	BLACK	RD	—	RED
BU	—	BLUE	VI	—	VIOLET
BR	—	BROWN	WH	—	WHITE
GN	—	GREEN	YL	—	YELLOW
GY	—	GREY			

CONNECTOR HOUSING AREA

The first digit of the connector identification number presents the location of the connector on the vehicle.



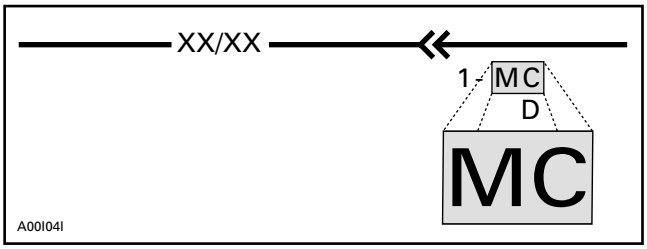
The following illustration shows the snowmobile with number on it. These numbers will correspond with the locations of the connector on the vehicle along with a brief description.



AREA	LOCATION
1	Right hand side of engine
2	Engine
3	Near right hand side footrest
4	Near driven pulley
5	Under console
6	Under hood
7	Near fuel tank
8	Under engine
9	Near steering column or on primary air intake silencer
10	On handlebar
11	Injection oil tank
12	Secondary air intake silencer

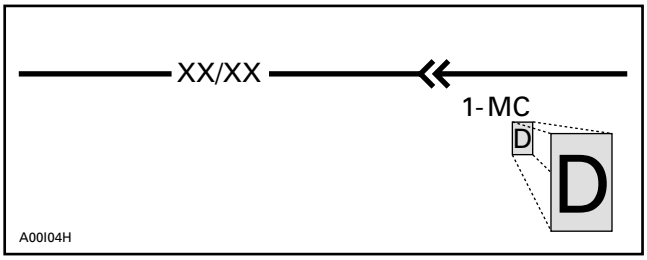
HOUSING REFERENCE PER AREA

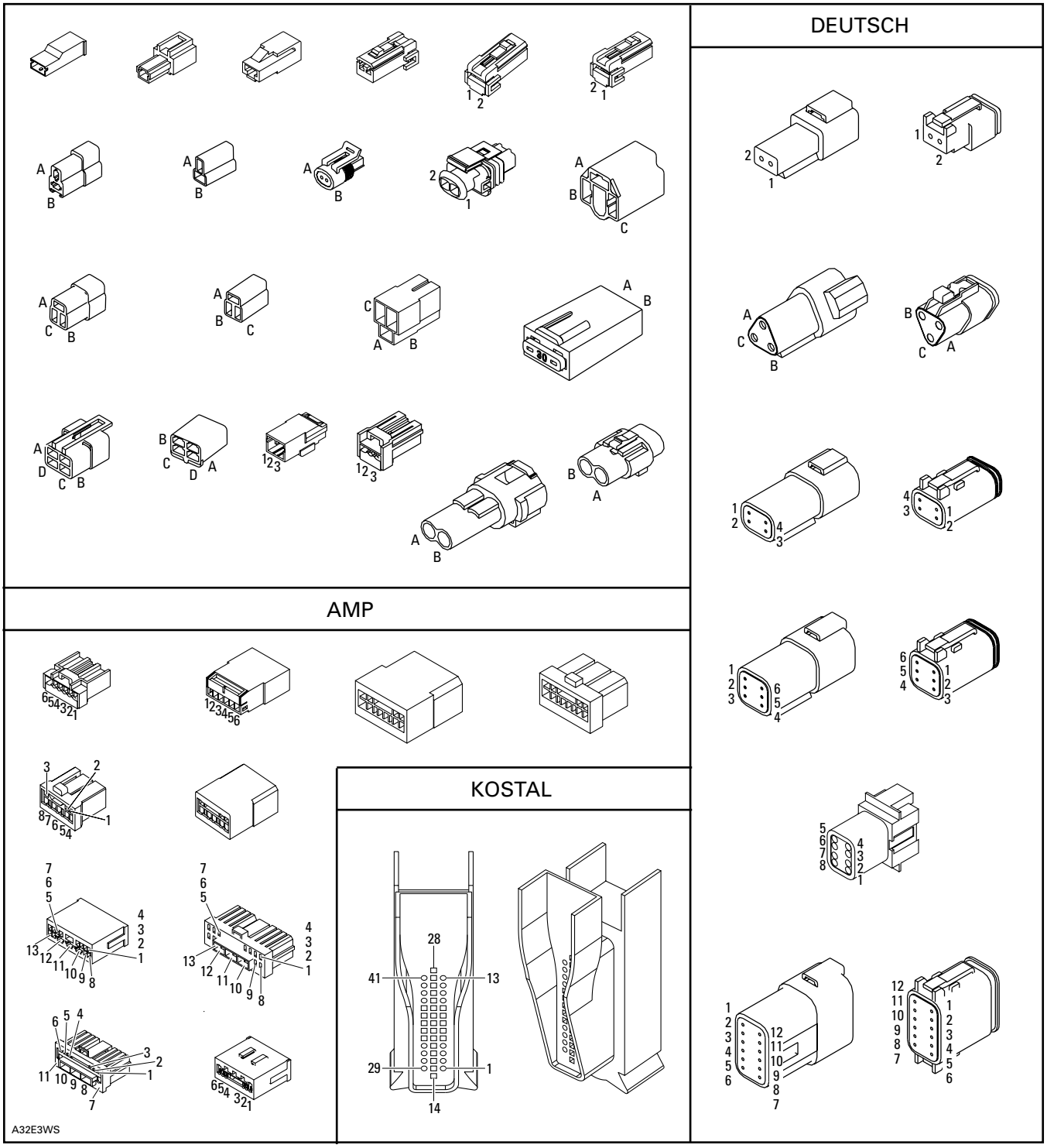
The next two letters of the connector identification number represents a connector reference. If there are many connectors in the same area this helps identify which wire is in which connector.



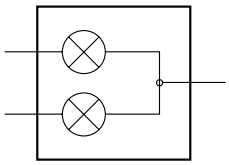
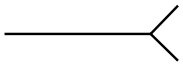
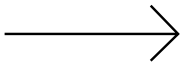
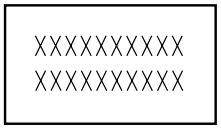
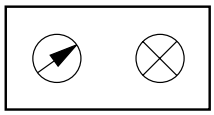
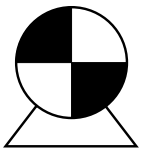
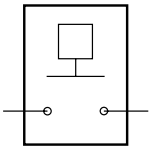
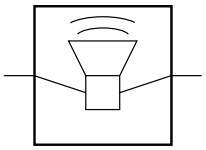
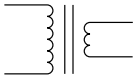
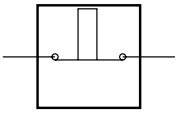
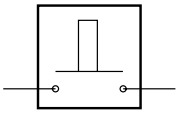
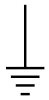
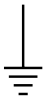
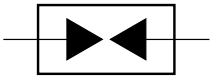
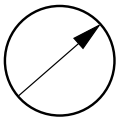
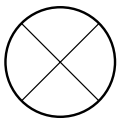
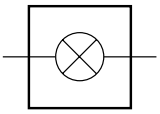
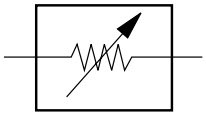
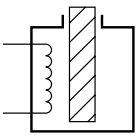
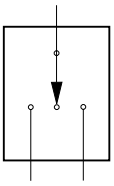
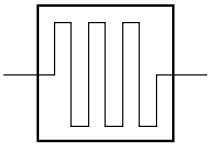
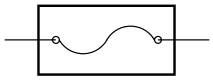
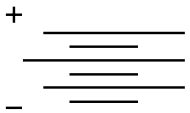
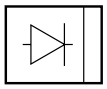
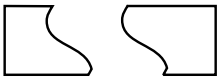
WIRE LOCATION IN CONNECTOR HOUSING

The third portion of the connector identification number represents the location of the wire in the connector housing. 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.





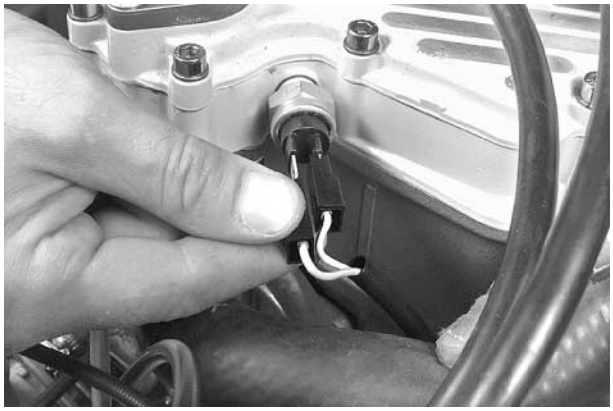
SYMBOLS DESCRIPTION

Beam and tail light 	Female terminal 	Male terminal 	Electronic module 
Meter 	Electric motor 	Low level sensor 	Buzzer 
Ignition coil 	Normally close switch 	Normally open switch 	Male terminal on instrument 
Engine ground 	Frame ground  Frame	Spark plug 	Meter movement 
Bulb 	Pilot 	Analog sensor 	Solenoid valve 
Magneto (Delta) 	3 position switch 	Heating element 	Fuse 
Trigger coil 	Battery +  –	Diode 	Partially illustrated component 

A00E9PS

UNPLUGGING CONNECTORS

Always unplug connectors by pulling on housing not on wire.



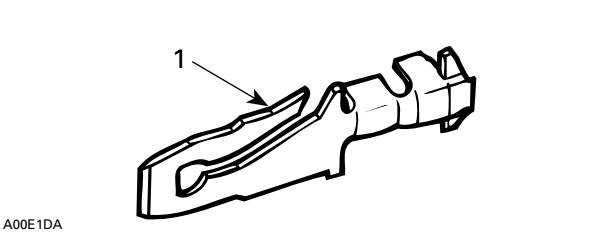
A06E1PA

TYPICAL

TAB AND RECEPTACLE CONNECTORS REMOVAL

Tab Connector

It is locked in its housing by a spring tab on its side. Removal is done by squeezing this tab.

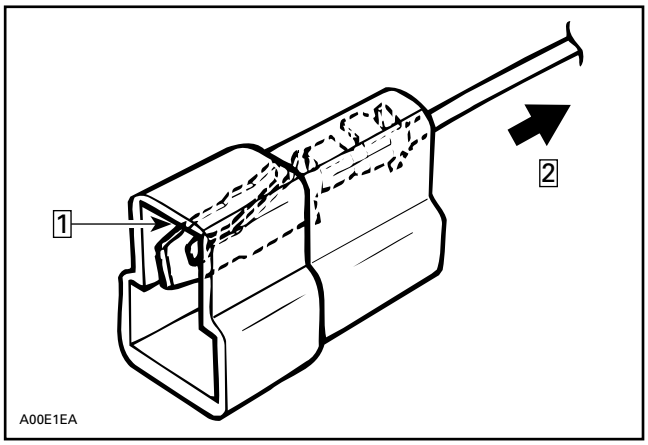


A00E1DA

TAB CONNECTOR
1. Locking tab

To remove:

– 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.



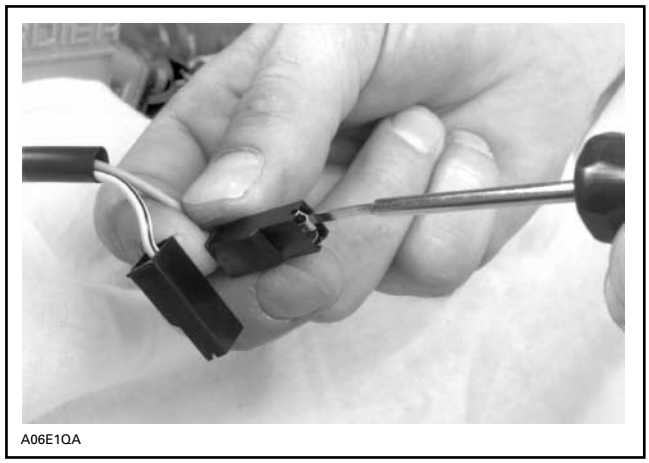
A00E1EA

1. Insert screwdriver here
2. Pull this side

Locking Receptacle Connector

To remove:

– Insert tool Snap-on TT 600-5 in access opening then pull housing toward wire side.



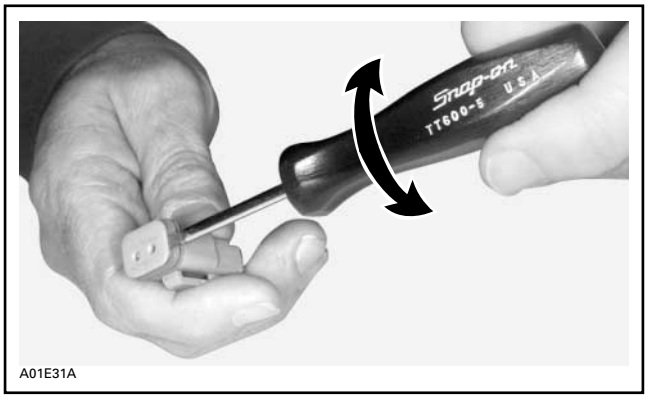
A06E1QA

Waterproof Connector Housing

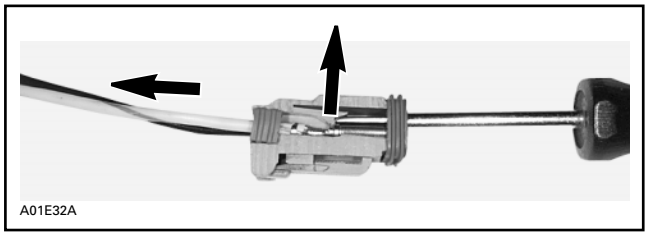
Female Connector Housing

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.

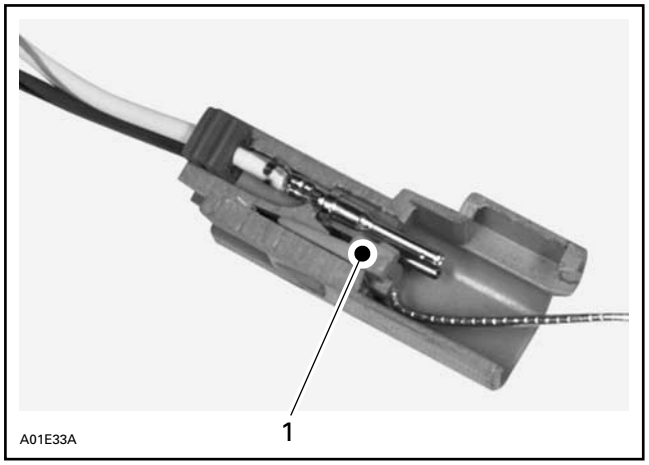


FEMALE CONNECTOR HOUSING — CUT-AWAY

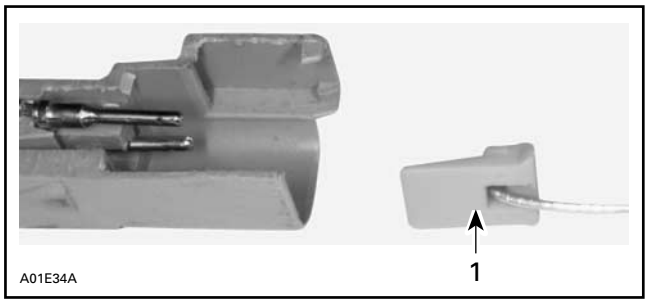
Male Connector Housing

To remove:

– Using a small hook, pull out the lock.

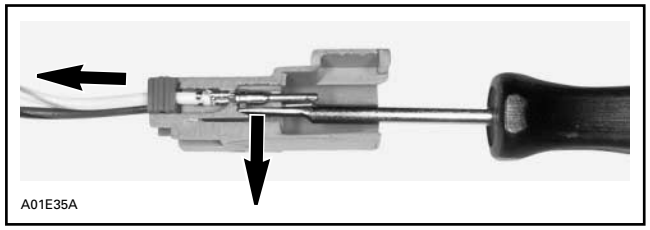


1. Lock



1. Lock

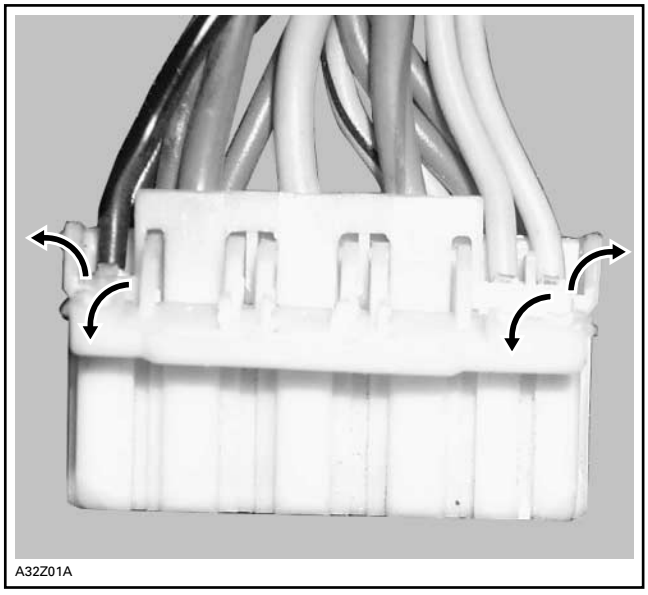
– Pry tab to free connector then pull wire out of housing.



MALE CONNECTOR HOUSING — CUT-AWAY

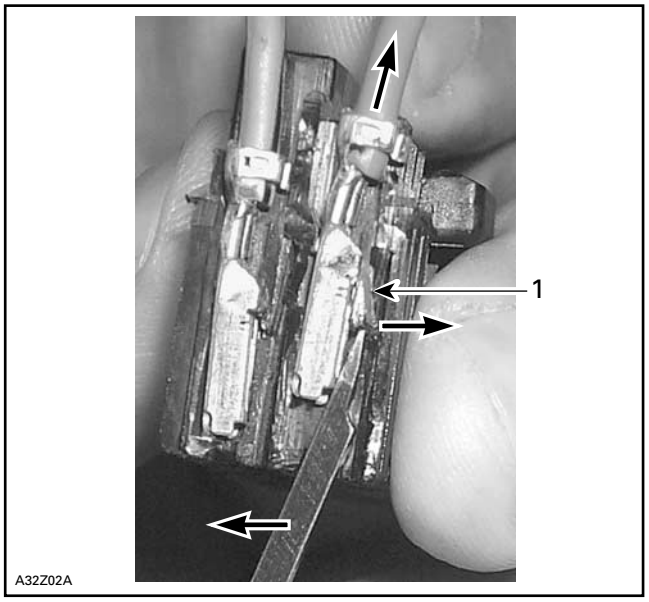
Multilock Connector Housing

Female Connector Housing



To remove:

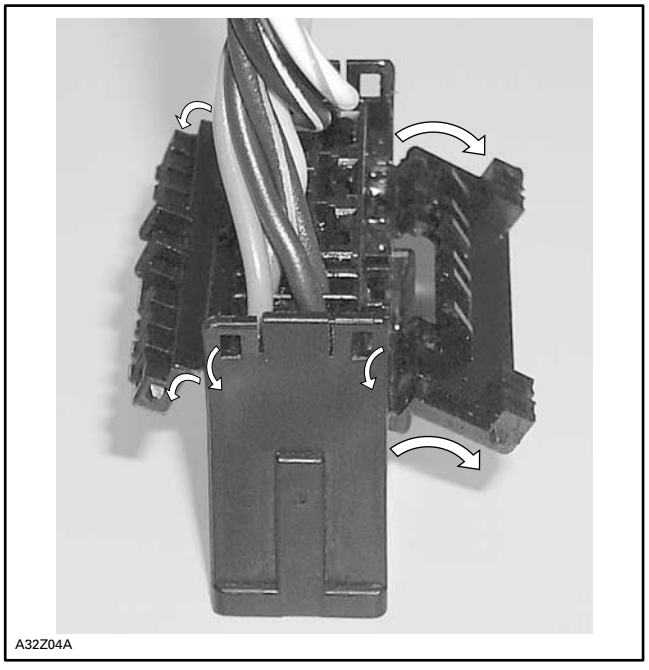
– Insert tool AMP- 755430-2 under lock and twist to lift it.



FEMALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

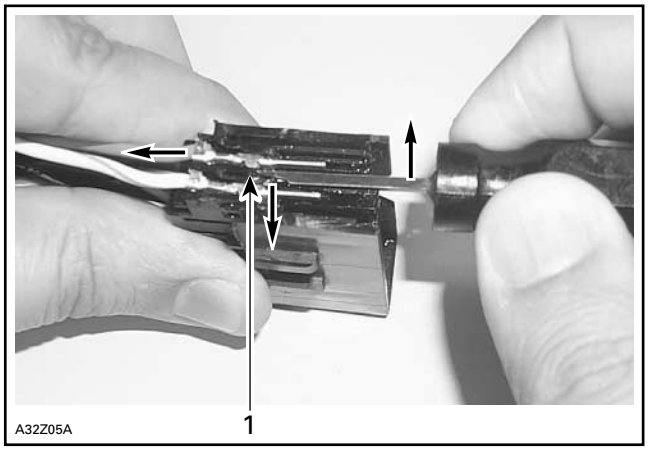
Receptacle connectors can be removed from female housing with sharp head pin.

Male Connector Housing



To remove:

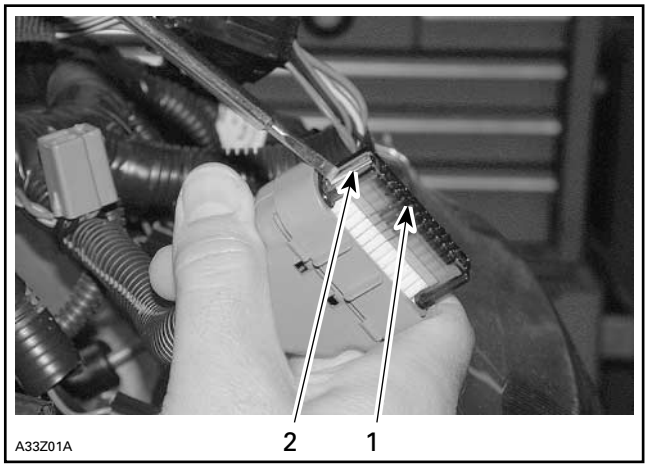
– Insert tool AMP-755430-2 under lock and twist to lift it.



MALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

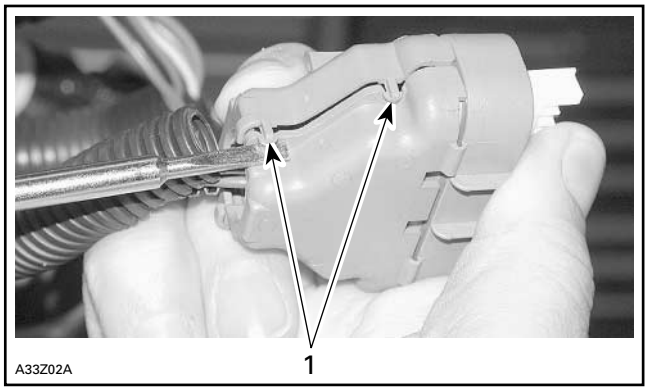
24-Circuit Connector Housing

Push on both tabs to remove retainer.



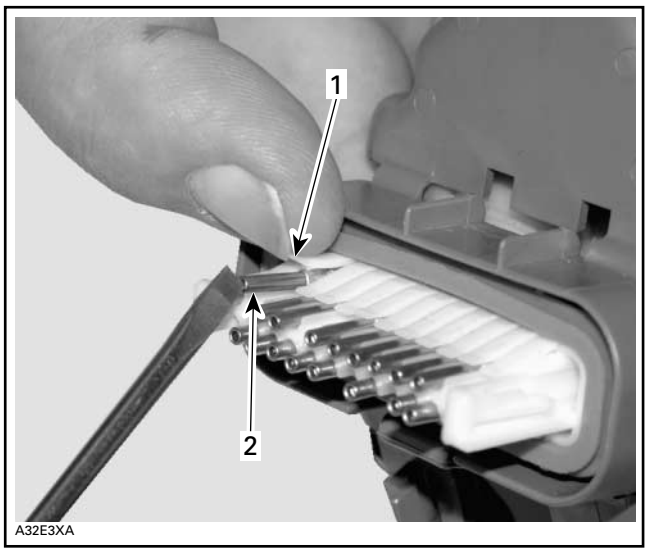
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



1. Tabs (2 on each side)

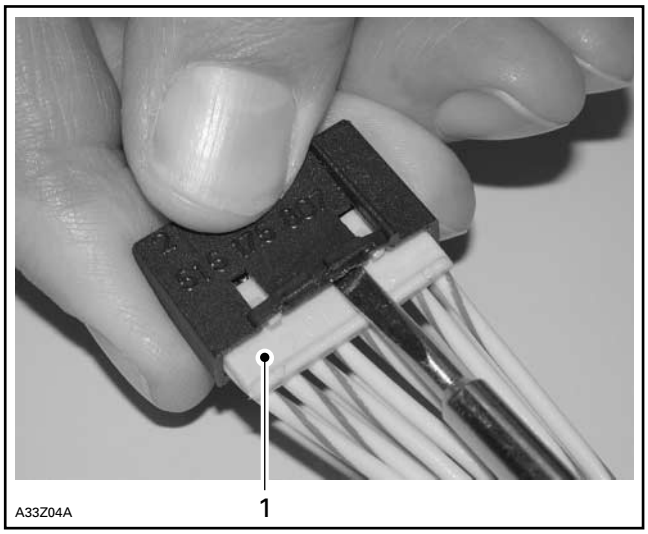
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. *Lift and hold plastic lock*
2. *Lift to unlock and push out*

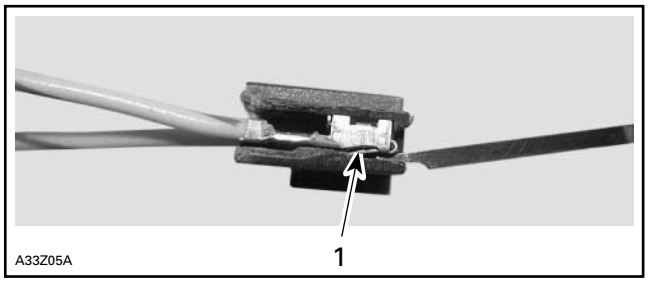
8-Circuit Connector Housing

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.

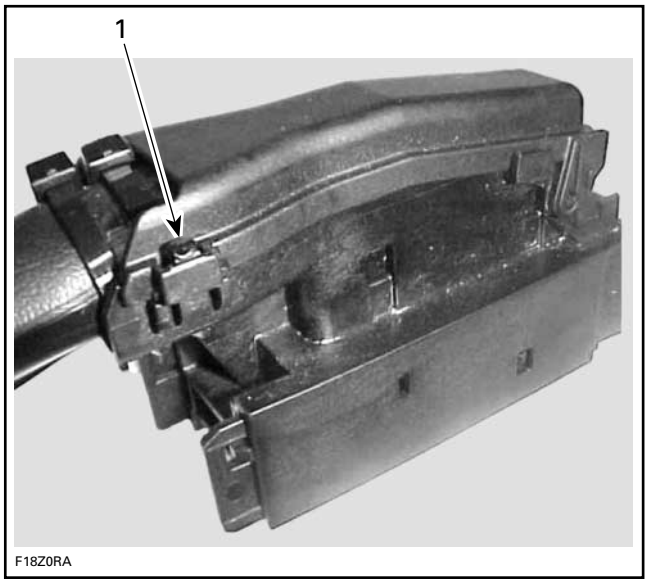


8-CIRCUIT CONNECTOR HOUSING — CUT-AWAY
1. *Tab*

Connector Housing A and B on ECM

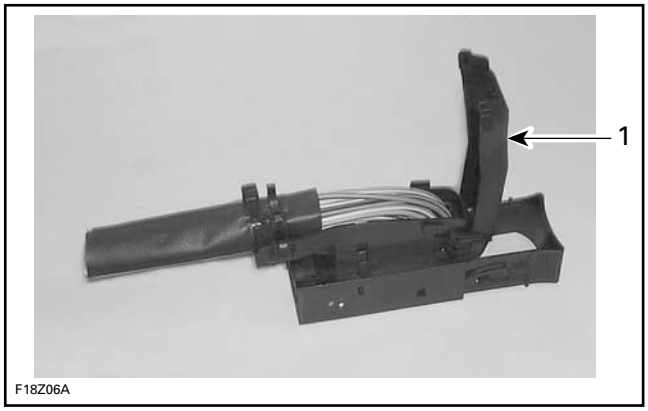
Terminal Removal

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.

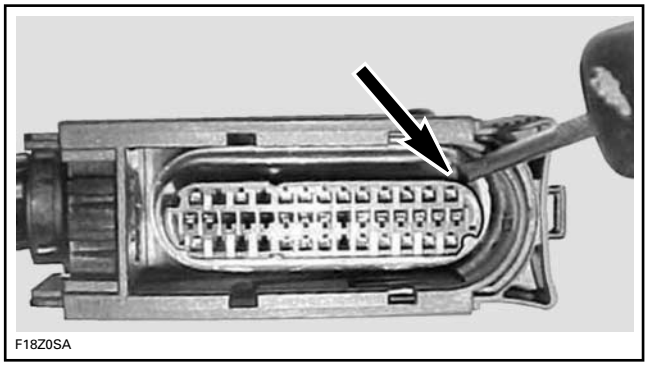


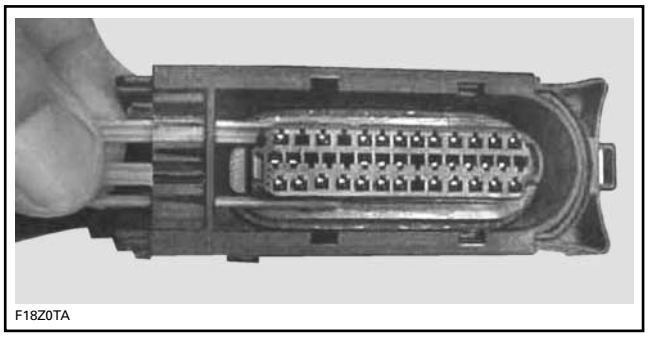
1. *Cover*

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.

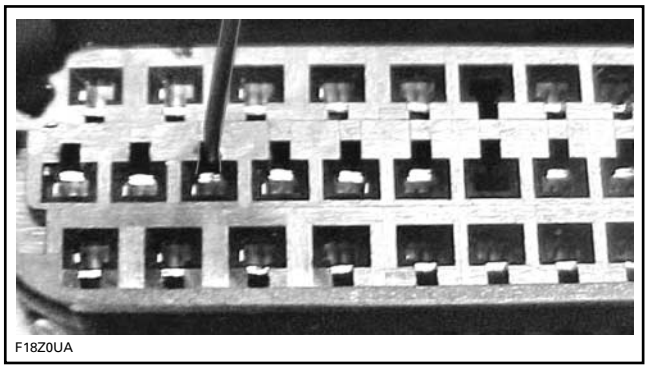


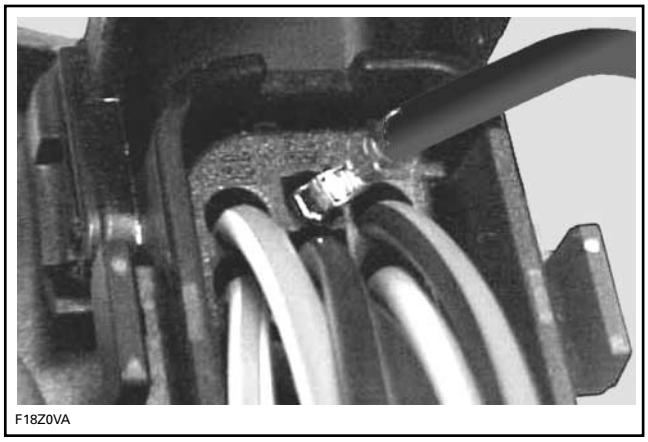


Use a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit inserted down into the housing to release the locking tab on the connector.

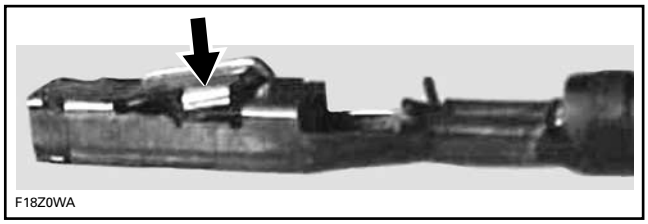
CAUTION: Using a probe larger than 0.76 mm (.030 in) may damage the terminal.

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.





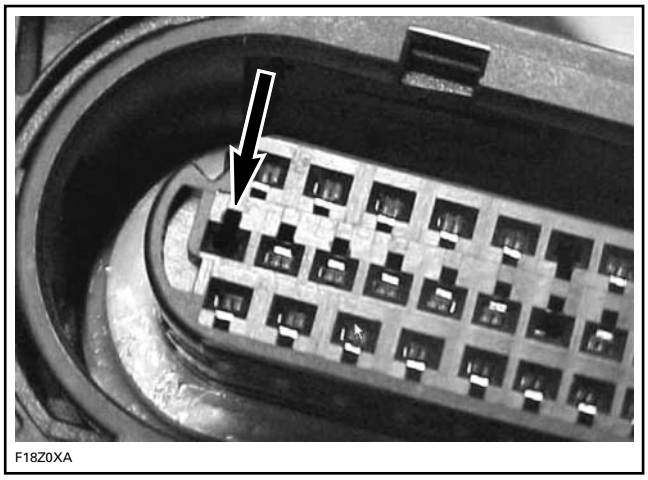
The locking tab on the connector may have to be bent out a little so it will lock in the housing when it is reinserted.



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 reinserting 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.

Reinstall the lock, attach the 2 tie raps, and close the housing cover.

Terminal Crimping (Kostal and AMP multilock)

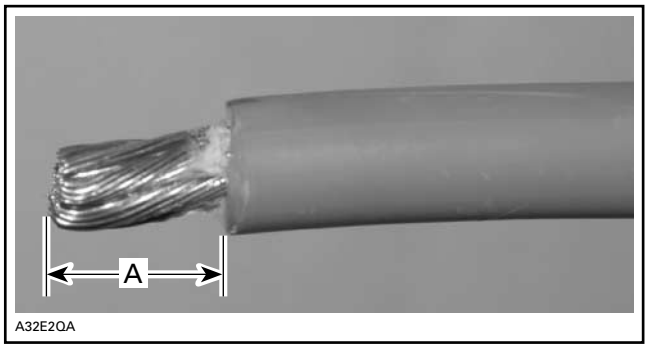
To crimp a new connector terminal, use the connector crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).


F00B0EA

CRIMPING TOOL

To properly crimp the wires, strictly follow this procedure.

Strip the wire to a maximum of 3 mm (1/8 in).

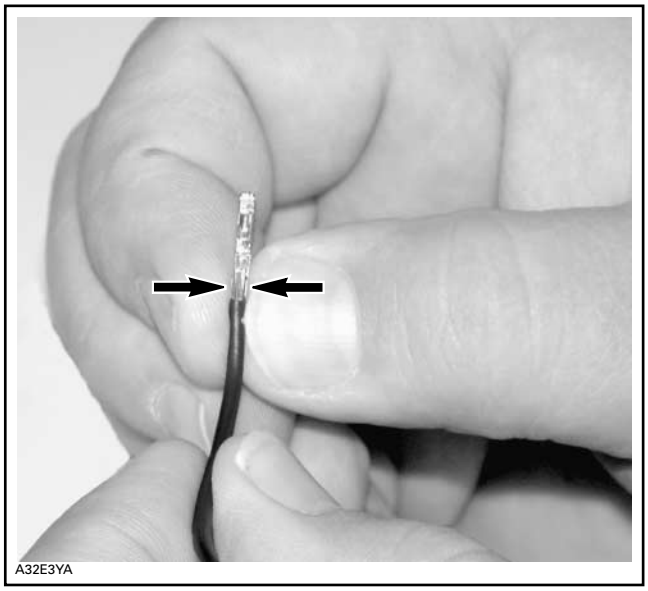


A32E2QA

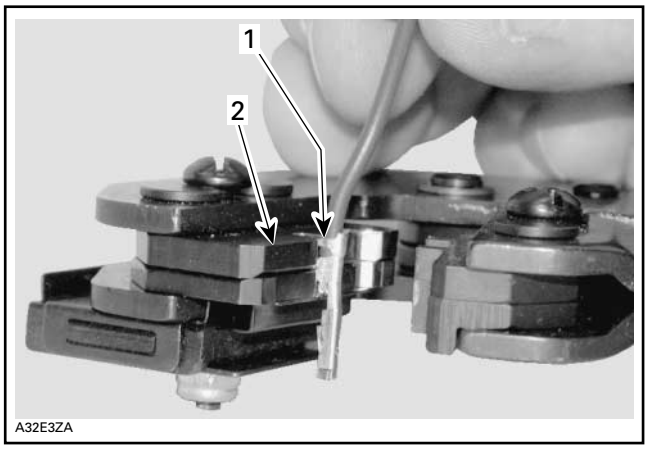
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.


A32E3YA

Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



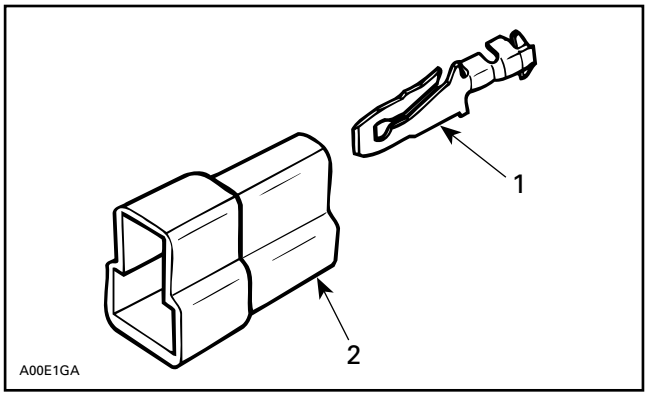
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

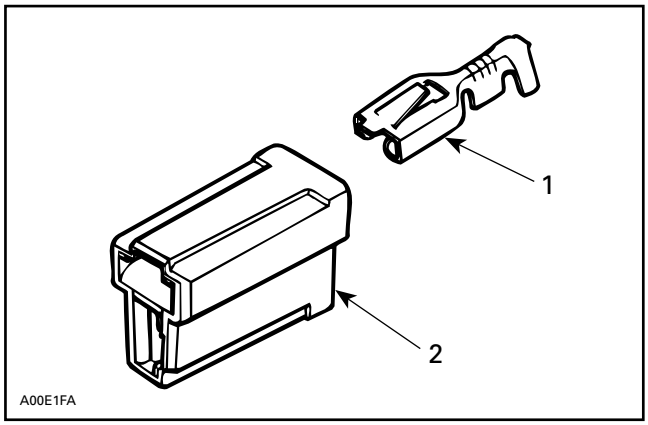
TAB AND RECEPTACLE CONNECTORS INSTALLATION

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.



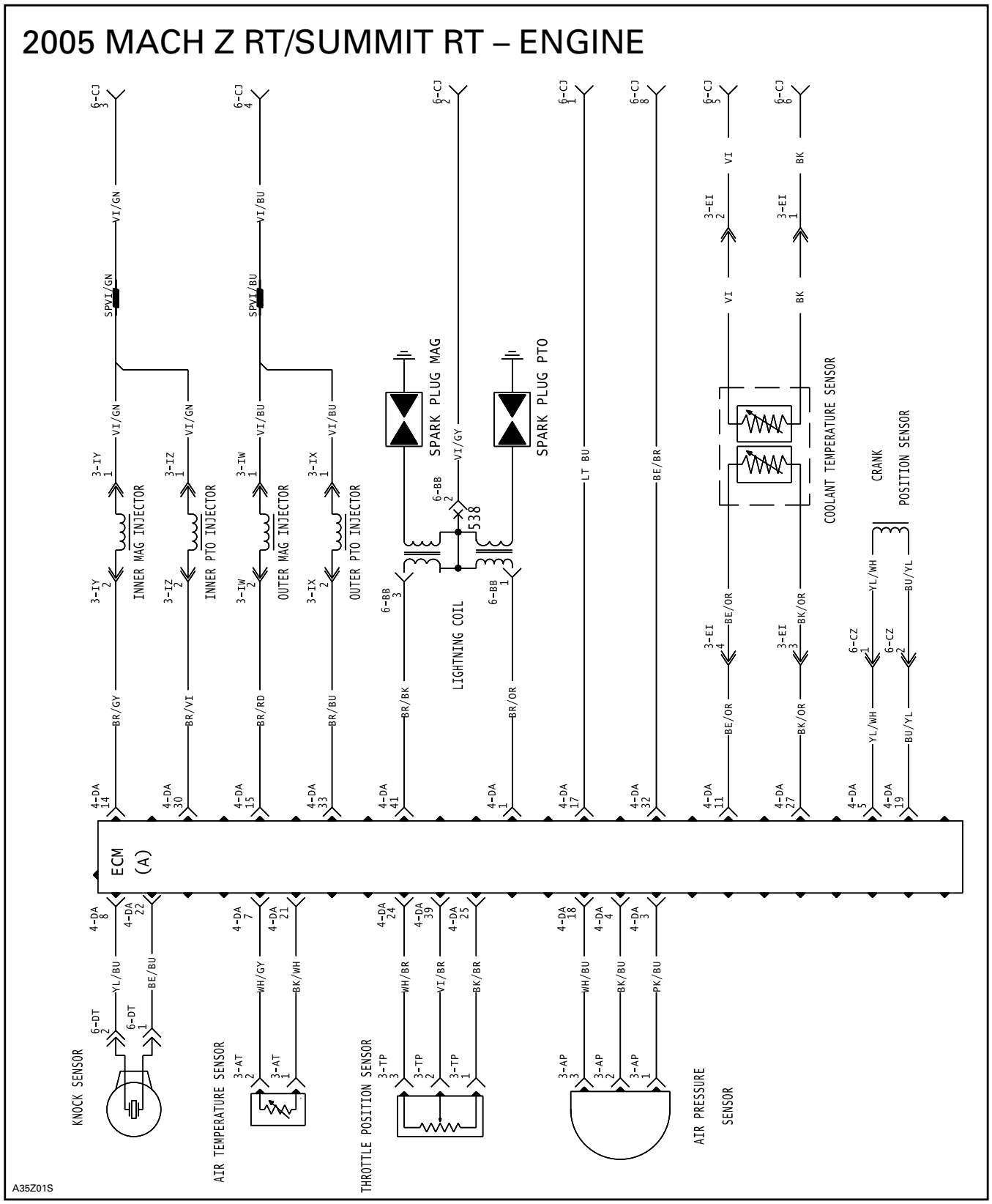
1. Tab
2. Housing



TYPICAL
1. Receptacle
2. Housing

⚠ WARNING

Keep wires away from any rotating, moving, heating, vibrating or sharp edge. Use proper fastening devices as required.



NOTES

NOTES

2005 MACH Z RT/SUMMIT RT